FISHERIES MANAGEMENT EVALUATION: A CASE STUDY OF THE BRITISH COLUMBIA GROUNDFISH FISHERIES

by

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B.Sc., University of Victoria, 1999

RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF RESOURCE MANAGEMENT
(PLANNING)

In the

School of Resource and Environmental Management

Project No. 431

SIMON FRASER UNIVERSITY

Fall 2008

APPROVAL

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Degree: **Master of Resource Management (Planning)**

Title of Research Project: **Fisheries Management Evaluation: A Case Study of the British Columbia Groundfish Fisheries**

Project No.: **431**

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ABSTRACT

The role of evaluation in fisheries management has been expanding in response to growing concerns over the state of the world's fisheries and ocean ecosystems. The British Columbia groundfish fisheries have been promoted as an example of fisheries management best practices but have not included comprehensive program evaluation within the management system. This study identifies best practices for comprehensive fisheries management evaluation and assesses the current state of evaluation in the BC groundfish fishery, showing that recent efforts to integrate evaluation within the BC groundfish management framework do not meet international best practice standards. Poor stakeholder engagement, the absence of explicit social and institutional objectives, and undocumented indicator selection processes are areas of weakness that must be addressed to ensure that BC groundfish fisheries meet best practices for fisheries management evaluation.

Keywords: management strategy evaluation; fisheries management; program evaluation; groundfish

Subject Terms: fishery management -- British Columbia -- groundfish; program evaluation -- fisheries; sustainable fisheries -- Canada

DEDICATION

For my parents, a constant source of encouragement and support through my many adventures.

ACKNOWLEDGEMENTS

I owe many thanks to many people. Thank you to my senior supervisor, Murray Rutherford, who guided me through this process and helped me to focus on one 699 long enough to finish it. To Bill de la Mare, an inspiration who opened my eyes to the possibilities in fisheries management, and who stayed with this project through its many iterations, despite his move half way around the world. To the faculty, administration, and students of REM, especially my fellow fish groups students with whom I enjoyed numerous animated discussions over the past three years.

Thank you to the fishermen, fisheries managers, and researchers that I have worked with over the past several years and who taught me so much about fisheries in BC.

And finally, thank you to my co-workers, friends, and family who were a source of knowledge, encouragement, and support. Especially thank you to everyone who reminded me to keep perspective and remember to enjoy life, even if I didn't always follow their advice.

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ACRONYMS

AAV	Average Absolute Variation
CGIAC	Commercial Groundfish Industry Advisory Committee
CIC	Commercial Industry Caucus
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Department of Fisheries and Oceans
ESD	Ecologically Sustainable Development
FAO	Food and Agriculture Organization of the United Nations
GHLAC	Groundfish Hook and Line Advisory Committee
GTAC	Groundfish Trawl Advisory Committee
HAB	Halibut Advisory Board
ITQ	Individual Transferable Quota
IVQ	Individual Vessel Quota
KEC	Key Evaluation Checklist
MSC	Marine Stewardship Council
MSE	Management Strategy Evaluation
RFP	Request For Proposal
SAC	Sablefish Advisory Committee
SARA	Species At Risk Act
SMART	Specific, Measurable, Achievable, Relevant, Time-Bound

TAC	Total Allowable Catch

GLOSSARY

Ex-vessel Price	The price received by fisherman at their point of landing (FAO 2008). Also referred to as the landed value or farm-gate price.
Formative Evaluation	Evaluation while the program is in progress is termed a "formative" evaluation and can be used to assess how well the program is meeting its objectives and as the basis for changes to the program. Formative evaluation identifies strengths or weaknesses in a program in order to enhance its quality and effectiveness (Patton 1997).
Goal	A statement describing a desired end state for a particular resource value. Worded generally to establish broad aims, not usually quantitative, has no time specified for their achievement, and normally applies to the whole region. (adapted from MSRM 2004)
Objective	A concise statement of a desirable future condition for a resource or resource use that is attainable through management action. (adapted from MSRM 2004)
Precautionary Approach	A management approach requiring that where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation. (UNCED 1992)
Prospective Evaluation	Evaluation of how likely a program is to meet its objectives in the future. (adapted from de la Mare 1998).
Stakeholder	All those with a substantial vested interest in the outcome of the evaluation. (Scriven 2005, p.2)
Summative Evaluation	Evaluation after the end of the program to judge its merit or worth is "summative" evaluation (Patton 1997). Summative evaluation is used to assess success in meeting the program objectives, and can be useful for accountability purposes and to inform the development of new programs (Patton 1997, Suvedi and Morford 2003).

CHAPTER 1. INTRODUCTION

1.1. Research Rationale

Fisheries around the world are under increasing scrutiny. Past activities have resulted in devastating resource collapses with all of the concomitant social and economic consequences (Jackson et al. 2001; Myers and Worm 2003; Pauly et al. 2005; Garcia and Grainger 2005; Worm et al. 2006). The Food and Agricultural Organization of the United Nations (FAO) classified 75% of all commercially valuable fish stocks globally as fully exploited, overused, or collapsed and in a state of recovery (FAO 2004). In response to the failures of past approaches to achieve sustainable fisheries, there is growing interest in using comprehensive evaluation tools to improve fisheries management practices through enhanced accountability and feedback systems (de la Mare 1998; Berkes 2003). A more explicitly defined management system that incorporates evaluation as a fundamental component of the system could better address conservation, the role of public funding, and allocations of the common property fisheries resource. Moreover, evaluation provides a mechanism for comparing disparate management systems.

Suggestions for changing fisheries management systems have included the adoption of new guiding principles for fisheries and new tools for managing those fisheries. Debates about guiding principles for fisheries management have

been dominated by the concept of sustainable development, applied to fisheries through the development of sustainable fisheries management guidelines (FAO 1999; Fletcher et al. 2002). The concept of sustainable development is the underpinning of many recent resource management conceptual models, and these models, whether influenced by sustainable resource management, social ecological systems theory, or human ecosystem theory, share strong similarities (Table 1).

Table 1. Subject dimensions from resource management theoretical frameworks that utilize the concept of sustainable development.

Theoretical Framework	Commission on Sustainable Development (UNDESA 2001)	Sustain-ability Triangle (Charles 1994)	Social Ecological System (Anderies et al. 2004)	Human Ecosystem Model (Machlis et al. 1997)	3 E's of Sustainable Development (Berke 2002; Godschalk 2004)
Subject Dimension	environmental	ecological	resource	biophysical resources	environmental sustainability
	economic	socio-economic	infrastructure	socio-economic	economic efficiency
	social	community		cultural	social equity
	Institutional	institutional	governance	social system	

Within the models of sustainable development identified in Table 1, there is agreement that the environmental, economic, and social elements of the system are interconnected and that management and policy actions that are supportive of sustainable development must recognize and support each element – if a management action is intended to achieve an environmental objective but fails to be socially or economically acceptable, then the action is contrary to a

sustainable development approach, and by extension, will fail to achieve long term environmental objectives. There has been little integration of these guiding principles with the newly implemented tools of fisheries management. At the management tool level, the shift has been towards “rights based” or “incentive based” fisheries management approaches, usually based on some form of individual output or individual transferable quota (ITQ) model (Grafton et al. 2006a), and extensive marine protected area closures (Lauck et al. 1998; Botsford et al. 1999; Hastings and Botsford 1999; Guenette et al. 2000).

Fisheries management tools can typically be categorized as belonging to one of two broad types – input controls and output controls. Input controls refer to controls meant to limit effort in a fishery, such as limits on licences, vessel size and fishing days. Input controls also include season openings, spawning closures, marine protected areas, and habitat or species protection zones. Input controls designed to limit effort are heavily criticized because these regulations seek to limit efficiency, which is both a questionable pursuit and often circumvented (Kompas et al. 2004). One of the key problems noted with input controls is that the input that is controlled is invariably an imperfect match with the goals of the management system. How imperfect that match is influences the effectiveness of the management system. For example, length limitations on vessels have resulted in a stable maximum vessel length size, but not a stable size distribution with respect to either active fishing vessels or gross tonnage (DFO 2006a; Transport Canada 2006). Vessels continue to be built larger by being built wider, taller, and deeper.

Output controls refer to controls that limit the output of a fishery, typically measured in landed fish weight or pieces. Examples of these types of controls include total allowable catches (TACs), individual transferable quotas (ITQs) and vessel trip limits. Fisheries management in recent years has placed a growing emphasis on the use of output controls, with suggestions that output controls can replace most of the more traditional means of management that use input controls (Branch et al. 2006; Grafton et al. 2006a; Holland 2007).

The challenge that is commonly faced following the adoption of a new management framework replete with new guiding principles and new forms of fisheries management tools is the assessment of how well the fisheries management systems are achieving intended outcomes. There has been an almost complete lack of conceptually comprehensive evaluations of fisheries management tools and systems to assess how well they are meeting fisheries management principles and objectives. Most evaluations consist of retrospective evaluations of the system, commonly based solely on quantitative trend data or qualitative interviews, and do not control for the unique variations within the fishery being examined. Prospective evaluation is being introduced in management strategy evaluations, using simulation modelling techniques, but is often limited in its application to only a few fisheries or even fisheries sub-systems and has focussed primarily on environmental and economic considerations. Few fisheries management systems have benefited from comprehensive evaluation, and even the more comprehensive evaluations may not be truly comprehensive temporally, i.e. including retrospective and

prospective evaluation, and conceptually, including all four dimensions of sustainable development – environmental, social, economic and institutional.

A good example of a new management framework can be found in the BC groundfish fisheries, which have received considerable attention both within BC and internationally. The BC groundfish fisheries are being promoted as an example of fisheries management best practices (McRae and Pearse 2004; Grafton et al. 2006b; Redstone 2007). Groundfish literally means a bottom dwelling fish, but in British Columbia the term is used more broadly to identify a group of fisheries that capture groundfish along with other species. Typical groundfish species include halibut, cod, and sablefish, but the full list of fish species that can be taken under groundfish licences in BC is far more extensive with over three dozen species of groundfish (rockfish, flatfish, roundfish, sharks, and skates) commercially harvested. Seven distinct fisheries comprise the BC groundfish fisheries with an annual landed value ranging from between $140 – 170 million annually (DFO 2005a).

Despite favourable initial reviews of the BC groundfish management system, questions remain about how well the groundfish management system is meeting fisheries management objectives (NTC 2005; UFAWU-CAW 2005; Nelson 2006; Wallace 2007). Evaluation is becoming more prominent in the BC groundfish fisheries through the introduction of management strategy evaluation (MSE) and the commitment by the federal Department of Fisheries and Oceans (DFO) to complete a comprehensive program evaluation of the groundfish integration pilot program in 2009. The increasing emphasis on the role of

evaluation to improve fisheries management, coupled with the promotion of the BC groundfish fisheries management system internationally, prompts consideration of whether or not current evaluation practices in the BC groundfish fisheries management system meet standards of best practice.

1.2. Research Objectives

Responding to the increasing prominence of fisheries management evaluation and the high profile of the BC groundfish fisheries internationally as an example of fisheries management best practices, I sought to:

1. identify best practices for comprehensive fisheries management evaluation;
2. assess the current state of BC groundfish fishery evaluation; and
3. make recommendations for improving fisheries management evaluation for the BC groundfish fisheries with general lessons applicable to fisheries elsewhere.

1.3. An Overview of the British Columbia Groundfish Fishery

The BC groundfish fisheries are highly diversified with 6 licence types, 7 distinct sectors (Table 2), a complex management history (

Table 3), and vessels ranging in length from less than 4 m to 56 m (DFO 2006a). The fleets range from very small rod and reel vessels, through mid-size hook and line vessels, to large scale factory processor trawlers. The fisheries substantially contribute to BC's economy and employment base with over 200 vessels participating in the groundfish fisheries (DFO 2007e).

Table 2. Characteristics of the BC commercial groundfish fishery sectors (DFO 1991; DFO 1998a; DFO 1999a; DFO 2008).

Fishery	Licence	Advisory Process	IQ Year
Groundfish Trawl	T	GTAC	1997
Sablefish Longline	K	SAC	1990
Halibut Hook and Line	L	HAB	1991
Rockfish Hook and Line Outside	ZN-O	GHLAC	2006
Rockfish Hook and Line Inside	ZN-I	GHLAC	2006
Lingcod Hook and Line	Sched II	GHLAC	2006
Dogfish Hook and Line	Sched II	GHLAC	2006

Table 3. BC groundfish management timeline.

Year	Management Event
1969	Davis Plan - Licence limitation, >5800 licences (Grafton and Nelson 2005)
1976	T (Trawl) Limited Licence, 142 vessels granted licences (Grafton et al. 2006b)
1977	200 mile limit - Canada's exclusive economic zone is extended from 10 miles to 200 miles from shore, officially established in 1996 with the passage of Canada's Oceans Act (Grafton and Lane 1998)
1979	Protocol amending the Convention between Canada and the United States of America for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and Bering Sea came into effect - US vessels no longer permitted to fish in Canadian waters. (IPHC 1992)
1979	L (Halibut) Limited Licence, 435 vessels granted licences (DFO 1991)
1980	K (Sablefish) Limited licence, 48 vessels granted licences (DFO 1999a)
1990	K ITQ - individual vessel quota, temporary transfers permitted in whole licence blocks only (DFO 1990)
1990	K 100% dockside monitoring (DFO 1990)
1991	L IVQ - individual vessel quota, no transferability (DFO 1991)
1991	L dockside monitoring (DFO 1991a)
1991	K ITQ temporary transfers allowed in half blocks (DFO 1991b)
1991	ZN-I Limited Licence - Inside Rockfish, 74 eligible licence holders (DFO 1999c)
1992	ZN-O Limited Licence - Outside Rockfish, 183 licences (DFO 1999c)
1993	L ITQ transferability allowed (temporary only) (DFO 1993a)

Year	Management Event
1993	K ITQ temporary transfers allowed in shares (DFO 1993b)
1994	T 100% dockside monitoring (AMR 2008)
1995	K ITQ per lb transferability (DFO 1995)
1996	T 100% on board observer coverage in outside bottom trawl (DFO 1996)
1996	schedule II dogfish and lingcod 100% dockside monitoring (DFO 2000c)
1997	T ITQ (DFO 1998a)
1998	L partial on board observer coverage (DFO 1998b)
1999	L ITQ permanent transferability (DFO 1999b)
2000	K ITQ permanent transferability (DFO 2000a)
2001	K partial on board observer coverage - 10% of fishing days (DFO 2001c)
2001	Schedule II dogfish and lingcod partial on board observer coverage (DFO 2001d)
2001	ZN-O partial on board observer coverage (DFO 2001e)
2002	Halibut electronic monitoring pilot (McElderry et al. 2003)
2005	longline / hook and line 20% catch coverage electronic monitoring pilot (DFO 2005b)
2006	Groundfish Integration 3 year pilot (DFO 2006b)
2006	Schedule II dogfish and lingcod ITQ with full temporary transferability and no permanent transferability (DFO 2006b)
2006	ZN-I and ZN-O ITQ with full temporary transferability and no permanent transferability (DFO 2006b)
2006	all K, L, ZN, and Schedule II trips subject to either an observer or electronic monitoring system (DFO 2006b)

The target and by-catch species intercepted in the groundfish fisheries have varied life history characteristics, ranges, and habitats but most are long lived and many have a low reproductive rate and a mid to late age of maturity. Such characteristics leave these species highly vulnerable to fishing pressure in that at high rates of exploitation they can be quickly depleted and slow to rebound (Smith et al. 1998; Myers and Worm 2003).

Responding primarily to concerns from science staff and the conservation community about inshore rockfish stocks and unreported rockfish discards, in 2003 the Canadian Department of Fisheries and Oceans outlined five requirements for the groundfish fishery (PFMI 2003):

1. All rockfish catch must be accounted for;
2. Rockfish catches will be managed according to established rockfish management areas;
3. Fishermen will be individually accountable for their catch;
4. New monitoring standards will be established and implemented to meet the above 3 objectives; and
5. Species of concern will be closely examined and actions such as reduction of total allowable catch (TACs) and other catch limits will be considered and implemented to be consistent with the precautionary approach for management.

In an effort to develop an implementation strategy supported by stakeholders, the groundfish integration consultation process was initiated by DFO in 2003. The Commercial Industry Caucus (CIC) was formed and given a mandate to provide advice to DFO on issues of relevance to the BC groundfish fisheries (CIC 2004). The CIC's first task was to devise a management system that would meet DFO's five requirements. The Commercial Industry Caucus came to agreement on the groundfish integration program in 2005 and the new program was implemented in 2006 on a pilot basis for three years (CIC 2005).

The key elements of the integration program are:

1. individual accountability for catch through 100% on board monitoring and ITQ system;

2. limited transferability between sectors to cover incidental bycatch;
3. sector autonomy with sector accountability for bycatch and sector specific rules;
4. changes to the regulatory structure to remove regulations that require discard and to shift from a system that promotes discards to one that discourages discards.

The groundfish integration program has several innovative elements, including:

1. the electronic monitoring system – with camera coverage of all catch used to audit vessel logbooks to enforce catch accountability;
2. the trading system for bycatch species; and
3. the removal of regulations requiring discard of non-target catch, replaced with a quota system that reverses the incentive structure to encourage retention of legal / marketable catch.

While the BC groundfish fishery is small relative to other fisheries around the world, most notably the Alaskan groundfish fisheries which are an order of magnitude greater in both volume and value, the innovative approaches introduced to address the rockfish discard problem have focussed attention on the BC fisheries, and prompted examination of the BC groundfish example. There have been multiple study tours, organized by the US environmental group Environmental Defense Fund, bringing US and Mexican fishermen and government officials to BC, and research attention, with the BC fisheries figuring prominently in several works promoting ITQ expansion (McRae and Pearse 2004; Grafton et al. 2006b; Redstone 2007). Concerns have been voiced about the impact of the groundfish integration program on the fleet and active

fishermen, including the effects of further downloading of costs onto already struggling fleets, the extensive leasing in the existing ITQ fisheries, loss of employment, loss of fisheries access for First Nations and coastal communities, and the program's ability to achieve conservation objectives (NTC 2005; UFAWU-CAW 2005; MCC 2006). DFO has committed to conduct an evaluation of the groundfish integration program prior to the completion of the pilot in spring 2009 (DFO 2008).

1.4. Report Outline

In chapter 2, I develop a comprehensive evaluation methodology incorporating an indicator framework and create a checklist of evaluation best practices based on the evaluation methodology. In chapter 3, I assess examples of previous evaluations in the BC groundfish fisheries using the best practices checklist in order to identify strengths and weaknesses. In chapter 4, I demonstrate how the comprehensive evaluation methodology could be applied to improve evaluation of the groundfish fisheries, using a case study of the groundfish integration program. In chapter 5, I discuss implications of the current state of fisheries evaluation in the BC groundfish fisheries, repercussions for fisheries internationally, and challenges for improving fisheries management practice. I conclude with suggestions for future research and next steps.

