Pacific Fisheries Resource Conservation Council

Incorporation of Traditional and Local Ecological Knowledge and Values in Fisheries Management

Prepared by
ESSA Technologies Ltd.

Completed May 2009
Issued March 2011

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Prepared for:

Pacific Fisheries Resource Conservation Council

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This background paper was prepared for the Pacific Fisheries Resource Conservation Council in its mandate to protect wild Pacific salmon stocks and encourage the conservation of their ocean and freshwater habitat. The views expressed in this background paper are those of the authors. Any comments or suggestions related to this report should be conveyed to the Council at:
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May 2011

The Honourable Gail Shea
Minister of Fisheries and Oceans Canada
House of Commons, Ottawa

The Honourable Terry Lake
Minister of Environment
Legislative Building, Victoria

Dear Ministers:

Subject: **Report on Traditional and Local Ecological Knowledge**

Our Council is pleased to transmit to you a copy of the background report entitled ***Incorporation of Traditional and Local Ecological Knowledge and Values in Fisheries Management.*** This report was prepared at our request by the ESSA Technologies Ltd consulting firm to provide information on the ways in which fisheries conservation could be advanced through the application of traditional and local ecological knowledge (TLEK) from an array of sources. By commissioning this report, our Council intended to advance the concept of using TLEK in practical and tangible ways to contribute to decision-making, particularly for wild Pacific salmon stock management. We asked the consultants to investigate the uses of TLEK in various instances and the ways it could be applied in salmon conservation.

We acknowledge that this background report is controversial in some respects. We are issuing it to encourage comment and discussion about its contents and perspectives. Our Council members have expressed strong and differing individual views about issues raised in the report; this was the primary reason for the nearly two-year delay in issuing it. But we believe that the issues it addresses deserve to be considered and debated.

We also acknowledge that, like all ground-breaking studies, this report has flaws in terms of overlooking some recent advances in the use of TLEK in Canadian government programs and in the techniques to draw from the knowledge of sports and commercial fishing communities. We are grateful to the authors for taking on the challenge of this task, and presenting valuable information and insights.

In releasing this report now, we also caution that the contents and analyses have been overtaken to some extent by time and changing conditions. For instance, some federal government initiatives, such as Species At Risk, have advanced to incorporate more elements of TLEK. Since most of the research for this report was undertaken three years ago, this shortcoming is inevitable. We are confident, however, that the consultants' views expressed in this report will provide the basis for productive discussion.

The Pacific Fisheries Resource Conservation Council is encouraging British Columbians to comment on this report, and we welcome comments from your colleagues and departmental officials.

Yours sincerely,

Jeff Marliave, PhD, Chair

Acknowledgement

We would like to thank the Pacific Fisheries Resource Conservation Council for initiating this interesting project, and the Steering Committee (Gordon Ennis, Nigel Haggan, Diane Lake, and Paul LeBlond) for guiding our work.

We