CHAPTER 2. FISHERIES MANAGEMENT EVALUATION “BEST PRACTICES”

I develop a comprehensive evaluation methodology and “best practices” checklist based on a review of the evaluation and resource management literature. I identify key considerations in evaluation practice, classify the existing forms of fisheries evaluation, and assess those forms with respect to the key considerations for evaluation. I suggest evaluation process steps synthesized from existing practices and identify how this integrates with the management strategy evaluation (MSE) form of existing fisheries management program evaluation. Because of the pivotal role of performance criteria in both the evaluation process and the MSE approach, I explore in depth the selection of performance criteria, suggesting an indicator framework and selection process and criteria. Finally, I synthesize and summarize the chapter in a “best practices” checklist.

2.1. Key Considerations

2.1.1. Defining Evaluation

Evaluation generally follows one or more of three aims (Patton 1997), with common definitions of evaluation corresponding to one of the three:

1. to judge the merit or worth of programs;
2. to improve programs; or

3. to generate knowledge.

When judging merit or worth, the focus is on the final outcome and this is captured by Scriven's (1991, p. 139) definition of evaluation as "the process of determining the merit, worth, or value." For program improvement the focus is on feedback to the program as captured by Suvedi and Morford's (2003, p. 1) definition of evaluation as "a management tool that involves measuring and reporting on the results of programs and projects." In the category of knowledge generation, the focus is on the audience rather than the program as captured by Stufflebeam's (2001, p. 11) definition of program evaluation as "a study designed and conducted to assist some audience to assess an object's merit and worth." There is overlap in each of these definitions and most evaluations will involve more than one of these evaluation goals, but the primary focus will help determine the type of evaluation conducted and expectations for the evaluation outcome.

Evaluation methodology must address, at the outset, the critical question of the purpose and type of evaluation. Within natural resource management, five broad purposes for evaluation are identified (Bellamy et al. 2001):

1. improving program management;
2. improving transparency and accountability;
3. reducing risk and uncertainty;
4. fostering learning; and
5. improving process.

Several elements of the evaluation must be considered to refine the purpose and determine the type of evaluation:

1. the scope, breadth, and depth of the evaluation;
2. when in the program to evaluate – formative versus summative;
3. what to evaluate – outcome versus process;
4. who does the evaluation – internal or external evaluators; and
5. what data are used – quantitative, qualitative or both.

It is tempting for practitioners skilled in a certain type of evaluation to apply their type of evaluation methodology without considering whether or not it is appropriate for the purpose. Stufflebeam (2001) warns against a focus on methods-based evaluation, citing Kaplan's (1964) "law of the instrument." Where a given method is equated with a field of inquiry, the field of inquiry is restricted to questions that are answerable by the given method and the conditions required to apply that method. The methods used should fit the problem, rather than the other way around.

2.1.2. Scope, Breadth and Depth

When conducting an evaluation, the extent of the evaluation, or what to include inside the evaluation 'box', must be determined. Too narrow a scope can yield an evaluation that fails to address the intent of the evaluation. Conversely, too broad a scope can result in an unwieldy evaluation that may be impossible, overly costly or too time-consuming to complete.

Bennett's Hierarchy of Evidence (Figure 1) demonstrates the trade offs in depth of evaluation - the higher up the program level, the greater the data requirements and the greater the time required to complete the evaluation. The hierarchy describes the seven levels in a program evaluation and the types of questions typically asked at each level.

Figure 1. The evaluation ladder - hierarchy of program evaluation evidence. Adapted from Bennett (1976).

Program Levels	Indicators
End results	What long-term changes occurred as a result of the program or project?
Changes in practices and behaviour	How did practices change as a result of program or project participation?
Changes in knowledge, attitude, skill and aspirations	How did participants' knowledge, attitudes, skills, and aspirations change as a result of program or project participation?
Reactions	How did participants and clients react to the program or project activities?
Participation	Who participated and how many?
Activities	In what activities did the participants engage through the program or project?
Inputs	Which personnel and other resources were used during the program or project? e.g., "We devoted 23 person-days on this project."

Both narrow and broad evaluations are susceptible to hidden biases, although for different reasons. In narrow evaluations it is easier to justify the exclusion of indicators, which may mean that important aspects of the program are not assessed. In broad evaluations, the sheer number of measures may encourage greater focus on those measures that are easier to collect or report on, resulting in a bias towards quantitative data.

Deciding on the scope of the evaluation is not just a matter of time and data constraints. The increasingly complex distribution of power and resources across geographical levels and modes of coordination for many programs further complicates determination of evaluation scope. Hollingsworth (2002) identifies four modes of coordination: (i) markets, (ii) networks, (iii) associations, and (iv) non-market organizations; and five geographical levels of organization: (i) global, (ii) trans-national regional, (iii) national, (iv) sub-national regional, (v) local.

The Nova Scotia Genuine Progress Index (Charles et al. 2002) is an example of a sub-national regional evaluation - fisheries and communities are considered, but the main organization level is geographic rather than based on a mode of coordination. The Australian sustainable fisheries management evaluation (Fletcher et al. 2002) is at the national level, but the main organizational feature is not geographical but instead is based on a mode of coordination – the fishery. The FAO concentrates on geographical organization, advocating for the use of indicators at the international, national, and regional levels (FAO 1999). Boyd and Charles (2006) advocate for a specific scale of geographical organization, arguing for the inclusion of local or community level indicators to address the needs of local level co-management and community based resource management. The Marine Stewardship Council (MSC) is primarily organized on modes of coordination, at the fishery and association level (MSC 2008). The scope that is covered by the evaluation must be determined for each evaluation considering the intent of the evaluation in specific terms and the resources available to conduct the evaluation.

2.1.3. Formative and Summative

Evaluations can be conducted at each stage in the development and implementation of a program, and ideally should be done at several or even all stages of the program (Suvedi and Morford 2003) (Table 4). If the intention is to improve a program, a formative evaluation is appropriate, conducted at the beginning of the program during the design stage or while the program is in progress. Waiting until the end of the program will not generate useful information for the purposes of improving the program, especially when the program is of an indefinite time period, as is the case with most of the management systems in fisheries. There is still value in conducting a summative evaluation when programs do end, in order to apply lessons learned to the development of other programs.

Table 4. The program stages at which evaluation can be conducted. Adapted from Suvedi and Morford (2003).

Stage		Description
Formative	design stage	Information collected about the needs of the target audience to help determine desired outcomes. Typically called a "needs assessment."
	start-up stage	Information gathered at the beginning of a program or project to establish a baseline to which changes can later be compared.
	while the program or project is in progress	Information collected during a program or project to help managers determine if adjustments are needed.
Summative	after the program wraps up	"Sums up" what has occurred in the project. Assesses end-of-project reactions and success in meeting objectives. Typically used for accountability purposes.
	long after the program finishes	Assesses the long-term benefits of a program.

2.1.4. Outcome and Process

Evaluations can look at program outcomes, processes, or both. Outcome evaluation assesses how well the program met its outcome goals. Process evaluation focuses on the mechanisms used to reach that end result. The methodology that is pursued depends on the answer to the question: is it the final destination that matters, the road taken to get there, or both? The decision to use an outcome or process evaluation approach is also tied to the goals of the program being evaluated, and the purpose of the evaluation.

Outcome evaluations can be free of causal assumptions if the measures used for assessment are direct measures of the subject of the evaluation. If the subject of the evaluation is the fishery output, and the evaluation generates direct measures of that output, then the outcome evaluation does not assume

causation. However, if the subject of the evaluation is a fisheries management system, and the measures are the state of the fishery, then there may be a causal assumption that the outcomes of the fishery are a result of the management system. Causal assumptions often can not be avoided where the effectiveness of a program is being evaluated and there is both a paucity of direct measures and confounding by multiple factors outside of the program. Where causality is assumed, the assumption should be explicitly recognized and tested. Testing can take the form of one, or ideally all, of (Barnthouse and Stahl 2002; Stem et al. 2005):

1. comparison to a control system, such as a fishery operating within the same environmental and market conditions but with a different management system;
2. conceptual demonstration of the cause-and-effect relationship using a framework such as a pressure-state-response framework; and
3. use of evidence from a suite of indicators.

Irrespective of causation, it is important to assess whether the outcomes measured are appropriate to the goals of the program and are considered in the greater context in which they exist. The question of “did the program work?” may not be answered, but perhaps, “did we get what we wanted?” can be answered.

Process evaluation can be a radically different approach than outcome evaluation. Process evaluations can satisfy multiple objectives but typically will not answer the question “did we get what we wanted?”, unless what was wanted was a certain type of process. In fisheries management, many programs have process goals, however they are often characterized as principles for

engagement rather than as goals of the program. Because of this, when the evaluation is conducted, an assessment of how well the principles of engagement were met may not be included, even though it is entirely appropriate to treat these as process goals that can be considered within the evaluation scope. In other cases, there may not be any process goals elucidated. In these instances, process evaluation is still possible based on “best practices” for natural resource management processes, of which there are several examples to draw from (e.g., Jentoft and McCay 1995; Plummer and Fitzgibbon 2004; Degnbol and McCay 2006).

One of the underlying assumptions for conducting a process evaluation is that good process will lead to good outcomes (Deming 1986). Another common justification for conducting a process evaluation is not based on this assumption, but rather on ensuring that legislative requirements or social expectations for engagement are satisfied.

2.1.5. Internal and External Evaluators

Once the question of why to conduct an evaluation has been answered, the proponent must address the question of who will do the evaluation. The answer depends on the purpose of the evaluation. Evaluations focused on the application of the evaluation to improve the program benefit from broad stakeholder involvement to ensure that the questions asked are the right questions, and this may involve an internal evaluator provided that person is skilled and can fill the “expert” role (Patton 1997). Accountability evaluation benefits from an independent external evaluator to ensure that there is actual

and perceived independence of the evaluator, and to guard against intentional or unintentional bias (Stufflebeam 2001). There are advantages and disadvantages of using in-house staff as opposed to external evaluators that should be considered when designing an evaluation program (Table 5).

Table 5. Internal versus external evaluators. From Suvedi and Morford (2003), as adapted from Boyle and LeMaire (1999).

Options	Advantages	Disadvantages
Using internal staff as evaluators	Familiar with organization	Potential for lack of objectivity
	Credible within organization	Burden of additional tasks on staff
	Develops internal evaluation capacity	Potential lack of power
		May lack evaluation skills
Hiring external evaluators	Has specialized skills	Lack of knowledge of organization
	Has independence and objectivity	Limited access to information and people
	Has readily available skills	Potential for extra expense

2.1.6. Quantitative and Qualitative Data

Edvardsson (2004) warns against the tendency to ignore goals that are not easily measured. There is a tension between developing an evaluation system that includes measures that will be viewed as objective, transparent, accessible and relevant to many jurisdictions, and maintaining meaning in the evaluation for goals and objectives that defy measurement. The practice of using ranking systems or scoring to assign quantitative values to data that would otherwise be qualitative has had some success, but is also subject to criticism.

For abstract and value-laden goals, Cortner (2000) warns against quantifying when doing so will transform a value problem into a technical problem.

The focus in deciding whether to use qualitative or quantitative data must be on the goal, and the appropriate measure to assess that goal should be used. Where there are no quantitative measures, qualitative methods should be employed as appropriate. The measure must then be evaluated to ensure that it is indeed capturing the goal, since it is achievement of the goal that is being assessed (Cortner 2000).

2.2. Categories of Fisheries Management Evaluation

Forms of fisheries evaluation can be grouped into four general categories. Fisheries evaluation has often occurred in a haphazard or highly individualized fashion, which makes classification difficult, but each category does have general patterns for the application of key evaluation considerations, including similar purpose, type, and other common elements.

2.2.1. Fisheries Management Program Evaluation

Fisheries management program evaluations tend to be political tools that assess fisheries against either government or idealized objectives. This category of fisheries evaluation is a bit of a catchall and is not prescriptive in the purpose or type. Program evaluations can be led either by the management agency or by a third party, and conducted by either internal or external evaluators. Government led or sanctioned evaluations tend to be used to assess fisheries to

meet national objectives or to justify program direction, with examples including sustainable fisheries management evaluation in Australia (Fletcher et al. 2002), the BC halibut and sablefish ITQ evaluations (EB Economics 1992a; EB Economics 1992b), and the BC halibut management plan evaluative component (DFO 2001b). External program evaluations led by individuals and organizations outside of the management agency typically have no direct feedback loop in the process for modifying the management system, although this function may take place through pressure on government. Examples of external management evaluations include Rapfish (Pitcher and Preikshot 2001) and the Nova Scotia Genuine Progress Index (Charles et al. 2002). Generally, program evaluation is retrospective, seeks to address program management, and is focused on outcomes rather than process, although all these characteristics as well as the purpose, conceptual scope, and program level are highly dependent on the individual evaluation.

2.2.2. Certification

Certification programs use market mechanisms to effect fisheries management change through direct intervention designed to influence consumer choices. Certification has similarities to program evaluation, although it is more specific in its characteristics. Certification is by necessity carried out by organizations external to the management agency, but may use internal or external evaluators. Certification programs are retrospective and while outcome and process goals may be identified, ultimately certification is concerned with outcomes, or the attainment of a sustainable fishery. Current certifiers are

primarily focused on ecological considerations. In other commodity markets, most notably coffee and chocolate, social and economic considerations are encompassed through fair trade certification. There is currently no corollary in mainstream fisheries certification. Certification is always formative, its primary purpose is to improve transparency and accountability with the secondary purposes being to improve program management and reduce risk. It is conducted at either a fishery or a species level, or both, and most certification programs operate at regional or national scales. Quantitative data, or qualitative data that has been quantified, is favoured, and the output is usually a score or grade. Most certification programs, such as Seachoice (2008), Monterey Bay Aquarium (2008), and Oceanwise (2008), are a sub-category of program evaluation. In contrast, the Marine Stewardship Council (MSC) (2008) is a hybrid between an internally and externally led program evaluation where fisheries are only assessed by the certifier if requested (and funded) by the fishery or government agency. The MSC process includes an opportunity for the fishery to change to meet certification criteria, providing the certifier with an internal feedback mechanism into the management system.

2.2.3. Species Assessment

One of the most common evaluations in fisheries is species assessment, although it is not always recognized as a form of evaluation. Species assessments are a highly specialized form of evaluation that is focused on species or stock condition. Species assessments form a critical underpinning for most fisheries management approaches, with evaluation outcomes being used to

set Total Allowable Catches (TACs), change management systems, and open or close fisheries. Species assessments are retrospective, assessing species condition during a snapshot in time based on past data collection, fishing behaviour, and environmental conditions. These assessments are usually conducted internally, although external scientists may be hired to conduct the evaluation. The purpose of species assessments is to reduce risk and to improve the management of the larger system. They use quantitative data, and they are focused on outcomes.

One type of species assessment is the process used to identify endangered species or species at risk, which seeks to classify a species into a category based on its stock condition and the risk factor for its long term health and survival. In Canada under the federal *Species at Risk Act* (SARA) this is a two-stage process with the actual species assessment carried on by an external organization, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the listing of species carried out by the federal government based on COSEWIC recommendations. COSEWIC assessments are entirely environmental in scope. Once a species is recommended by COSEWIC for listing, a socio-economic impact assessment is conducted prior to a decision on listing by the federal government. The socio-economic assessment is internal to the federal government, is not publicly released, and is disconnected from the COSEWIC assessment.

2.2.4. Management Strategy Evaluation

Management strategy evaluation (MSE) is the implementation scheme for the precautionary approach, operationalizing that approach through the development of a well-specified management procedure with performance criteria (de la Mare 1998; Kell et al. 1999; Punt 2006). MSE involves the definition of a set of measurable management objectives, identification of candidate management procedures for assessment based on decision rules, and a prospective evaluation of the procedures against the objectives (de la Mare 1998).

MSE has at its heart prospective evaluation of options using a simulation based operating model, and ongoing retrospective evaluation to assess the predictive strength of the prospective evaluation. MSE is a formative evaluation, aiming to improve program management and reduce risk, and uses a technique that also seeks to improve transparency and accountability, foster learning, and improve process. The evaluation uses quantitative data, is often internal but may rely on external experts for components or for the entire MSE procedure, and addresses fisheries outcomes as well as elements of process – although the latter is seldom explicitly evaluated. MSE requires identification of explicit objectives for fisheries management that are intended to be inclusive of the full range of fisheries objectives, although examples are typically concerned with environmental objectives.

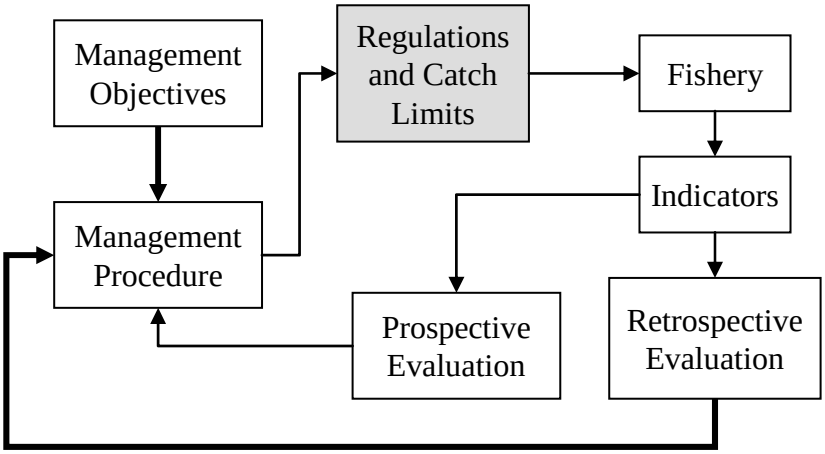
Of all forms of fisheries management evaluation considered here, MSE is the most comprehensive, has the strongest feedback into the management

system, and is the most explicit. MSE provides a solid foundation from which to integrate meaningful evaluative practice within fisheries management, but it would benefit from a stronger link to retrospective evaluations that address the full suite of fisheries objectives. An integration of prospective and retrospective evaluation is critical to achieve a truly comprehensive MSE (Figure 2). The two types of evaluation are distinct, but share common elements, namely shared management objectives and to a certain extent, shared indicators.

The indicators used in the prospective evaluation need not be identical to those used in the retrospective (Rice and Rivard 2007), but rather the retrospective evaluation should include a wider array of indicators inclusive of the indicators used in the prospective evaluation. The prospective evaluation occurs after management objectives are identified, and after management options have been identified, but before changes to the regulatory system have occurred. A prospective evaluation is based on a simulation modelling approach where the relationship between management options and relevant fishery outcomes is defined within the operating models. The simulation modelling approach allows for a rigorous assessment of the likelihood that management options will achieve expected outcomes without the jeopardy of first implementing changes that could lead to irrevocable harm. The main limitation of prospective evaluation is in the creation of the operating models. Typically, MSE operating models concentrate on the stock-recruitment-harvest relationship with the management options consisting of changing TAC levels. There is more that can be evaluated through prospective approaches, addressing broader conceptual management

objectives, but this would require greater resources to conduct the MSE than are usually allocated.

Figure 2. Redefining the role of evaluation in a Management Strategy Evaluation. Adapted from de la Mare (1998).



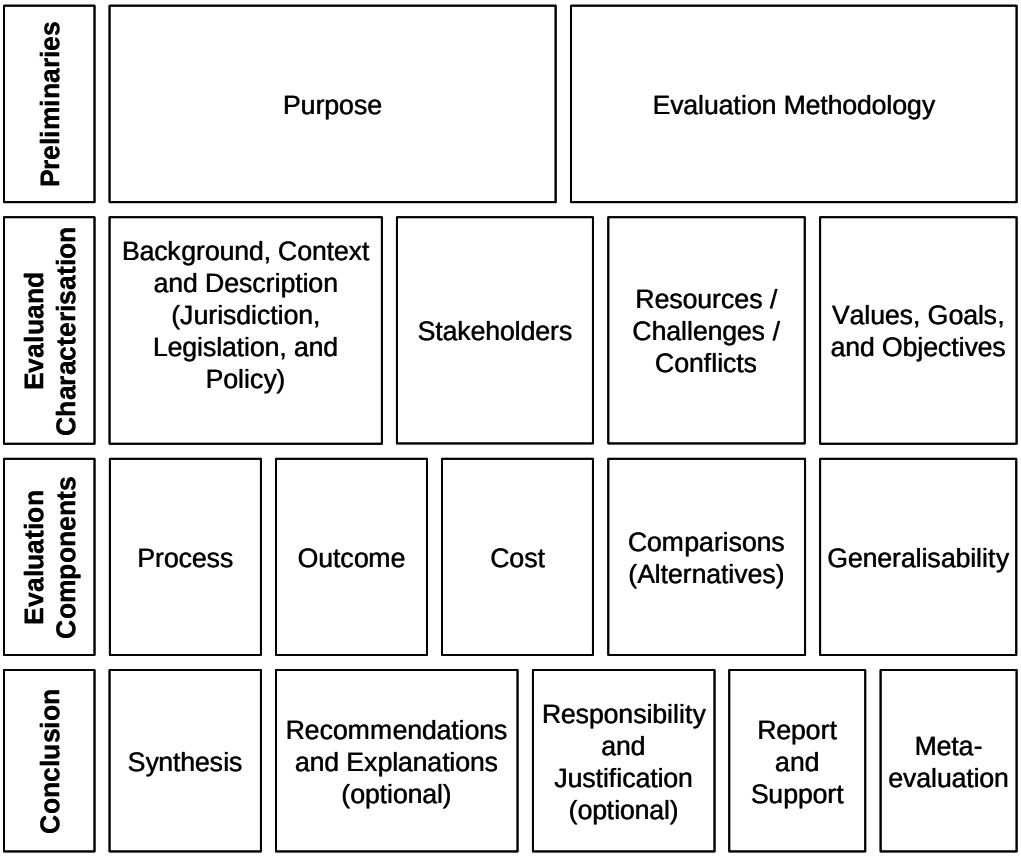
2.3. Evaluation Process

Defining an evaluation methodology requires identification of the elements of the evaluation and the steps to carry out the evaluation.

2.3.1. Key Evaluation Checklist

The Key Evaluation Checklist (KEC) (Figure 3) is an evaluation tool that suggests all of the elements that should be considered in an evaluation. The evaluation checklist is intended to ensure complete coverage.

Figure 3. An evaluation checklist. Adapted from Davidson (2005) and Scriven (2005).



2.3.2. Evaluation Steps

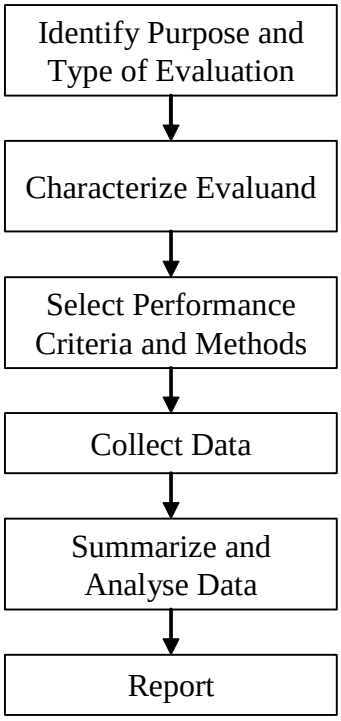
From the evaluation and natural resource management literature I examined a number of recommended evaluation processes (Table 6). The processes examined varied from four step through to twelve step evaluations, but all showed strong similarities and followed the same general pattern. With reference to both the KEC checklist (Figure 3) and examples from the literature (Table 6) I synthesized a six step evaluation process (Figure 4).

Table 6. Process steps for conducting a natural resource management (NRM), program, or policy evaluation.

Source	Bellamy et al. (2001)	Nielsen and Holm (2007)[1]	Bardach (2005)	Fletcher et al. (2002)	Suvedi and Morford (2003)
Type	NRM	Program	Policy	Fisheries Management	NRM
Steps	1. issue characterization	1. select criteria of merit	1. define the problem	1. Identify the Operational Objectives	1. Identify purpose
	2. identify the objective / intent of the evaluation	2. set standards of performance	2. assemble some evidence	2. Decide on the Indicator	2. Review program goals
	3. identify the theory and assumptions underlying the policy initiative	3. collect data pertaining to the evaluand's performance on the criteria relative to the standards	3. construct the alternatives	3. Develop the Performance Measure/Limit	3. Identify evaluation stakeholders
			4. select the criteria	4. Identify data Requirements/ Availability	4. Contact stakeholders
	4. select evaluation criteria		5. project the outcomes		5. Revisit the purpose of the evaluation
	5. select evaluation methods		6. confront the trade-offs	5. Conduct Evaluation	6. Decide if evaluation will be in-house or contracted out
	6. develop a process of implementation	4. integrate results into a final value judgement	7. decide!	6. Assess Robustness	
			8. tell your story	7. Fisheries Management Response - Current, Future, and if Performance Limit exceeded	7. Determine data-collection methods
	7. generate products and outcomes				8. Create data-collection instrument
					9. Test data-collection instrument
				8. Summarize Comments and Action for next steps	10. Collect evaluation data
					11. Summarize and analyze the data
				9. Assess External Drivers	12. Prepare reports for stakeholders

[1] adapted from Scriven (1980) and Fournier (1995)

Figure 4. Evaluation process steps.



The reporting step can and should be multi-step, including a draft to stakeholders, release of a public document, revision of the report based on feedback, and possibly revisiting earlier evaluation steps depending on the nature of the feedback. A final seventh step may also be included, which is the post-evaluation evaluation, or the meta-evaluation. While recommended, this seventh step is optional and outside the primary evaluation. Meta-evaluation involves evaluating the evaluators and the evaluation to ensure that the following criteria of merit are met (Scriven 2005):

- validity
- utility (usually to clients, audiences and stakeholders) (usability)
- credibility (to select stakeholders, such as funders, regulatory agencies, and program staff)

- cost-effectiveness
- ethicality and legality (including conflict of interest and protection of rights of human subjects)

All evaluations should have an intended use (Patton 1997). This places great importance on the role of stakeholders in the evaluation, since it is stakeholders who will use the evaluation and who will be most impacted by the outcome of the evaluation (JCSEE 1994). Stakeholders include anyone who has a "substantial vested interest in the outcome of the evaluation" (Scriven 2005, p.2). Stakeholders can be included in the earliest stages of the evaluation, and contribute to defining the purpose and type of evaluation, or later in the process, sometimes as late as the data collection or even reporting stage. The earlier in the process that stakeholders are included, the more likely that the evaluation will be accepted and utilized (Greene 1988; JCSEE 1994).

2.3.3. Integrating Evaluation Process and MSE

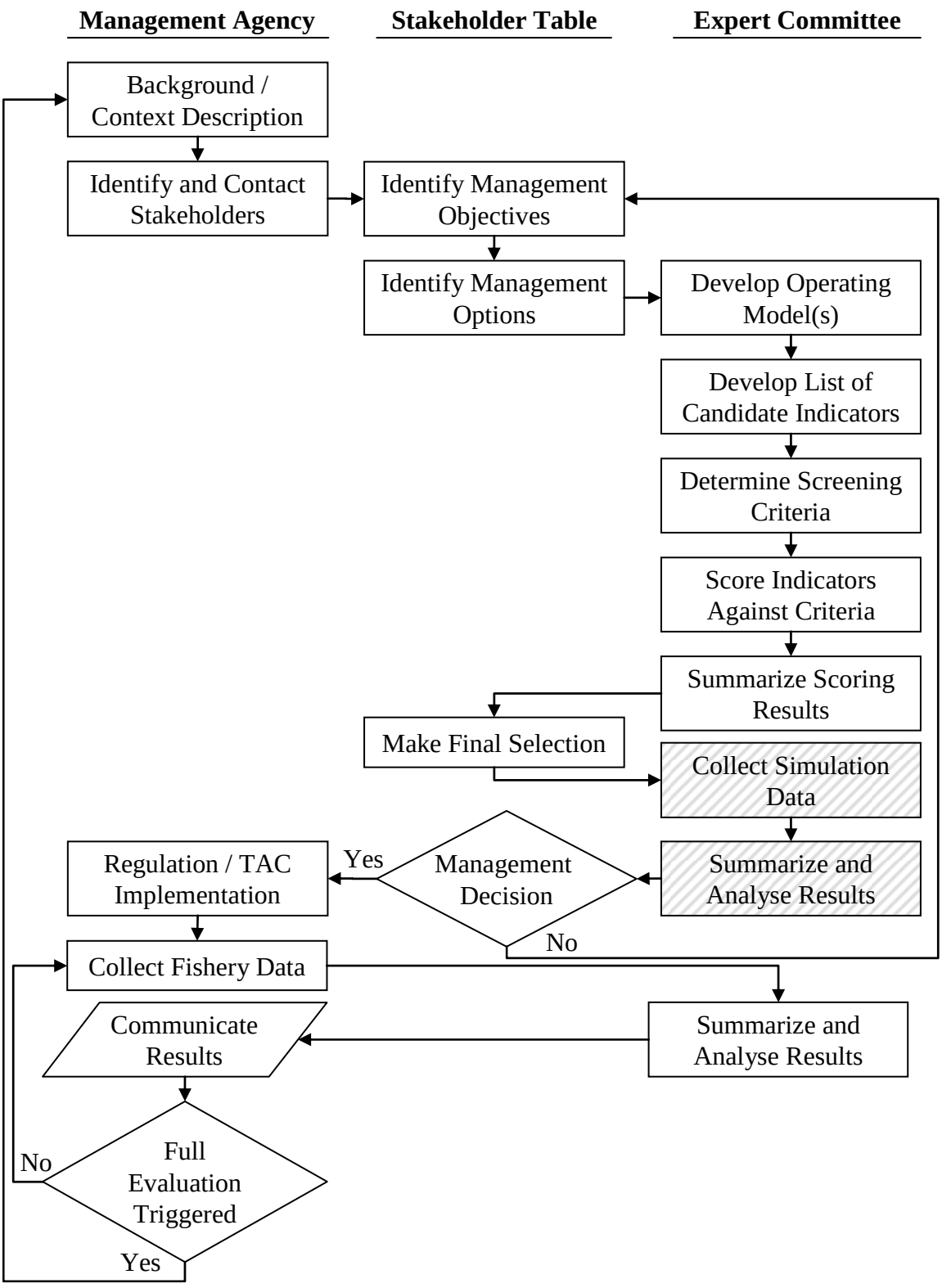
A fundamental difference between an evaluation approach as described in section 0 and a management strategy evaluation is that the former typically has a beginning and an end whereas the latter is an iterative process with a feedback loop. Integrating the MSE approach into evaluation processes requires consideration of both the steps in the evaluation and who is responsible for carrying out each step (Figure 5). Beyond that, there are two levels of evaluation – the prospective evaluation that occurs at the beginning of the MSE implementation and the retrospective evaluation that occurs post-implementation of the management strategy and then at regular intervals thereafter. Post-

implementation retrospective evaluation would typically occur seasonally or annually. At longer intervals, of between three and ten years, or if the outcome of the retrospective evaluation is at any time unsatisfactory, either because the observed outcomes indicate that the evaluation procedures are inadequate or because expectations have changed, the process loops back to the beginning to advance through each step once more. The revisiting of steps can be as simple as reaffirming what was already decided upon, or it can involve a complete revision of the previous decisions. For a management strategy evaluation to be effective, however, there must be a commitment to follow a set of decision rules for an extended period of time. The full evaluation process should be revisited at regular intervals or if:

1. the program objectives change;
2. new information becomes available;
3. new uncertainties are identified; and/or
4. the evaluation procedures are shown to be inadequate, including problems with the operating model or with the indicators chosen to assess management objectives.

The central core of the management strategy evaluation approach is the selection and assessment of performance criteria. The single evaluation process step “select performance criteria” encompasses the majority of MSE steps, which suggests that this third step of the evaluation process warrants additional consideration to ensure that the evaluation methodology proposed adequately integrates MSE and the evaluation process.

Figure 5. Process diagram integrating the evaluation process with MSE, where the dashed background squares represent the prospective evaluation steps and the solid grey squares represent the retrospective evaluation steps.



2.4. Performance Criteria Selection

The core of the MSE approach is the selection and assessment of performance criteria, which prompts additional consideration of the performance criteria selection step. Selection of performance criteria is the critical pivot point of the evaluation. The prior steps prepare for the selection of criteria and the steps after implement and report upon the assessment of the performance criteria. Performance criteria selection encompasses deciding upon a structure to organize the criteria, identifying higher level goals and objectives, and selecting and screening indicators.

The use of indicators to promote sustainable fisheries development has been embraced internationally (FAO 1999), nationally (DFO 2001a) and regionally (FBC 2006). The development of indicators for fisheries has been addressed many times, including in special issues of both Marine and Freshwater Research (2000, 51(5)) and the ICES Journal of Marine Science (2005, 62(3)). Despite the commitments to indicator development and the dozens of papers published on the topic of indicators for fisheries management, implementation of indicator systems has been limited, seldom extending beyond the identification of an indicator framework that suggests the structure for selecting and organizing performance criteria.

I identify a structure for organizing the performance criteria and explore the process for deciding upon goals, objectives, and indicators. The indicator decision process includes recommendations for selection, at both the individual indicator and overall levels, and reporting and documentation components.

2.4.1. Hierarchical Structure

The selection of performance criteria benefits from identification of a structure within which to organize the criteria elements. I reviewed recommended structures from the resource management and social ecological systems literature. There are a number of examples where the indicator framework has only a single level of organizational structure, typically called criterion (Santiago Declaration 1995), category (Boyd and Charles 2006), or goal (MSRM 2004). More complex hierarchical structures are common within the social ecological systems literature and within the broader resource management and evaluation literature, with three or more levels of organization common (Table 7). Marks et al. (2007) argue for greater organizational structure to allow flexibility in selection of specific indicators while ensuring that the range of issues identified is adequately covered.

Table 7. Hierarchical structures for Indicator Frameworks.

Hierarchical Level	German SSI[1]	Marks et al. 2007	SFM[2]	SEOC[3]	Aus ESD[4] / FAO	MSRM[5]
organizational structure		Subject grouping			Dimension	Goal
	Domain	Domain	Criteria	Goal / objective	Overall objective / core objective	
	Goal dimension	Goal dimension		Sub-goal	Operational objective	Objective
	Measurement dimension	Indicator group				
measurement	Indicator	Indicator	Indicator	Indicator	Indicator	
					Performance measure / limit	

[1] German System of Social Indicators (GSSISSID 2007)
[2] Sustainable Forest Management (Santiago Declaration 1995)
[3] Sweden's Environmental Objectives Council (Edvardsson 2004)
[4] Australian Ecologically Sustainable Development (ESD) (Fletcher et al. 2002) and FAO Guidelines (Garcia et al. 2000)
[5] Ministry of Sustainable Resource Development Writing Resource Objectives (MSRM 2004)

The balance that must be achieved in the hierarchical structure is capturing sufficient complexity to integrate disparate data, while not overburdening the process. Deciding on a hierarchical structure from those already developed is made more difficult by the use of different terminology in the various frameworks, with only the term indicator retaining a relatively consistent definition, although even the meaning of that term varies (Reyntjens and Brown 2005).

The indicator structure I have chosen is based on the Australian ESD and FAO framework, with terminology modifications based on MSRM (2004). The hierarchical structure provides three levels of organisation to categorize

indicators from broadest to most specific: Subject Dimension, Goal, and Objective.

2.4.2. Identifying Goals and Objectives

One of the greatest obstacles in evaluating fisheries management regimes has been the lack of clear and agreed upon fisheries goals and objectives. Objectives are usually vague, and often assumed rather than explicitly stated. This leaves objectives open to debate and interpretation, a situation that is further complicated by changing governments, changing priorities, and changing societal values.

Objectives operationalize the higher level goals of fisheries management. They are not necessarily directly measurable, but they should be specific. There are different definitions and expectations for objectives. The SMART objective approach states that objectives must be: specific, measurable, achievable, relevant, and time-bound (MSRM 2004). Objectives within fisheries management evaluation usually do not have all of the SMART characteristics but when combined with additional measures and targets can achieve SMART guidelines.

The term objectives is often used interchangeably with goals – what many fisheries management documents refer to as objectives are goals based on the terminology convention used here (MSRM 2004). I follow the terminology and procedure for developing goals, objectives and indicators as described in the guide "Writing Resource Objectives and Strategies" (MSRM 2004):

GOALS:

1. describe a desired end state for a particular resource value;
2. worded generally to establish broad aims;
3. not usually quantitative;
4. no time specified for their achievement; and
5. normally apply to the whole region.

OBJECTIVES:

1. describe end-results that will contribute to broader goals;
2. describe desired future conditions for individual resources or uses;
3. measurable;
4. geographically and time specific; and
5. can apply to whole geographic region or specified parts of region.

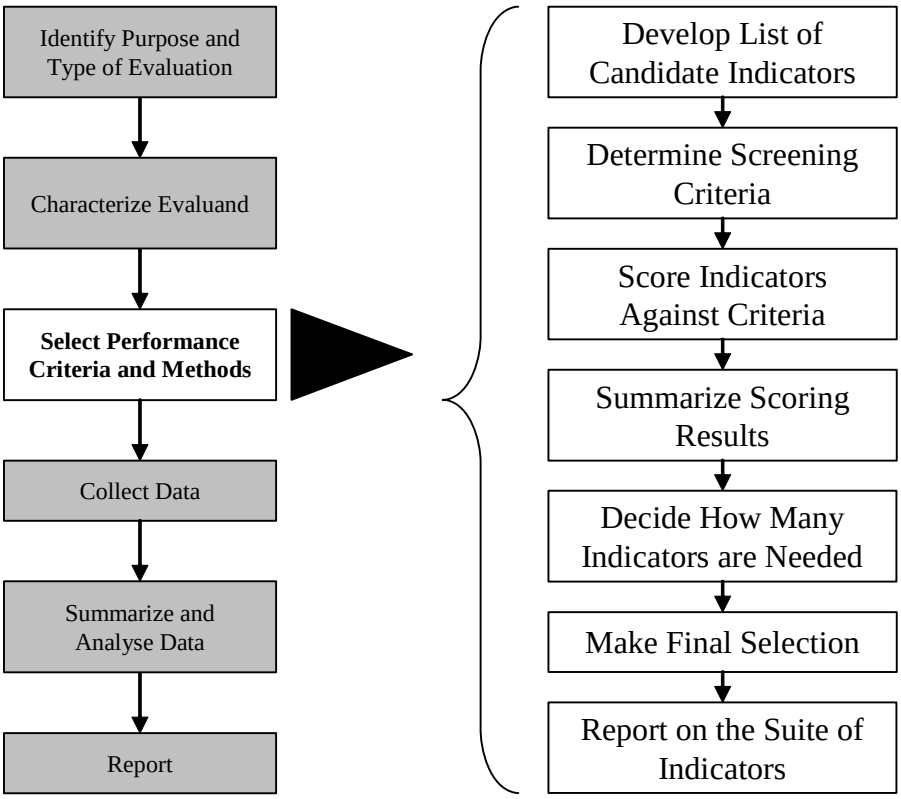
2.4.3. Indicator Development

Indicators should be precise, evaluable, approachable, motivating, and coherent (Edvardsson 2004). The indicator should be a useful communication as well as policy tool that has meaning to stakeholders. It should relate to that which is being evaluated. There should be a theoretically sound link between the indicator and the evaluand. It should be easily measurable if possible, using data that are already available or that can be collected, but evaluators must guard against the tendency to ignore goals that are not easily measured. An indicator must always be recognized as a measure of a goal, not the goal itself. It is important to provide the opportunity to go back and assess the goal, to ensure that the measure is capturing the goal, and that if success is claimed through

meeting the indicator target, that the intent of the goal has actually been achieved (Cortner 2000).

Rice and Rochet (2005) suggest an eight step process for fisheries management indicator selection. When nested within an evaluation process as suggested here, the first step, determining user needs, is part of the larger evaluation process, leaving a seven step process detailing indicator selection (Figure 6).

Figure 6. Indicator Selection Process nested within the evaluation process.



There are literally hundreds of indicators to choose from in fisheries evaluation. Under most circumstances it is impossible or at least undesirable to use all available indicators – requiring that the list of indicators be reduced,

ideally through the use of established screening criteria. De la Mare (1998) suggested selection criteria specific to MSE development:

1. relevance to fisheries management strategy evaluation;
2. ease of understanding and interpretation by stakeholders and resource managers; and
3. measurability and availability of data.

To facilitate scoring indicators, I compiled a list of indicator selection criteria adapted from the criteria suggested by de la Mare (1998), Rice and Rochet (2005) and Garcia and Staples (2000):

1. concreteness
2. theoretical basis / scientific validity
3. cost
4. measurement
5. availability
6. historical data
7. sensitivity
8. responsiveness
9. specificity

Rochet and Rice (2005) suggest assigning ranking scores of high, moderate, and minor for each screening criterion. Each indicator should be evaluated against all of the screening criteria, but then the suite of suggested indicators should be assessed to ensure that as a group they work together. The Bellagio Principles, a set of ten principles identified to guide the assessment of sustainable development (IISD 1996), provide screening criteria for the suite of

indicators. The list of indicators should be as short as possible while as a group meeting the ten principles:

1. guided by a clear vision and goals;
2. holistic - review of the whole system as well as its parts and recognition of the interaction among the parts;
3. essential elements - consider equity and disparity within the current population and over generations; consider ecological considerations; consider activities to contribute to human well-being;
4. adequate scope;
5. practical focus;
6. openness;
7. effective communication;
8. broad participation;
9. ongoing assessment; and
10. institutional capacity.

The final step in the indicator selection process is the documentation and communication of the selected indicators (Table 8).

Table 8. The categories of documentation for indicator development and communication (Garcia and Staples 2000; EAA 2008).

Category	Sub-category
Rationale	-
Indicator definition	description
	scope
Policy context	context description
	targets
Policy questions and reporting	key policy question
	reporting (graphics)
Methodology	methodology for indicator calculation
	methodology for gap filling
Data specifications	-
Uncertainties	methodology uncertainty
	data sets uncertainty
	rationale uncertainty
Further work	short term
	long term

2.5. Fisheries Evaluation "Best Practices" Checklist

I identified a checklist of 25 questions summarizing the evaluation methodology (section 0), the KEC checklist (section 2.3.1) and the performance criteria selection process (section 2.4). The checklist represents fisheries management evaluation "best practices" and can be used either to guide an evaluation in progress or to assess an evaluation after the fact. The checklist questions are straightforward and require minimal interpretation, facilitating their use as a rapid assessment tool. All questions should be answerable if the evaluation is properly documented.

1. Were the six evaluation process steps followed?
    - Identify purpose and type of evaluation
    - Characterize evaluand
    - Select performance criteria and methods
    - Collect data
    - Summarize and analyze data
    - Report
2. Were the objectives / intent of the evaluation explicitly identified?
3. Was the methodology for the evaluation defined?
4. Were adequate resources available to cover the evaluation given the identified scope, breadth and depth?
5. Was the fishery background and context described?
6. Were the resources, challenges, and conflicts of the fishery management system described?
7. Were the values, goals and objectives for the fishery management system explicitly identified?
8. Were the fisheries stakeholders identified?
9. Were stakeholders meaningfully engaged?
10. Did the selection of performance criteria follow indicator selection best practice process?
    - Develop list of candidate indicators
    - Determine screening criteria
    - Score Indicators against criteria
    - Summarize Scoring Results
    - Decide How Many Indicators are Needed
    - Make Final Selection
    - Report on the Suite of Indicators
11. Were indicators screened against indicator screening criteria?
    - concreteness
    - theoretical basis / scientific validity
    - cost

- measurement
- availability
- historical data
- sensitivity
- responsiveness
- specificity

12. Was the suite of indicators assessed against the Bellagio Principles?
    - guided by a clear vision and goals;
    - holistic - review of the whole system as well as its parts and recognition of the interaction among the parts;
    - essential elements - consider equity and disparity within the current population and over generations; consider ecological considerations; consider activities to contribute to human well-being
    - adequate scope;
    - practical focus;
    - openness;
    - effective communication;
    - broad participation;
    - ongoing assessment, and
    - institutional capacity.
13. Were fisheries management process objectives assessed?
14. Were fisheries management outcome objectives assessed?
15. Were the costs of the fisheries management system assessed?
16. Were the alternative fisheries management systems compared?
17. Was the generalizability of the system assessed?
18. Was the data used in the evaluation documented in its source and method of analysis?
19. Was the evaluation transparent?
20. Were the conclusions of the evaluation consistent with the stated objective of the evaluation and the data assessed?

21. Were the five sub-components (process, outcome, costs, alternatives, and generalizability) synthesized?
22. Was the evaluation reported on to stakeholders?
23. Were the findings of the evaluation incorporated into the management system?
24. Was the evaluation temporally comprehensive – including both prospective and retrospective components?
25. Was the evaluation conceptually comprehensive – including social, environmental, economic, and institutional dimensions?

CHAPTER 3. ASSESSING FISHERIES MANAGEMENT EVALUATION: EXAMPLES FROM THE BC GROUNDFISH FISHERIES

3.1. Assessment Approach

From a search of the DFO publications database, academic literature that focuses on economics and fisheries management, and a review of the BC groundfish management plans from the period 1991 to 2008, I identified evaluations that have occurred within the BC commercial groundfish fisheries. Past and current examples of evaluation in the BC groundfish fishery cover the spectrum of typical approaches to fisheries evaluation, including certification, program evaluation, and species assessment. Specific evaluations include:

- DFO program evaluation (EB Economics 1992a; EB Economics 1992b)
- DFO Management Plan Fishery Evaluations (DFO 1999b; DFO 2000b; DFO 2001b; DFO 2002; DFO 2003a; DFO 2004a; DFO 2005b)
- Marine Stewardship Council pre-assessments and assessments (SCS 2004; Devitt and Benson 2006; SCS 2008)
- COSEWIC species assessments (COSEWIC 2007)
- Management Strategy Evaluation (Cox and Kronlund 2008)
- DFO stock assessment (DFO 2003b; DFO 2005c)
- International Pacific Halibut Commission stock assessment (Clark and Hare 2005)
- External academic evaluations (Casey et al. 1995; Grafton et al. 2000; Hartley and Fina 2001)

- Industry sponsored evaluations (Nelson 2006)
- External conservation organization evaluations (Redstone 2007; Wallace 2007)

I selected five examples of evaluation to consider in greater detail and scored them against the fisheries management evaluation “best practices” checklist. The five examples were selected to cover the four categories of fisheries management evaluation. I gave preference to the most recent and complete examples available from each category to ensure that the selected examples reflected current evaluation practice. For fisheries management program evaluation, I opted to focus on examples of evaluation that were sanctioned and supported by DFO. While evaluations have occurred in recent years highlighting certain areas of fisheries programs (Nelson 2006; Nelson 2007; GSG 2008), there are few comprehensive program evaluations for BC groundfish and no recent ones. To address this, I selected two evaluation examples for this category. The 1992 halibut ITQ program evaluation (EB Economics 1992b) is an example of a comprehensive BC groundfish program evaluation, sponsored by DFO and carried out by an external evaluator. For the second example I examined the use of evaluation within the groundfish integrated management plans (DFO 1999b; DFO 2000b; DFO 2001b; DFO 2002; DFO 2003a; DFO 2004a; DFO 2005b; DFO 2006b; DFO 2007a; DFO 2008). These plans demonstrate the common usage of evaluation by DFO and are the primary example of government sponsored program evaluation that has been publicly available for the BC groundfish fisheries since 1999. I examined the BC

Halibut MSC assessment (SCS 2008) as an example of certification, a COSEWIC assessment for the Canary rockfish as a recent example of a species assessment evaluation (COSEWIC 2007) and the sablefish MSE (Cox and Kronlund 2008) for the MSE category.

3.2. Evaluation Example Overview

For each of the five examples of evaluation that I assessed, I provide a brief description, including who conducted the evaluation, when, and why, example highlights, the context, and why the example is important to the BC groundfish situation.

3.2.1. DFO Halibut ITQ Program Evaluations

Towards the end of the second year of the halibut individual quota pilot in 1992, DFO commissioned a program evaluation to assess the halibut fishery to assist in the decision about whether or not to retain individual quotas in the halibut fishery (EB Economics 1992b). The evaluation was completed by an external evaluator funded jointly by DFO and the BC Ministry of Agriculture, Fisheries, and Food. The evaluation assessed fisheries conditions in seven categories:

1. financial and economic benefits;
2. economic impact and distribution, including employment, income, and community impacts;
3. impacts on the resource;
4. enforcement;
5. safety;

6. cost effectiveness; and
7. perceptions and user satisfaction.

The evaluation was based on interviews, questionnaires, and quantitative data. The data were compiled from the catch sales database, landings validation database, quota monitoring database, provincial government wholesale values, DFO cost and earnings surveys from 1988 and 1991, and information on license holders and quota holdings provided by DFO. Consistent with the recommendations of the report, the halibut fishery individual quota system was retained, with program modifications including introducing quota transferability and capping vessel catch volumes.

3.2.2. DFO Management Plan Fishery Evaluations

BC groundfish fishery management plans are produced annually by the DFO groundfish management unit. These plans outline the fishery regulations for the year in addition to describing the fishery and, in some instances, evaluating the fishery against a set of objectives and indicators. In the absence of dedicated fisheries program evaluations within the BC groundfish fisheries, these management plans are a demonstration of current evaluation practices.

To include management plan evaluations as an example, where there is no single report outlining an evaluation, I first conducted a review of all groundfish management plans from 1996 through 2008 to identify what plans included an evaluation component. The halibut management plans were the first to explicitly include an evaluation component and were more comprehensive and

consistent than the management plans for the other fisheries. Based on this, I selected the halibut management plans as a best case scenario for assessment. I summarized the use of evaluation from each annual halibut management plan and based the evaluation assessment on this summary.

The first groundfish management plan to list fisheries objectives was the 1999 halibut plan (DFO 1999b). This was followed by the sablefish, inside rockfish hook and line, and outside rockfish hook and line plans in 2000, and the groundfish trawl and schedule II plans in 2001. These first management plans to identify objectives did not include a retrospective analysis. The management objectives identified in the 1999 halibut management plan are very brief, but include objectives across all four sustainable development subject dimensions:

- Sustainable harvest fishery
- Stability and viability of the existing fleet
- Continued inclusion of First Nations
- Continued cost recovery by participants in the commercial fishery

The 2000 halibut management plan (DFO 2000b) elaborated on the stated objectives, identifying strategies associated with the objectives, but also reduced the extent of the objectives, identifying halibut and rockfish specifically rather than the entire fishery system, citing food, social, and ceremonial requirements met for First Nations rather than the broader “continued inclusion,” and dropping the reference to a stable and viable fleet:

- To ensure conservation and protection of halibut and rockfish stocks through the application of scientific management principles applied in a

risk averse and precautionary manner based on the best scientific advice available.

- To meet the federal Crown's obligations regarding aboriginal fisheries for food, social and ceremonial purposes.
- To develop sustainable fisheries through co-management approaches with client groups and stakeholders to share in decision making, responsibilities, costs and benefits

The 2000 halibut management plan, like the 1999 plan, did not include an explicit evaluation of the fishery, but did include an assessment of the halibut fishery in the following statement, with no information provided on the process used to reach these conclusions about the halibut fishery, nor data to support these claims.

> The IVQ program has proven very successful. Not only has IVQ management resulted in a more sustainable, rational and safer commercial halibut fishery, it has also improved the financial viability of the industry. The IVQ program has also successfully involved vessel owners more closely in the management of the resource from which they derive their livelihood. A co-operative approach to management has evolved in the commercial halibut fishery. This co-operative approach has become a model for other fisheries in the region. (DFO 2000b, p. 13)

The 2001 halibut plan (DFO 2001b) was far more extensive, but confused and combined objectives and strategies. Many of the objectives can be classified as process objectives rather than outcome objectives, focusing on the process of working together rather than on the achievement of an outcome. The objectives can be summarized, not including the strategies which formed the majority of the objectives section, as:

- Conservation of halibut and rockfish, and incidentally caught seabirds

- Initiated stakeholder consultations
- Cost recovery
- Improved catch monitoring and data collection within the Food, Social, and Ceremonial fishery and the recreational fishery.

The 2001 plan also included a performance review for the first time, including management plan evaluation criteria (of which some could be called indicators with targets, some process objectives), as well as a 2000 post-season review, although the post-season review did not follow the management plan evaluation criteria identified. The 2002 evaluation partially addressed the evaluation criteria identified in the 2001 management plan. Again in 2002, the focus was on adherence to the TAC, levels of discard, observer coverage and enforcement, development of co-management agreements – in part to achieve cost recovery – and resolution of allocation disputes. The 2002 management plan identified a total of 14 objectives with 11 performance measures by:

1. four general management objectives without performance measures;
2. six commercial fishery management objectives, of which five had one performance measure and the sixth had two performance measures;
3. two First Nation fishery management objectives with one performance measure each; and
4. two recreational fishery management objectives with one performance measure each.

There was overlap in some of these objectives, with the objective to improve catch data appearing in the commercial, First Nation, and recreational sections, each with individual performance measures. The performance

measures in some cases were stated as strategies for achieving the objective rather than as a measure for assessing if the objective was achieved.

The 2003 plan objectives and performance measures were largely unchanged from 2002, with the reworking of some objectives and measures and the addition of a management objective and performance measure within the commercial section. The 2004 plan saw a streamlining of the objectives and performance measures, with only two sections, general and halibut fishery, where there were previously four sections. Six general objectives were identified and four halibut fisheries management objectives, each with a single performance measure. The 2005 plan had nearly identical general objectives and measures and a pared down fisheries section with only three management objectives, with the removal of the 2004 objective “provide opportunity for the commercial sector to expand its role in the management of the commercial fishery” (DFO 2004a, p. 17). The 2005 management plan, like the 2001 through 2004 plans, included an assessment based on the previously identified performance measures. Seven of the 10 performance measures can be classified as qualitative descriptive measures.

The practice of identifying the objectives and conducting a post-season evaluation was discontinued in 2006 with the introduction of a new management plan that covered all groundfish fisheries in a single plan. The objectives of the groundfish integrated pilot are identified in the annual groundfish management plans from 2006 through 2008 (DFO 2006b; DFO 2007a; DFO 2008), but not the objectives of the fisheries and no evaluation component.

> The objective of the pilot plan is to improve stock management through bycatch monitoring, reduced discarding, and requiring harvesters to be accountable for all catch. (DFO 2008, p. 17)

3.2.3. Halibut MSC Assessment

MSC is arguably the premiere fisheries certification system in the world. It enjoys an international profile, is funded directly by fisheries undergoing certification and by foundations, was co-founded by the World Wildlife Fund and its' work is supported by the Packard Foundation (MSC 2008). MSC standards for sustainable fisheries management include three principles, each with associated criteria. For each fishery that enters the certification process, an assessment team is chosen, which selects fishery specific indicators for the criteria and evaluates the fishery using the indicators.

MSC certification has made few inroads into BC fisheries. A number of fisheries are under assessment, but none had been certified as of September 2008. This is in stark contrast to fisheries occurring adjacent to BC waters, in Alaska, Washington, and Oregon, where MSC certification has been granted to halibut, sablefish, pollock, and other fisheries. BC groundfish fisheries that have undergone pre-assessment or are currently being assessed include hake, spiny dogfish, halibut, and sablefish. The halibut fishery is the furthest along in the process. Assessed in 2004 and denied certification, the Pacific Halibut Management Association reinitiated the process following groundfish integration and a revised halibut assessment was released in September 2008 (SCS 2008).

3.2.4. COSEWIC Groundfish Assessments

Species assessments in BC groundfish are typically carried out by either the Canadian or American federal government agencies or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). COSEWIC adopted a strategic approach to assess what were considered the most vulnerable and at risk species following the enactment of the *Species at Risk Act* (SARA) legislation (COSEWIC 2008). The strategy has meant that many of the groundfish species, notably rockfish, sharks and rays, were among the first marine species to be assessed by COSEWIC. The majority of recent species assessments for BC groundfish are COSEWIC assessments. COSEWIC assessments are contracted out by COSEWIC to external evaluators. These evaluators are fisheries scientists that may be independent contractors, DFO employees, or university affiliated researchers.

Of the six groundfish species recommended for listing by COSEWIC, none had been listed under SARA as of September 2008 (Table 9). The COSEWIC process has been criticized both for the fact that COSEWIC makes recommendations solely on the environmental subject dimension (GOC 2006) and, conversely, because COSEWIC is only the first stage of the SARA listing process and COSEWIC recommendations can be overruled based on socioeconomic considerations (Mooers et al. 2007).

COSEWIC assessments are by their nature narrow in focus and scope. They apply to single species, have an exclusively environmental dimension, and are retrospective. These features of this form of assessment require that the

comparison of COSEWIC groundfish assessments to best practices recognize that at least some of the limitations identified are limitations of the approach and not the individual COSEWIC assessments.

I selected the most recent publicly available Pacific groundfish assessment as the example of species assessment (COSEWIC 2007). The canary rockfish assessment is complete but the decision to list under SARA is still under consideration.

Table 9. COSEWIC reviewed species intercepted in the BC commercial groundfish fisheries (GOC 2008). The rockfish and skate species have commercial value and are landed, whereas the four shark species are incidental bycatch species with no commercial value.

Common Name	Species Name	Date of Last Status Report	COSEWIC Status	SARA Status
Canary Rockfish	*Sebastes pinniger*	November 2007	Threatened	No Status
Rougheye Rockfish	*Sebastes aleutianus*	April 2007	Special Concern	No Status
Bocaccio	*Sebastes paucispinis*	November 2002	Threatened	No Status
Longspine Thornyhead	*Sebastolobus altivelis*	April 2007	Special Concern	No Status
Big Skate	*Raja binoculata*	April 2007	Not at Risk	N/A
Longnose Skate	*Raja rhina*	April 2007	Not at Risk	N/A
Sandpaper Skate	*Bathyraja interrupta*	April 2007	Not at Risk	N/A
Bluntnose Sixgill Shark	*Hexanchus griseus*	April 2007	Special Concern	No Status
Tope/Soupfin Shark	*Galeorhinus galeus*	April 2007	Special Concern	No Status
Blue Shark	*Prionace glauca*	April 2006	Data Deficient	N/A
Basking Shark	*Cetorhinus maximus*	April 2007	Endangered	No Status

3.2.5. Sablefish Management Strategy Evaluation

The most recent MSE addition in BC is the 2008 sablefish MSE (Cox and Kronlund 2008). The sablefish MSE was a joint project of the sablefish licence

owner association (Canadian Sablefish Association) and DFO. MSE represents a significant advancement in fisheries management, but there are limitations in how the approach is being applied. In BC groundfish in particular, MSE use has been very limited in both application and scope. Of the three largest commercial groundfish fisheries, only sablefish has had an MSE applied. Within the sablefish MSE, the fisheries management objectives are limited in scope to only those identified by the convenors of the process – sablefish licence owners and DFO. The resulting objectives cover environmental and economic objectives, but do not identify social or institutional objectives.

The sablefish MSE represents the culmination of several years of concerted effort to improve fisheries management practices, and includes a comprehensive assessment of the identified management options to enable an informed selection of the strategy for achieving the identified objectives. The indicators used in the assessment are catch variability using the average absolute variation (AAV) (Punt and Smith 1999), catch levels, and spawning biomass.

3.3. Assessment Results

Based on the written reports for each assessment, I assigned a ‘yes’ if the question was fully met and a ‘no’ if not. A ‘partial’ was assigned in cases where the question did not merit a ‘yes’ response but was not wholly unmet, the determination of which depended on the nature of the question. For questions that had multiple elements, such as questions 1, 10, 11, 12, and 25, if more than

half of the elements were met then a ‘partial’ answer was assigned. For questions that did not have multiple elements, a ‘partial’ was assigned if the subject of the best practice question was acknowledged if not fully achieved. For example, question 9, which asks if the evaluation meaningfully engaged stakeholders, if the evaluation attempted but failed to achieve stakeholder engagement, it received a ‘partial’ answer. ‘Partial’ answers indicated areas were there was the intent to meet the best practice but that it was not successful or complete. Where information needed to assess a checklist question was missing, ‘unknown’ was recorded.

Table 10 sets out the results of the best practices assessment for the five examples of BC groundfish fishery evaluations.

Table 10. Summary of the five BC groundfish fishery evaluation examples scored against the evaluation "best practices" checklist. (1) 1992 Halibut Program Evaluation, (2) Halibut Management Plans, (3) Halibut MSC Assessment, (4) COSEWIC Canary Assessment, and (5) Sablefish MSE. Each checklist question was answered Yes (Y), No (N), Partial (P) or Unknown (?).

Evaluation "Best Practices" Checklist	1	2	3	4	5
1. Were the six evaluation process steps followed?	Y	N	Y	Y	Y
2. Were the objectives / intent of the evaluation explicitly identified?	Y	N	Y	Y	Y
3. Was the methodology for the evaluation defined?	Y	N	Y	Y	Y
4. Were adequate resources available to cover the evaluation given the identified scope, breadth and depth?	?	?	Y	N	?
5. Was the fishery background and context described?	Y	Y	Y	N	Y
6. Were the resources, challenges, and conflicts of the fishery management system described?	P	P	P	N	P
7. Were the values, goals and objectives for the fishery management system explicitly identified?	N	P	Y	N	P
8. Were the fisheries stakeholders identified?	P	Y	P	N	P
9. Were stakeholders meaningfully engaged?	N	N	Y	N	P
10. Did the selection of performance criteria follow indicator selection best practice process?	N	N	?	N	?
11. Were indicators screened against indicator screening criteria?	N	N	?	N	N
12. Was the suite of indicators assessed against the Bellagio Principles?	N	N	?	N	N
13. Were fisheries management process objectives assessed?	N	P	P	N	N
14. Were fisheries management outcome objectives assessed?	Y	P	Y	P	Y
15. Were the costs of the fisheries management system assessed?	P	N	N	N	P
16. Were the alternative fisheries management systems compared?	P	N	N	N	N
17. Was the generalizability of the system assessed?	N	N	N	N	N
18. Was the data used in the evaluation documented in its source and method of analysis?	Y	N	Y	Y	Y
19. Was the evaluation transparent?	N	N	Y	Y	Y
20. Were the conclusions of the evaluation consistent with the stated objective of the evaluation and the data assessed?	N	N	?	Y	Y

Evaluation "Best Practices" Checklist	1	2	3	4	5
21. Were the five sub-components (process, outcome, costs, alternatives, and generalizability) synthesized?	N	N	N	N	N
22. Was the evaluation reported on to stakeholders?	Y	Y	Y	Y	Y
23. Were the findings of the evaluation incorporated into the management system?	Y	?	?	?	Y
24. Was the evaluation temporally comprehensive – including both prospective and retrospective components?	N	N	N	N	Y
25. Was the evaluation conceptually comprehensive – including social, environmental, economic, and institutional dimensions?	N	N	P	N	N

All examples that I examined of evaluation in the BC groundfish fishery achieved a 'yes' answer for less than half of the 25 checklist questions. The halibut MSC and the sablefish MSE rated highest of the five examples, each with 11 'yes' answers, compared to the halibut management plan with only three 'yes' answers. None of the examples was conceptually comprehensive, some by design and others by omission. Significant gaps that were consistent across evaluations include stakeholder engagement, the indicator selection and screening process, and inclusion of evaluation sub-components that compare alternatives and assess the generalizibility of the system.

3.3.1. DFO Halibut ITQ Program Evaluations

The oldest evaluation examined, the halibut ITQ program evaluation, followed evaluation process, documented the data used, and reported on findings which were then acted upon by DFO in transitioning the ITQ program from a pilot to a full program. However, the evaluation failed to meet nearly every other best practice. The process of indicator selection was not documented or

justified and the evaluation overall was not transparent. The evaluation relied heavily on interview data to assess a number of indicators, resulting in elements of the evaluation that were characterized as being assessments of the program outcome but that would more appropriately be characterized as assessments of perceptions of the program. The evaluation was meant to be a full evaluation of the fishery following the implementation of ITQs, but did not address process objectives and only superficially considered evaluation costs and alternatives. Recommendations were made regarding program design, including quota transferability, that were not supported by evaluation methodology nor the stated objectives for the evaluation, and causal relationships were assumed. Overall this evaluation achieved ‘yes’ answers to less than one third of the checklist questions.

3.3.2. DFO Fishery Management Plan Evaluations

Fishery management plan evaluation sections are a poor fit with program evaluation, but were examined because they represent the extent of recent fishery program evaluation within the BC groundfish fisheries that is available for public review. The evaluation, a collection of evaluation sections from several years of management plans, achieved a ‘yes’ answer to only three of the checklist questions: stakeholders were identified, the fishery background and context was described, and the evaluation was reported on to stakeholders. For four other questions the evaluation was rated as ‘partial’, with some program and outcome objectives examined, some challenges within the fishery management

system described, and some goals and objectives identified. No other best practices were even partially met in this example.

3.3.3. Halibut MSC Assessment

The halibut MSC assessment was one of the two better evaluations examined based on the checklist ratings. MSC assessments are by design not prospective and do not consider the full scope of the fisheries management system, most notably the cost, generalizability, and alternative systems. Management process objectives are only examined to a limited extent. Based on the design of the MSC program, six of the 25 checklist questions would be expected to be partially or not met. The main area of weakness identified using the checklist is the indicator selection and screening process. The selection of indicators for MSC assessments are fishery specific and rigorous, but the indicator selection process is undertaken by the assessment team and is not transparent, resulting in several questions that could not be answered as to whether or not indicator screening criteria were used. Two questions were answered as ‘unknown’ due in large part to the short duration since the release of the assessment. The certification decision by MSC has not yet been made. Until that time, it is not possible to assess whether or not the conclusion is consistent with the stated objective of the evaluation. Similarly, there has not been time for the findings of the evaluation to be incorporated into the management system, so this question also was answered as an unknown. The Halibut MSC was the only evaluation to be rated with a partial grade for being conceptually comprehensive, including elements of environmental, economic,

and to a limited extent, institutional and social. This evaluation more than any others examined included a broad spectrum of stakeholders through a commenting process and incorporation of stakeholder views.

3.3.4. COSEWIC Groundfish Assessments

The COSEWIC Canary species assessment is by its nature narrow in scope. Similar to the Halibut MSC, it would be expected that seven of the 25 checklist questions would not be met. Four of the five elements of program evaluation (process objectives, costs, alternatives, and generalizability) are not encompassed by the approach and the evaluation would not be expected to be either temporally or conceptually comprehensive. Even with the expectation that a number of best practices would not be achieved by this evaluation example, the evaluation achieved ‘yes’ on less than half of the 18 best practices it is reasonable to expect it to meet. The greatest deficiencies were in the indicator selection process, the identification of goals and objectives, characterization of the context and challenges, and identification and engagement of stakeholders. The absence of a process to engage stakeholders and identify the larger context within which the species assessment occurs is also somewhat to be expected given the singular species focus of COSEWIC assessments, but does suggest why these assessments are frequently challenged by stakeholders when they do have an opportunity to review them after the evaluation is completed and reported on.

3.3.5. Sablefish Management Strategy Evaluation

The sablefish MSE assessment was the second of the two better evaluations examined based on the checklist ratings. The main area of weakness identified from the checklist is the indicator selection and screening process, which was the common area of weakness across all five evaluations examined. The sablefish evaluation had partial grades for the fishery description, characterization, and stakeholder engagement, reflecting the attempts made by the convenors to address these components, but was ultimately incomplete with only the federal government and primary industry provided the opportunity to identify indicators and engage during the evaluation. The other stakeholder interests, including First Nations, community interests, conservation interests, and industry representatives that are not sablefish licence holders were not provided the opportunity to engage during the process. This may also partially explain why the MSE was not conceptually comprehensive. The sablefish MSE, despite having the same number of ‘yes’ answers as the halibut MSC, differed in its’ strengths. Whereas the MSC evaluation included a broad spectrum of stakeholders and was the only evaluation of those examined to rate a partial on conceptual comprehensiveness, the MSE rated ‘not met’ or ‘partial’ for these practices. The strengths of the MSE were in that it was the only evaluation examined that was temporally comprehensive, incorporating a prospective component, and it directly influenced fisheries management.

CHAPTER 4. A GUIDE TO IMPLEMENTING COMPREHENSIVE FISHERIES MANAGEMENT EVALUATION: A CASE STUDY OF THE BC GROUNDFISH FISHERIES

The BC groundfish fisheries have undergone dramatic management changes since 2006. The groundfish integration program, introduced on a three year pilot basis in 2006, included implementation of individual transferable quotas (ITQs), complete on board monitoring coverage, requirements for individual catch accountability, and limited quota transferability between the groundfish sectors. During this period of fisheries change, there has been virtually no publicly available, government sanctioned evaluation. The aggregate value of the groundfish fisheries is greater than any other Pacific fisheries species grouping, at over $150 million landed value per year. The groundfish fisheries occur in regions undergoing increasing scrutiny as large ocean management areas are established, and these fisheries are being promoted as demonstration fisheries to highlight Canada's commitment to sustainable fisheries. The groundfish integration program is set to undergo a program evaluation following the completion of the groundfish integration pilot (DFO 2008). I show how the comprehensive evaluation methodology discussed in chapter two could be used to achieve best practices in this planned evaluation of the BC groundfish

integration program, and how this methodology would address the shortcomings of previous evaluations in the BC groundfish fisheries.

4.1. Step 1: Identify Purpose and Type of Evaluation

Identifying the purpose and type of evaluation is a basic first step that may appear to be the simplest, but it is not consistently implemented. This first step is critical for establishing the foundation that the remaining five steps build upon.

Fisheries and Oceans Canada has released a request for proposals (RFP) to conduct the groundfish integration evaluation. That RFP identifies the purpose and type of evaluation, but is not as explicit and not as wide in scope as the evaluation literature suggests it should be. The evaluation of the groundfish integration program must be an evaluation of the groundfish fisheries – it is impossible to identify the impact of the program and its successes and failures without also understanding the condition of the fisheries pre- and post-integration. Since there was no pre-integration comprehensive evaluation of the groundfish fisheries, an assessment of the integration program must address this deficiency with a comprehensive analysis of the groundfish fisheries that includes retrospective pre-integration evaluation as well as post-integration evaluation. The four sustainable development dimensions (environmental, economic, social, and institutional) must be covered.

The methodology identified in the RFP is a combination of qualitative, through interviews of stakeholders, and quantitative, through a review of fisheries

data retrieved from the monitoring service provider and DFO. The scope and purpose of the evaluation requires a mixed methods approach, including both quantitative and qualitative data sources as identified, although the RFP is overly limited in its identification of data sources. This will be explored in Step 4: Collecting Data.

4.2. Step 2: Characterize Evaluand

The characterization of the evaluand is the step at which the individual and unique circumstances of a fishery system are identified. Understanding the context of the evaluation is critical to ensuring that the steps following – the performance criteria selection, analysis, and reporting – are meaningful and relevant to the conditions of the fishery system being evaluation.

The characterization of the BC groundfish fisheries should cover identification of the jurisdiction, the management agency, the current management system, and the stakeholder groups. The jurisdiction and management agency are well known in the BC fisheries, with the federal government holding sole jurisdiction and the fisheries managed by the federal management agency Fisheries and Oceans Canada. This is complicated by the unresolved rights and title claims of First Nations. At present, jurisdiction and ultimate management responsibility is retained by the federal government, and past and current treaties do not alter this, although with possible future treaty settlements and ongoing litigation by First Nations, this landscape could change significantly.

The management system of the BC groundfish fishery is highly complex and is not well documented. The most complete documentation of the system is in the annual management plan, which for 2008/2009 is 157 pages in length, has been amended twice within the year, and does not provide details on the electronic monitoring system, the quota trading system, the semi-formal co-management working relationship between the department and the Commercial Industry Caucus (CIC), the goals and objectives for the fisheries, or the ongoing allocation and management negotiations with First Nations and the recreational sector. Details about the electronic monitoring system have been documented in a working paper prepared by the CIC Electronic Monitoring Sub-committee, but this document has not been finalized and has not been made available for public release. The initial groundfish integration pilot proposal released by the CIC in 2005 provides some documentation on the workings of the CIC, but has not been updated since 2005 and is now out-of-date.

Although it would be a major undertaking, complete and comprehensive documentation of the BC groundfish management system is needed as a preliminary step to completing the evaluation of the integration program and the groundfish fisheries. This has not been identified by DFO as a task to be completed as part of the evaluation.

The identification of stakeholder groups is similarly in a state of partial completion. A complete stakeholder consultative board, the Commercial Groundfish Industry Advisory Committee (CGIAC), was struck in 2003, and included representatives from commercial industry, First Nations, provincial

government, labour, conservation non-profits, recreational interests, and coastal communities (CIC 2005). This committee last met in late 2006 and was dissolved in 2007, to be replaced by a committee that has never materialized. The stakeholders have been identified, but have not been effectively engaged. The creation of a forum that will ensure a voice for stakeholders in ongoing management decisions, which would then also provide a venue to engage stakeholders in the evaluation of the fishery, has received support from stakeholder groups and has been agreed to by DFO but has not been implemented (DFO 2007b; MCC 2007).

4.3. Step 3: Select Performance Criteria and Methods

The selection of performance criteria is the pivotal step of the evaluation, forming the core of the process. This step often suffers from being either not explicit or too narrowly defined to meet the purpose of the evaluation. Within fisheries evaluations, the selection of performance measures is usually not given adequate consideration. The RFP for the groundfish integration evaluation approached this step in a haphazard way, not clearly differentiating between program objectives and evaluation objectives, and identifying the performance measures that would be used without providing the evaluator with the opportunity to identify these measures in a reasoned, rational way that is tied to fishery objectives and includes stakeholder input. The measures that were identified are not sufficient to address the scope of the evaluation that is required.

Using the indicator structure identified in 2.4.1, and based on the sustainable development conceptual model, I identify fisheries management goals and objectives against which the groundfish fishery management system can be assessed. I address the first step of the seven step indicator selection process considered in 0, the development of a candidate list of indicators. In developing these goals, objectives, and indicators I use the conceptual framework and terminology from the Commission on Sustainable Development (UNDESA 2001), as it is internationally recognized and is consistent with Canadian federal legislation (Oceans Act 1996):

1. Environmental (or biophysical)
2. Social
3. Economic
4. Institutional (or governance)

4.3.1. Fishery Management Goals

From policy, legislation, and academic literature I developed a list of fisheries goals and objectives that apply to the BC groundfish fisheries. Broad level fisheries management goals showed common themes across jurisdictions, from which I compiled a list of eight goals, common across multiple fisheries jurisdictions and relevant to the BC groundfish fisheries (Oceans Act 1996; FAO 1999; Grieve and Richardson 2001; Fletcher et al. 2002; MSC 2002; Fletcher et al. 2003):

1. maintenance of biological diversity
2. maintenance of marine productivity

3. economic efficiency
4. profitability and economic returns
5. fish product health and safety
6. community stability and health
7. equitable distribution of benefits
8. effective fisheries management

Each of the listed goals primarily relates to a single sustainable development dimension but most fit reasonably into several.

4.3.2. Objectives and Indicators

I identified objectives for each goal and classified according to the four sustainable development dimensions (Table 11). I then identified indicators associated with the objectives drawing from the indicator literature (OECD 1993; FAO 1999; Force and Machlis 1997; Charles et al. 2002; Fletcher et al. 2002; MSC 2002; Segnestam 2002; Fletcher et al. 2003; OECD 2003; UNDSD 2006; UNDESA 2007). Each objective has between one and five associated indicators with 66 indicators identified in total (Table 12).

Table 11. A list of fisheries objectives identified for each fisheries goal, categorized by sustainable development dimension.

Sustainable Development Dimension	Goal	Objective
Environmental	maintenance of biological diversity	maintain species abundance at or above specified level
		minimize impacts on non-commercial species impacts
		maintain species integrity
	maintenance of marine productivity	maintain ecosystem integrity
		maintain levels of species biomass to minimize significant impact on the broader ecosystem
		climate change
Economic	economic efficiency	capital productivity
		minimize wastage
		energy efficiency
	profitability and economic returns	catch
		catch variability
		financial viability
Social	fish product health and safety	toxic contamination
		product tracking
	community stability and health	coastal community population stability
		education
		security
		employment
		employee safety
		infrastructure
		resilience
	equitable distribution of benefits	income
		access
		rents
Institutional	effective fisheries management	stakeholder involvement
		stakeholder confidence and satisfaction
		cost recovery
		cost effective
		accountability
		enforcement
		statutory obligations

Table 12. A list of indicators identified to achieve complete coverage of all fisheries objectives identified and listed in Table 11.

Objective	Indicator
maintain species abundance at or above specified level	change in threat status of marine species
	spawning biomass relative to unfished levels
minimize impacts on non-commercial species impacts	discard of non-commercial species
maintain species integrity	population structure of species – age, sex, and size distribution
maintain ecosystem integrity	the spatial extent of habitat
	area fished, by gear type, classified by habitat type
	the population structure of dependent and related species – age, sex, and size distribution
maintain levels of species biomass to minimize significant impact on the broader ecosystem	biomass levels relative to unfished levels
	relative levels of biomass removed
climate change	greenhouse gas emissions
capital productivity	number of inactive or underutilized fishing vessels
	financial net return / capitalized value
	ex-vessel price
minimize wastage	landed value of marketable discard
	proportion of catch unutilized
energy efficiency	total primary energy supply per unit of fish landed
	total primary energy supply per unit of landed value
catch	total allowable catch
	proportion of TAC caught
	net financial returns
catch variability	average absolute variation (AAV)
financial viability	enterprise level net revenue
toxic contamination	emissions of contaminants from fishing activity
	concentration of toxic contaminants in fish products
product tracking	proportion of fish products with comprehensive product labelling
coastal community population stability	population growth
	population density
	population age and gender structure
education	literacy

Objective	Indicator
	education level
security	crime rates
employment	employment status
	primary employment (skippers, crew) per unit of landed weight and value
	secondary employment (processing, transportation) per unit of landed weight and value
	number of active fishing vessels
employee safety	accident claims registered per 1000 fishermen
	deaths per year
infrastructure	number and location of marine fuel docks
	number and location of fish processing and offload stations
	number, status, and location of docks
	number, status, and location of vessel ways and vessel repair facilities
resilience	debt levels among fishermen
	aggregate fishing capacity
	age distribution of fishermen
	proportion of fishermen with multiple licences
	fleet size and age profile
income	proportion of population living below national poverty line
access	distribution of access and catch
rents	proportion of landed value captured by rent
	distribution of rents
stakeholder involvement	degree to which stakeholder views are included in management plan development
	degree to which stakeholder views are included in policy development
	degree of management process transparency
stakeholder confidence and satisfaction	confidence in the fisheries management system, by stakeholder group
	satisfaction with the state of fisheries
	satisfaction with the management agency
cost recovery	absolute cost recovered
	costs recovered relative to management costs
	costs recovered relative to landed value
cost effective	absolute cost of management

Objective	Indicator
	distribution of management expenditures by category
accountability	information access
enforcement	violations reported
	coverage of fisheries activity
statutory obligations	the proportion of food, social, and ceremonial allocations that are met
	the number of successful appeals of management decisions based on a failure to consult

4.4. Step 4: Collect Data

The groundfish integration RFP identifies interviews with stakeholders and fisheries data from the monitoring service provider and DFO as the data sources for the evaluation. While this covers most data that would be available for the evaluation, there are two important sources not included. One is the quantitative data held by industry participants, in the form of financial data that can be accessed through government records or surveys of industry, and the other is the data collected by non-governmental, non-industry groups, be they academics, non-profits, First Nations, or community organizations.

A third data source that is not included is the collection of primary data, such as infrastructure surveys, that will fill gaps in the current data sets. Excluding indicators in an evaluation solely on the basis of a lack of data, while it may be pragmatic, tends to bias an evaluation. Where data are not available to address an indicator, the first step should be to attempt to compile the data from existing sources. Where unsuccessful, the second step is to attempt to collect the

data, and the final step is to attempt to identify a complementary indicator for which data can be compiled or collected.

Addressing the 66 indicators identified in 4.3.2, with the exception of the five indicators that require species status information (biomass and population structure) and the one indicator that requires the mapping of habitat, all data for the indicators can be compiled from existing government data sources or collected through an interview or survey process. For the six indicators that are exceptions, more extensive biological and habitat assessment work is required, although these data are available for some of the groundfish species currently and for some regions.

The limiting factor in actually carrying out an evaluation of the BC groundfish fisheries is that while the majority of the data required can be compiled, with some effort, from existing government data sources, much of these data are restricted and not made available to the public. A report released in 2008 summarized federal fisheries data availability (Edwards et al. 2008):

- Individual catch data are restricted, aggregate catch data are not
- Quota holdings and transactions information is not restricted, unless it can be used to calculate individual vessel catch
- Licence and vessel ownership is not restricted
- Contact city of licence and vessel holders has been refused in some instances and released in other instances. These data are available online from the Transport Canada website, indicating that they are not confidential, but continue to be refused for release and are not readily available in a downloadable format.

Of the 66 indicators, 24 could be assessed using government sourced data that are not consistently made available to the public. This fact highlights the importance of either the establishment of a more transparent data system that requires the release of government data, or the support of the federal government to make the necessary data available for evaluation.

4.5. Step 5: Summarize and Analyze Data

The fifth step in the evaluation process consists of analyzing and summarizing the data compiled in the previous step, as well as developing fisheries operating system simulation models to both explore the causal relationships that lead to the observed results and to explore scenario outcomes using prospective evaluation. It is at this stage that comparisons between alternative systems and an assessment of the generalizability of the system can be carried out, to round out the five sub-components of the evaluation, with the previous three – process, outcomes, and cost – covered within the indicators identified. The results are then fully explored and documented, to ensure transparency in the evaluation findings, and summarized to facilitate communication.

To be fully comprehensive, the evaluation must be inter-disciplinary and make use of mixed methods, combining indicators that consist primarily of either trend data or survey data, modeling that generates expected indicator values under alternate scenarios, and outputs that can be readily communicated and understood by stakeholders. This step is the most intensive step of the process,

and will likely require the involvement of external experts to design and implement the modeling component, integrate the results into a comprehensible whole, and communicate the findings. Demonstrating each element of this step is beyond the scope of this research. Instead, I present trend data for four indicators (Table 13) with interpretation to demonstrate the application of the indicator framework, based on data received from DFO. The indicator data presented fall within the retrospective evaluation component, but also demonstrate how these same indicators can be presented and interpreted if generated using a model of the fisheries system. Where data were available, a time series spanning fifteen years is included. For a number of the indicators, only two data points were available, the first year of ITQs for sablefish (1990) and halibut (1991) and the first year of integration (2006). To address the evaluation purpose, both pre- (2005 and earlier) and post-integration (2006-2008) data points would be necessary. For the halibut and sablefish fisheries, because ITQ implementation represented such a dramatic shift in the management regime in the relatively recent past, a time series that is inclusive of the pre-ITQ period or immediately post-ITQ period is appropriate.

Table 13. The four indicators used to demonstrate the application of the indicator framework through the presentation of trend data and interpretation, with their associated dimension, goal, and objective.

Subject Dimension	Goal	Objective	Indicator
Economic	profitability and economic returns	catch	total allowable catch
			proportion of TAC caught
	equitable distribution of benefits	access	distribution of access and catch
Social	community stability and health	resilience	aggregate fishing capacity

4.5.1. TAC and Proportion of TAC Caught

TAC is the Total Allowable Catch, or the annual catch limit for the species for a given management area. TAC is the primary management tool for groundfish species. Where the landings exceed the TAC, this can be an indication of the failure of the management system to control catches, or a failure of the management system to set TACs that accurately reflect species abundances, or both. Where the TAC is not caught, this can be an indication that the TAC is too high for the species, or that the species is not financially valuable enough to warrant fishing effort to catch it, or that other species interactions are limiting the ability of the fishery to catch the TAC. Under individual quota management systems, quota availability may also influence landings resulting in aggregate landings far below the available TAC. In the BC ITQ system, for example, quota is made available via an unregulated open market based on “willing buyer, willing seller” (CIC 2005). Where there is no willing seller, or when buyers and sellers are not matched up, the amount of quota available is effectively reduced and by extension, catch is reduced.

Landed catch has closely followed TAC in both the sablefish (Figure 7) and halibut (Figure 8) fisheries for more than three decades. During the mid and late-1980's, catches frequently exceeded TACs, in some years by up to 26% in the sablefish fishery. Since the introduction of ITQs in these two fisheries, the landed catch closely matches the TAC, with catches more likely to be under the TAC than over.

The hook and line lingcod (Figure 9) and dogfish (Figure 11) landed catches are far below their respective TACs. Groundfish integration has complicated the interpretation of catch and TAC comparisons. The barriers for leasing dogfish and lingcod quota between the hook and line and trawl fleets have been relaxed such that there is a considerable flow of quota between these sectors. The lingcod TAC has been constant over the period 1999 through 2008, but the implementation of hook and line lingcod ITQs in 2006, combined with the integration of the groundfish fisheries, resulted in an observed jump in the TAC in the 2007/2008 season. The 2006 management changes allowed for trawl lingcod quota to transfer into the hook and line sector and for the carryover of a portion of the uncaught TAC into the following year, increasing the 2007/2008 TAC (DFO 2007a, DFO 2007c). The interpretation of lingcod TAC is further complicated by the area management system in the lingcod fishery. The Northern BC coast quota (5CDE) has never been caught in full, whereas the 3D (North West Coast Vancouver Island) TAC has often been caught and even exceeded in recent years (Figure 10).

The TAC indicators are confounded by multiple factors which complicates the attribution of cause-and-effect. These two indicators are good examples of a causal assumption problem where the intent is to measure the merit and worth of the program, but the measure is of the state of the fishery, and that state may or may not be attributable to the program. However, the TAC indicators are direct measures of the ‘catch’ objective of the ‘profitability and economic returns’ goal, reflecting a desired state of the fishery. Options available to address the confounding issue with these indicators include:

1. comprehensive documentation of the management system to ensure that the indicators are considered in their context;
2. the exploration of the possible cause-and-effect relationships that might influence the indicator, such as what pressures in the fishery, both related and unrelated to the management system, may lead to the observed state; and
3. the selection of additional indicators to address the objective and goal.

Figure 7. Sablefish total allowable catch and landed lbs for the period 1982-2005 (Haist et al. 2005; DFO 2006c).

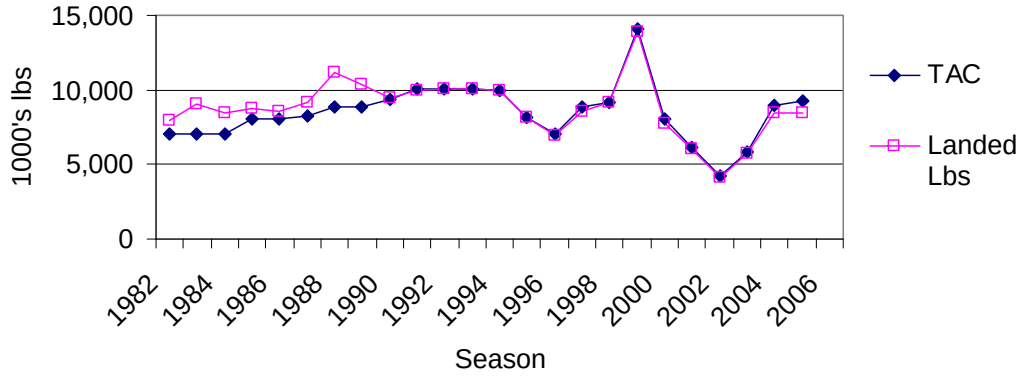


Figure 8. Halibut total allowable catch and landed lbs for the period 1982-2006 (DFO 2006d; IPHC 2008a; IPHC 2008b).

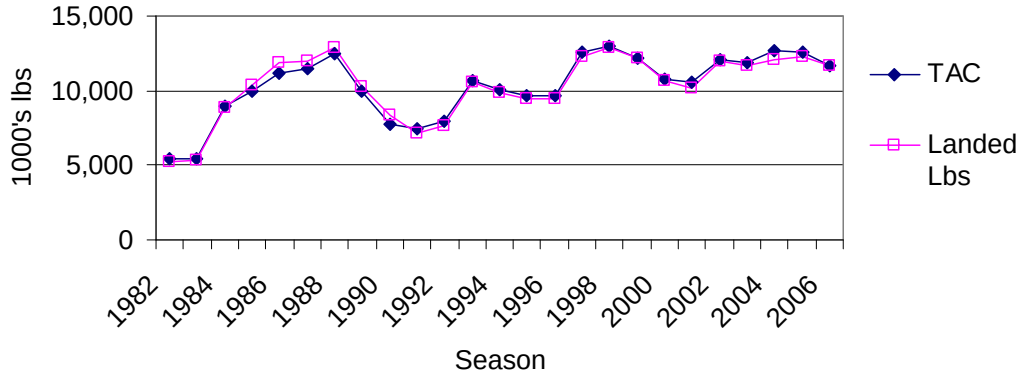


Figure 9. Lingcod total allowable catch and landed lbs for the period 1999/2000 to 2007/2008 (AMR 2004a; AMR 2004b; AMR 2004c; AMR 2004d; AMR 2004e; AMR 2005; AMR 2006; DFO 2006e; DFO 2007c; DFO 2008).

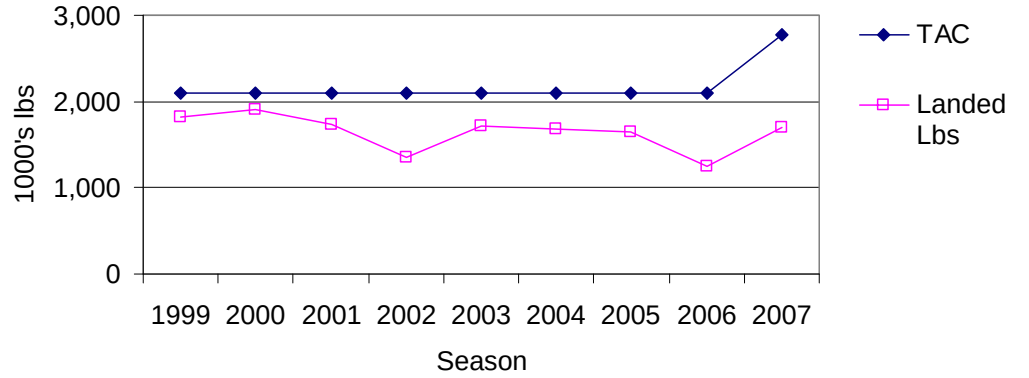


Figure 10. The percent difference between hook and line lingcod total allowable catch and landed lbs for the period 1999/2000 to 2005/2006 for each lingcod management area (3C – Southern West Coast Vancouver Island; 3D – Northern West Coast Vancouver Island; 5AB – Central BC Coast; 5CDE – North BC Coast) (AMR 2004a; AMR 2004b; AMR 2004c; AMR 2004d; AMR 2004e; AMR 2005; AMR 2006; DFO 2006e; DFO 2007c; DFO 2008). Catches that exceeded the total allowable catch are the positive numbers above the x-axis.

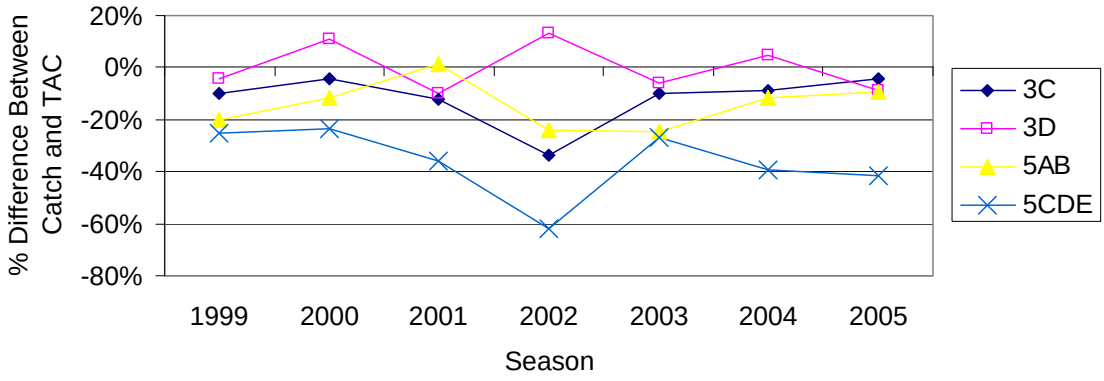
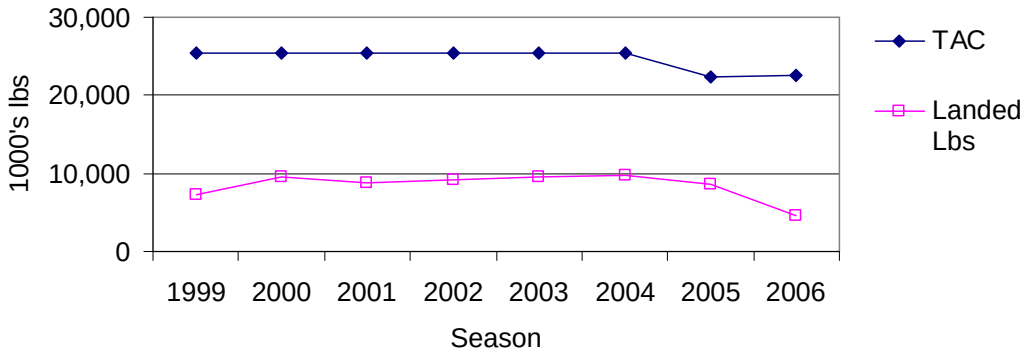


Figure 11. Dogfish total allowable catch and landed lbs for the period 1999/2000 to 2006/2007 (AMR 2004a; AMR 2004b; AMR 2004c; AMR 2004d; AMR 2004e; AMR 2005; AMR 2006; DFO 2007d; DFO 2008).



4.5.2. Aggregate Fishing Capacity

There are a number of measures available to assess aggregate fishing capacity, with the most readily available being the number of active fishing vessels and the fleet profile. The number of active vessels in the sablefish fishery dropped with the initial implementation of ITQs and since then has been slowly increasing (Figure 12). At a low of 21 vessels in 1993 to a high of 35 vessels in

2005, the number of active vessels is still well below the pre-ITQ count of 48, which was limited by the 48 sablefish K licences.

The number of active vessels in the halibut fishery has been steadily dropping since ITQ implementation, from a high of 435, which is the number of licences, to less than half that by 2006 (Figure 13). The 2006 drop, during the first year of groundfish integration, from 221 vessels in 2005 to 182 vessels in 2006, may be partially explained by the integration program, which enabled non-halibut vessels to land their halibut bycatch. Ten non-halibut licensed vessels had significant halibut landings (defined as greater than 100 halibut pieces) in 2006.

The decrease in the number of active halibut vessels was accompanied by a shift in the size distribution of the active halibut fleet. Prior to ITQs, and during the first two years when there was no transferability permitted, the halibut fleet was dominated by mid-size vessels, of between 10-15 metres (or 30-50 feet) (Figure 14). There has been a shift towards larger vessels in the fifteen years since ITQs were first instituted, with the majority of the vessels leaving the fishery coming from the mid-size range and only the largest size class increasing in numbers (Figure 15).

The number of vessels participating in the lingcod and dogfish fisheries has demonstrated an overall downward trend with intermittent increases (Figure 16, Figure 17). Both of these fisheries are managed under the schedule II privilege common to all commercially licensed vessels in British Columbia. Over 3200 vessels are able to participate in the fishery, but effort has fluctuated widely

in response to ex-vessel price, the costs for entry, most notably increasing up front monitoring costs, and in 2006, the implementation of ITQs as part of groundfish integration.

The high degree of confounding evident within the aggregate fishing capacity indicator again demonstrates the difficulties that can be encountered when measuring and interpreting indicators. The aggregate fishing capacity indicator differs from the TAC indicators previously considered in that the measures chosen for the fishing capacity indicator are not direct measures of a desired state of the fishery related to the objective and goal. The indicator, and by extension the measures for the indicator, indirectly address the goal to achieve ‘community stability and health’. To address the confounding in this case, options, similar to those identified for the TAC indicators, include:

1. comprehensive documentation of the management system to ensure that indicators and measures are considered in their context;
2. the exploration of the possible cause-and-effect relationships that might influence the indicator and the relationship between the measures and the indicator; and
3. the selection of different indicators, different measures for the indicator, or additional indicators to address the objective and goal.

Figure 12. Number of active vessels in the directed sablefish fishery, 1989-2006 (AMR 1997; DFO 2006c).

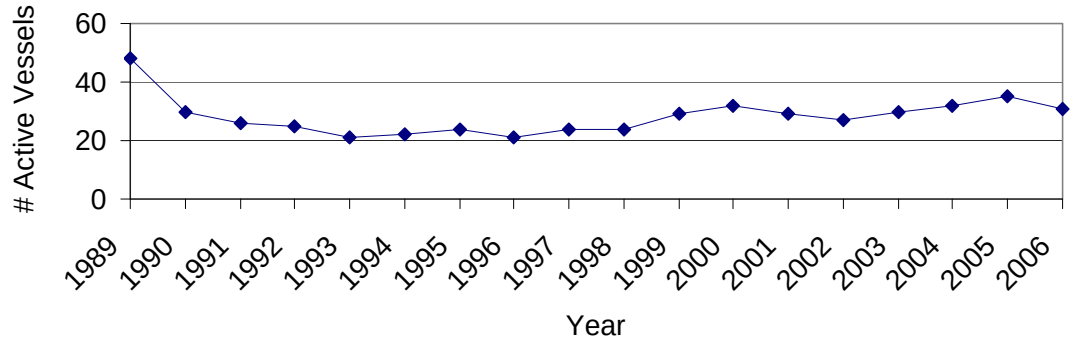


Figure 13. Number of active vessels in the directed halibut fishery, 1989-2006 (AMR 1998; DFO 2006d).

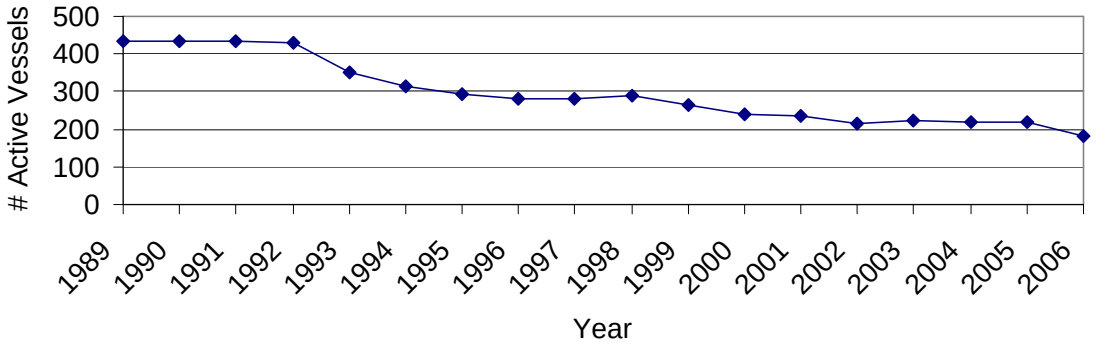


Figure 14. Vessel length distribution for active halibut vessels, 1991 and 2006 (DFO 2007e; DFO 2007f).

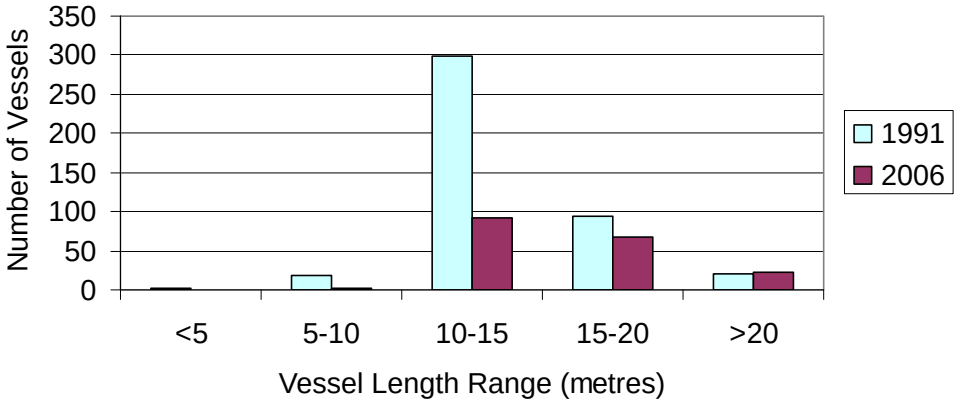


Figure 15. Vessel length distribution for active halibut vessels, expressed as a percent of active vessels, 1991 and 2006 (DFO 2007e; DFO 2007f).

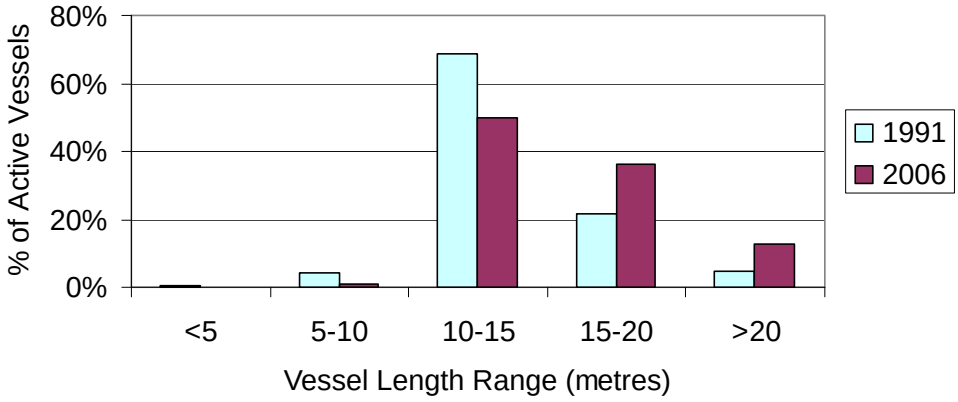


Figure 16. Number of active vessels in the directed dogfish fishery, 1996-2006 (DFO 2004b).

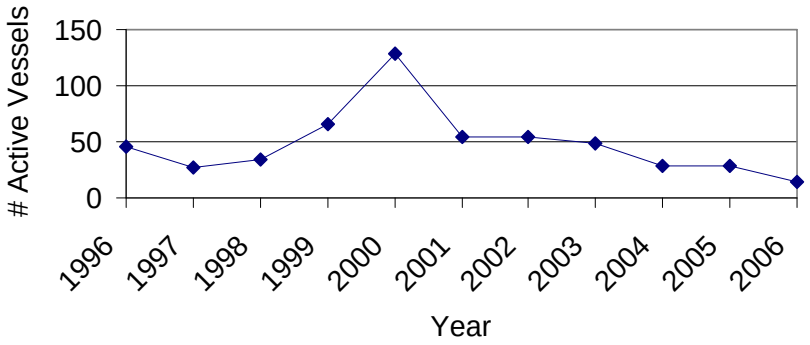
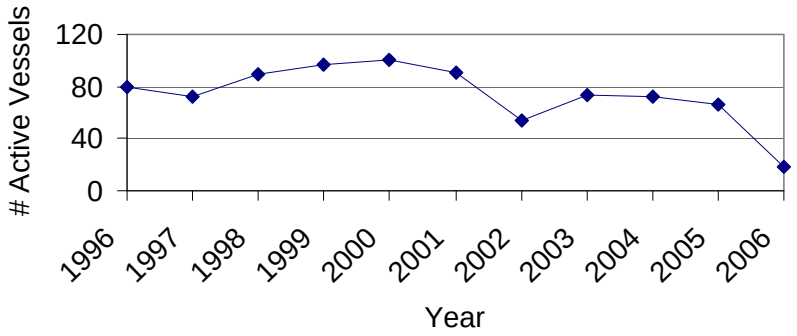


Figure 17. Number of active vessels in the directed lingcod fishery, 1996-2006 (DFO 2004b).



4.5.3. Distribution of Quota Access and Catch

Permanent quota holdings are an indication of the ownership concentration of a fishery. Within the halibut fishery, concerns over catch concentration during the development of the ITQ system prompted a 1% licence quota cap (DFO 2008). This rule ensures that there will always be a minimum 100 vessels in the fleet. No one vessel can catch more than 1% of the TAC in a given year, unless the vessel had catches in excess of 1% during the pre-ITQ period. Only two licences had quota holdings above the 1% cap in 2006 (Figure 18). The majority of halibut licences have minimal quota holdings of less than 0.19% of the TAC.The majority of quota is permanently held on licences with between 0.20 and 0.39% of the TAC, which equates to between 23,000 and 44,000 lbs of quota at the 2006 TAC value (Figure 19).

For sablefish, permanent licence quota holdings are much larger than for halibut. The majority of licences have permanent quota holdings between 150,000 and 300,000 lbs based on the 2006 TAC, with increasing ownership concentration between 1990 and 2006 (Figure 20, Figure 21).

Figure 18. The number of halibut licences in each permanent quota holdings range, in 1991 and 2006, where quota holdings are expressed in % of TAC (DFO 2007e).

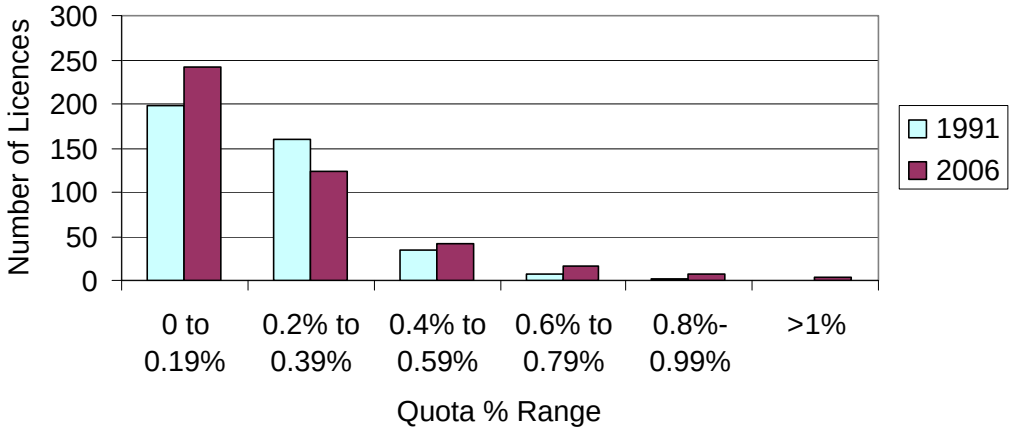


Figure 19. The percent of total halibut quota in each permanent quota holdings category in 2006, where quota holdings are expressed in 1000's of lbs (DFO 2007e).

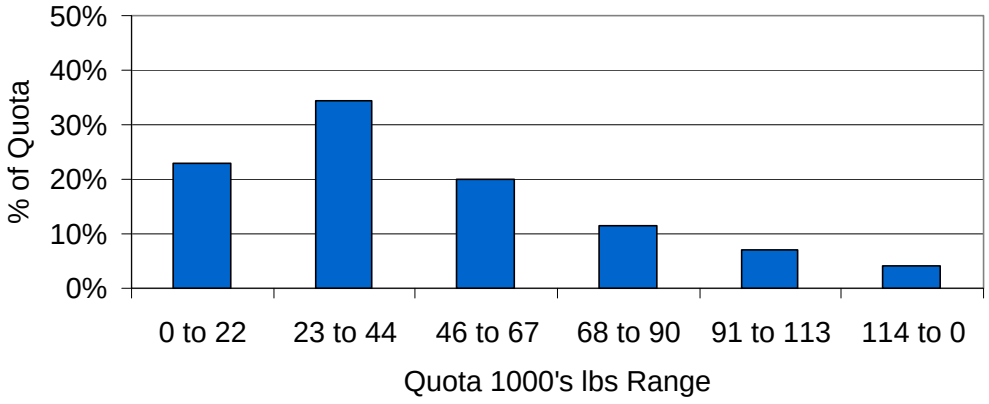


Figure 20. The number of sablefish licences in each permanent quota holdings range, where quota holdings are expressed in % of TAC, for 1990 and 2006 (DFO 2007e).

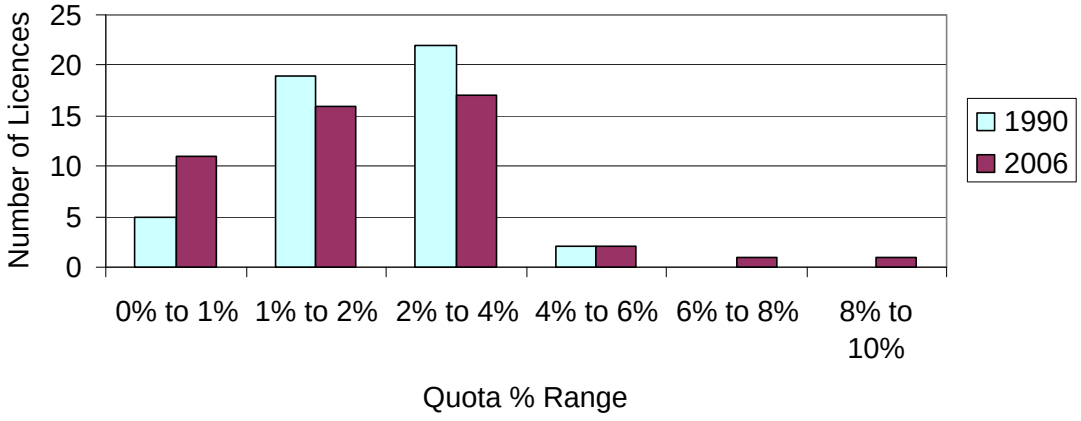
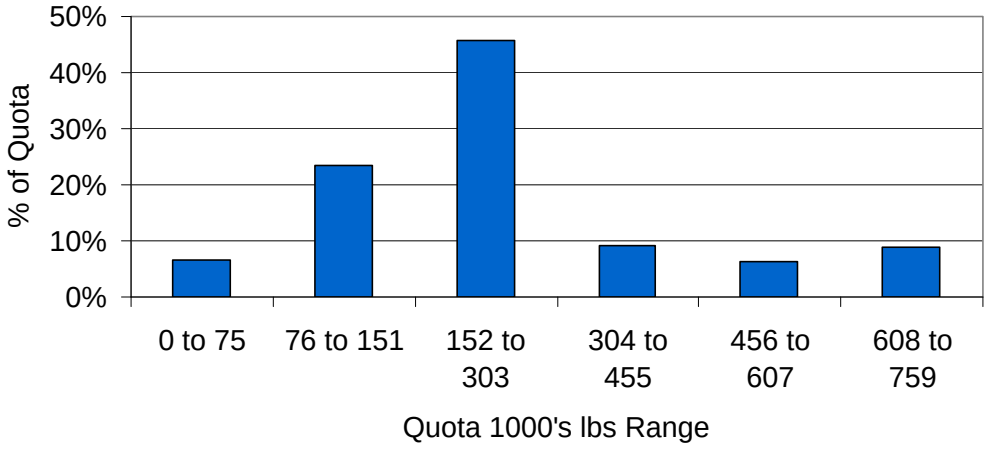


Figure 21. The percent of total sablefish quota in each permanent quota holdings category in 2006, where quota holdings are expressed in 1000's of lbs (DFO 2007e).



To assess licence catch concentration in the absence of individual catch data from DFO for the halibut and sablefish fisheries, I used a proxy for catch – temporary and permanent quota holdings on the vessel at the end of the year. There are a number of conditions necessary in order to consider year end quota holdings a reasonable approximation of vessel catch:

1. caught quota cannot be transferable to other licences;
2. catch must closely match the TAC, to within the percentage difference that is considered acceptable;
3. the quota lease value must be high enough to discourage loss of uncaught quota;
4. the carryover allowance of uncaught quota must be low enough to be considered acceptable; and
5. regulations limit the amount by which an individual vessel's catch can exceed its quota holdings.

The halibut and sablefish fisheries meet these conditions, with halibut catch matching year end quota holdings to within 10% above, based on a carryover allowance of 10%, and 5% below, based on the TAC utilization (Figure

7). Sablefish catch matches year end quota holdings to within 15% above, based on a carryover allowance of 15%, and 10% below, based on the TAC utilization. The trawl, dogfish, and lingcod fishery year end quota holdings are not a reasonable proxy for catch because of TAC utilizations less than 70%, low value quota, or carryover allowances up to 30%.

There has been a marked shift in the volume of year end quota holdings per vessel in the halibut fishery (Figure 22). The 1991 season, being the first year of individual vessel quotas (IVQs) in halibut and the IVQ being non-transferable, is similar to the pre-IVQ fishery in terms of catch distribution by vessel. Over the fifteen year period following IVQ introduction, year end quota holdings were increasingly concentrated, with the top 53 boats holding 50% of the TAC compared to 130 vessels in 1991, indicating increasing concentration of catch (Figure 23).

As with sablefish quota ownership, the concentration of sablefish year end quota holdings is much greater than that seen in the halibut fishery. The percent of sablefish TAC and the quota poundage at year end for the top three vessels in each year since 1990 has shown an increasing trend, indicating greater catch concentration, with the value topping out at 3 vessels with 50% of the quota at the end of the 2002/2003 season (Figure 24). Since then the values dropped to between 40%-50%, with a major shift in the fleet in the 2006/2007 season, the first full year of groundfish integration. Within sablefish, there are no catch concentration rules and a single vessel in the sablefish fishery has had year end quota holdings close to 2 million lbs of sablefish each year.

Figure 22. The distribution of halibut year end quota holdings by vessel quota holdings category for 1991 and 2006 (DFO 2007e).

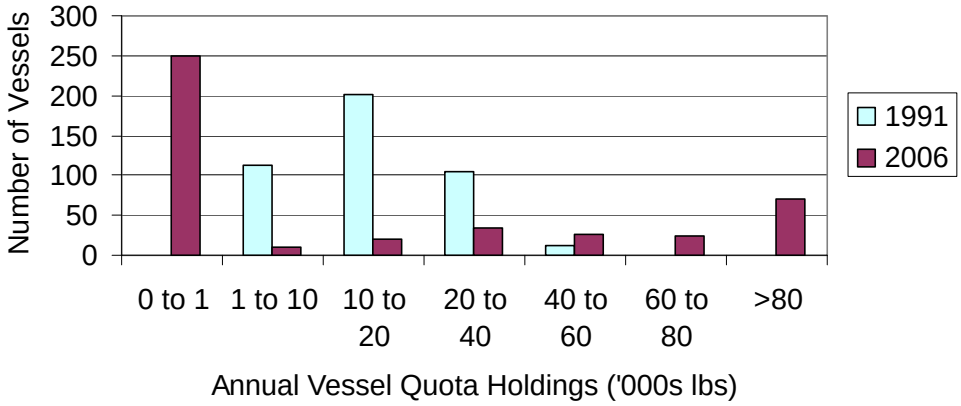


Figure 23. The cumulative halibut year end quota holdings in each vessel quota holdings category for 1991 and 2006 (DFO 2007e).

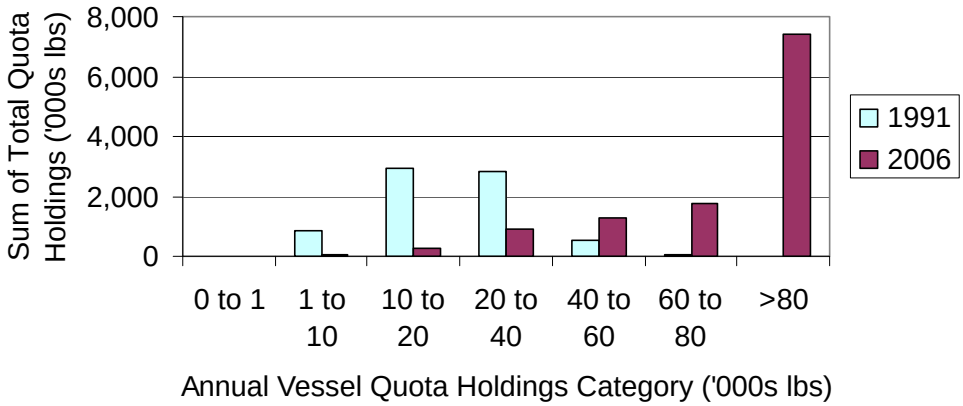


Figure 24. The % of sablefish year end quota holdings (temporary and permanent) on the 3 K licences with the highest quota holdings in each year, 1990 through 2006/2007 (DFO 2007e).

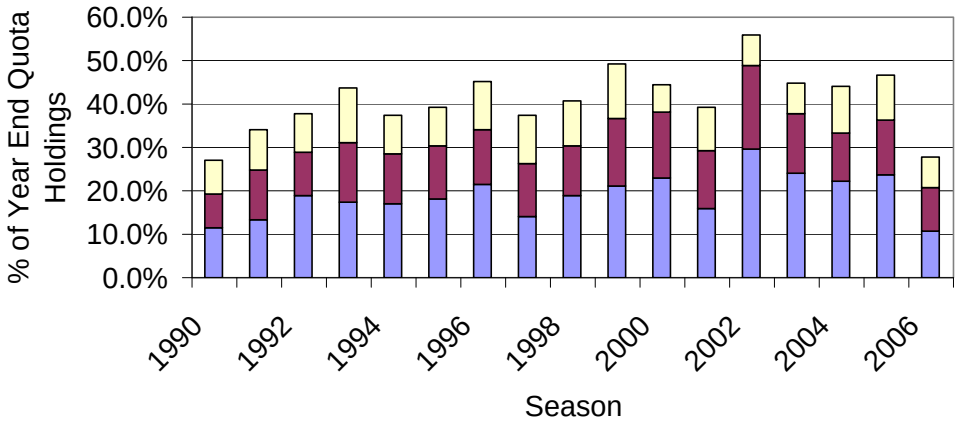
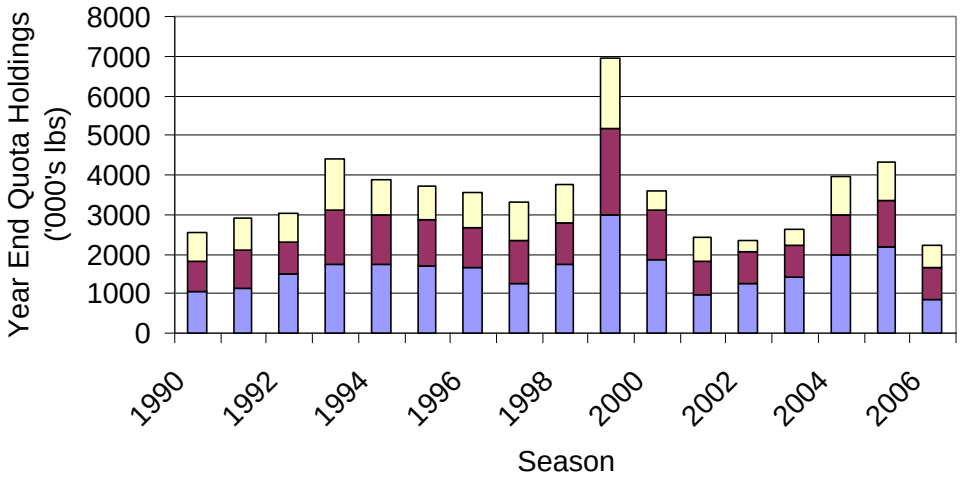
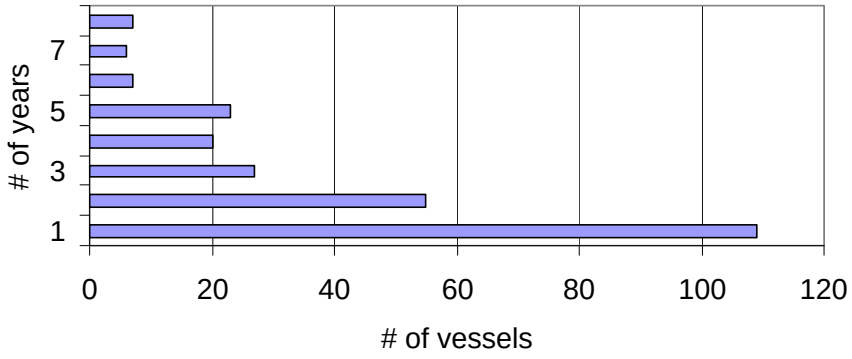


Figure 25. The sablefish year end quota holdings (temporary and permanent) on the 3 K licences with the highest quota holdings in each year, in thousands of pounds (DFO 2007e), 1990 to 2006/2007.



For the dogfish fishery, quota holdings only apply to the 2006/2007 fishery, and for that year cannot be used as a proxy for catch because the majority of the quota was not caught. Hook and line dogfish catch data by vessel are available for the period 1996-2003, prior to groundfish integration and ITQ implementation. These data are by calendar year rather than season. Over the eight year period, 254 vessels landed hook and line dogfish, either in a directed dogfish fishery or as part of another fishery such as halibut. The vast majority of these vessels only participated for a single year, with only 20 vessels that participated for six or more years over the eight year period (Figure 26).

Figure 26. The consistency of participation of vessels landing dogfish for the years 1996-2003, showing the number of vessels in the fishery against the number of years that they participated in the fishery (DFO 2004b).



No vessels that participated in the fishery for less than three years were in the top ten vessels based on landing volume in any year and in total 26 vessels filled all of the top ten landings spots for the eight years.

The dogfish fishery was a highly concentrated fishery before groundfish integration and ITQ implementation, with the top three vessels taking as much as 45% of the total catch (Figure 27). The year with the greatest concentration was 1997, the least, 2000, and fluctuating catch concentration throughout the entire period. The landings of the top three vessels in each year were increasing in 2001-2003 (Figure 28). Individual vessel catch data have not been made available for the analysis from DFO for the period 2004-2007, encompassing the period just prior to and after integration and ITQs. It is not known if the decrease in the number of vessels participating in the fishery has changed the concentration profile significantly over what was the norm prior to integration.

Figure 27. The % of dogfish catch for the top 3 licences in each year, 1996 through 2003 (DFO 2004b).

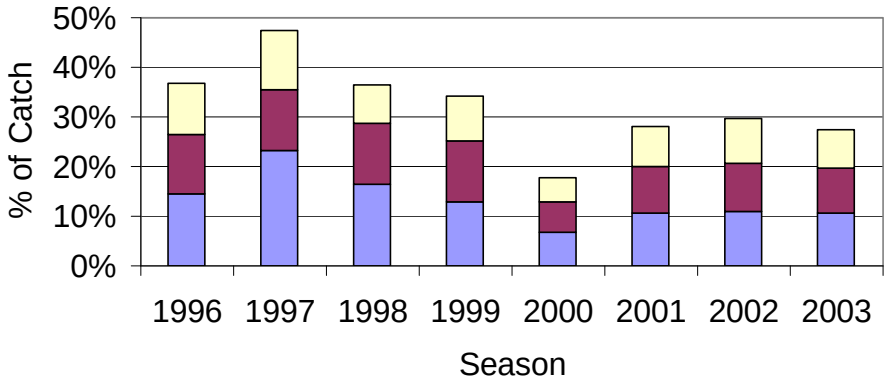
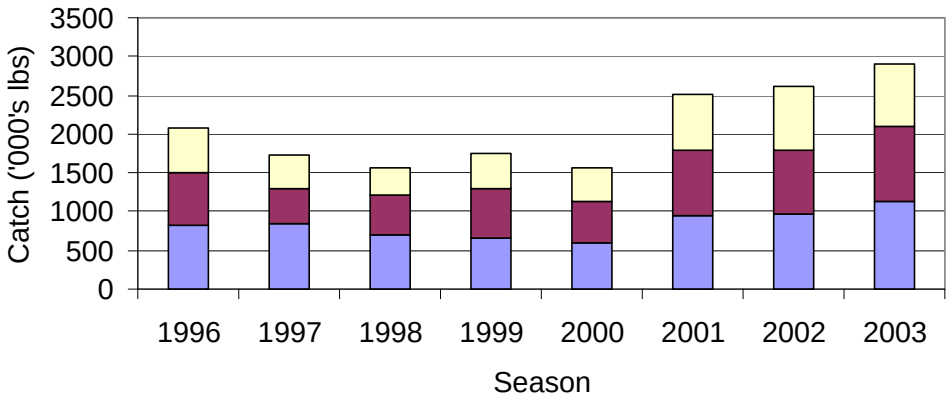


Figure 28. The dogfish catch in lbs for the top 3 licences in each year, 1996 through 2003 (DFO 2004b).



4.6. Step 6: Report

The final stage of the evaluation is the report of the findings. DFO has commissioned evaluations of the groundfish integration pilot program in each year of the pilot, but these evaluations have been internal documents only and have not been made publicly available. The use of such internal evaluations encourages an environment of distrust and erodes stakeholder confidence in the management system. The commitment to transparent and accountable fisheries management should extend to the communication of evaluation findings, good

and bad, to encourage fisheries management improvements and to build confidence amongst stakeholders that management systems are being critically assessed.

The practice of making real time fisheries data, such as current season fleet catch statistics, available online is a good example of how information can be made available. Evaluation reporting can be improved through the extension of the online reporting of data to include more of the data used to generate fisheries indicators. Ultimately, fisheries management evaluation should be an iterative process that is standardized, conducted on a regular basis, with findings contributing directly to improved fisheries management. There is much that must be done before this final step can be realized, but it is proper execution of this final step that will ensure that the evaluation achieves its purpose.

4.7. Summary

The steps that must be taken to ensure that the evaluation of the groundfish integration program achieves “best practices” for a comprehensive fisheries management evaluation are:

1. Define the purpose of the evaluation more explicitly.
2. Extend the scope of the evaluation to encompass the fisheries as a whole, that is as coupled natural, social and economic systems, pre- and post-integration.
3. Fully document the groundfish fisheries management system.
4. Establish a forum to engage all stakeholders in the fisheries management evaluation.

5. Adopt clear fisheries management objectives, not to be confused with the evaluation objectives and purpose.
6. Identify a complete set of indicators and performance measures, selected and screened against accepted selection and screening criteria.
7. Make fisheries data fully available for the evaluation.
8. Fill data gaps with data collection, or identify alternative indicators that are comparable but for which data are available.
9. Develop fisheries operating system models to aid interpretation of retrospective data and to permit prospective evaluation of alternative management options.
10. Establish reporting procedures that improve the availability of evaluation outcomes.
11. Nest the evaluation process within a management system approach that includes feedback mechanisms to incorporate evaluation outcomes into management decision making.

CHAPTER 5. DISCUSSION

5.1. Current State of Fisheries Evaluation

While initial implementation of the MSE approach in the BC groundfish fisheries should be lauded for its achievements, the MSE did not include the wider stakeholder community and as a result does not address the wider objectives for fisheries management, notably social and institutional objectives. In parallel a narrowly focused program evaluation is occurring, but this is not connected to the MSE, nor does it conform with evaluation “best practices.” The integration of a comprehensive management strategy evaluation approach, which includes a strong retrospective evaluation component, does not appear to be imminent, but such an approach holds great promise and is achievable if it is afforded political support and resources.

The adoption of a management approach that entrenches evaluation and feedback systems into the management system will not resolve all conflicts within fisheries, but it could help to elevate management decision-making away from political lobbying to be more clear, rational, transparent, and fair. The management process should be such that stakeholders are able to understand why the decision was made and what was considered in making that decision. Stakeholders should also have confidence that decisions are based on the

values articulated in the legislation and policy of the federal government of Canada.

The methodology I developed for achieving integration of comprehensive evaluation within the BC groundfish fisheries is a guide which can be adjusted to the circumstances, but in which each of the steps should be followed. The BC groundfish fisheries have not had a structured evaluation process applied to address concerns over how well the management system is meeting fisheries objectives and what improvements can be made. Where evaluation has occurred, stakeholders have not been consistently involved in defining fisheries objectives, and the result has been the identification of a very limited class of objectives. Evaluation objectives have been confused with program objectives, objectives have been confused with performance measures, and indicators confused with objectives. Evaluations are usually single or dual themed, and miss or only poorly represent whole dimensions of sustainable development, particularly social or institutional objectives. The hierarchical indicator framework suggested here is intended to ensure that indicators are identified that will adequately cover the full range of objectives for fisheries management.

The BC groundfish fisheries are repeatedly held up as an example of best practices for fisheries management. Certainly the fisheries have demonstrated innovative and perhaps successful new approaches to fisheries management, but without a comprehensive evaluation, the praise may be premature. The fisheries world is watching BC groundfish fisheries, which creates both an incentive to ensure that what is being characterized as a success is actually

meeting fisheries objectives better than alternative systems would, and also means there is an audience far beyond British Columbia that can benefit from the pioneering of improved fisheries management evaluation strategies. The evaluation “best practice” recommendations presented here are widely applicable to fisheries in general. The structure and process steps guide the integration of evaluation into a fishery management system while requiring that the individual and unique circumstances of the subject fishery system be recognized and respected.

5.2. Challenges

Many obstacles remain in achieving comprehensive fisheries management evaluation. Setting targets for measures can be one of the most difficult and contentious aspects of defining the indicator framework. There is often agreement at the vague overview level, but as the framework becomes more detailed, disagreements arise. The setting of targets is the final and most detailed stage of the performance criteria selection and is the point where tensions are likely to be at their highest. Setting targets is difficult not just because of disagreement, but because of uncertainty and unwillingness to set targets now that may not hold true for the future. This is where a continual evaluation is important for long-term programs – it is necessary to decide upon an evaluation methodology, but at the same time, part of the process must involve revisiting indicators and targets to reassess, given new conditions and new information, whether or not they are still appropriate and relevant. This is all the more challenging when data are limited. Evaluation requires the availability of

reliable data and is not a replacement or substitute for continued fisheries stock assessment or fisheries data collection. Evaluation can be used to help determine how limited resources should be allocated, but still requires that base support for research and data collection exists within the management system.

5.3. Conclusion

Current evaluation practices often under-represent the range of fisheries objectives and management options available and may result in management strategy decisions that fail to gain wide support and to address the fisheries issues that have been raised. Fisheries management evaluation will benefit from the application of best practices developed within the evaluation field and the adoption of comprehensive approaches that include retrospective, prospective, and thematically complete evaluation. The improvement of evaluation practices is not enough, however. Fisheries management evaluation must be connected to a strategic management feedback system. The combined approach is feasible, but will require acceptance and commitment from the management agency, including the resources to develop the prospective evaluation tools specific to BC groundfish, an expansion of the science funding to improve data on environmental conditions of stock status and productivity, and a shift in how fisheries are managed in BC, to be more inclusive, transparent, and equitable.

For the groundfish fisheries of BC, major changes are being made to the structure of the fisheries without the application of comprehensive evaluation practices with management feedback loops. Evaluation is only one step of the

process. Evaluation is a tool to assess current fisheries conditions, compare to past conditions and across fisheries, and integrate modelling techniques to explore causal explanations for observed trends and to assess alternative management options for their likelihood to achieve intended outcomes. With repetition and strategic interventions, evaluation that is nested within a management approach that incorporates evaluation outcomes into management decision making will provide a time series of data on how well the system compares to the ideal and a road map for how to make improvements. While there will still be mistakes and missteps, these should be reduced and when they do happen, it is more likely that managers will learn from them and use that learning experience to improve the way in which they manage fisheries.

5.3.1. Next Steps

Within the scope of this research project, I analyzed the current status of evaluation within the BC groundfish fisheries and I identify a strong rationale for improving evaluation practices, along with a methodology for how to do so. I demonstrate the application of the methodology to the evaluation of the integrated groundfish fisheries. Future research opportunities include the development of operating models that can be used to conduct the prospective evaluations across all four sustainable development dimensions and the completion of the groundfish fishery evaluation. An area of future work opportunity to achieve evaluation best practices is in the close engagement of stakeholders – a common weakness in current evaluations. This area requires considerable work to develop a consultative process that is inclusive and

provides opportunity to engage stakeholders effectively in fisheries management broadly and fisheries evaluation specifically. The development of an effective stakeholder forum may not be an easy task, but the commitment to develop this process has been made by DFO and a strategy for achieving it has been identified (DFO 2007b). The establishment of the stakeholder forum will be a significant step towards the development of a management system that will be conducive to the achievement of evaluation best practices in the BC groundfish fisheries.

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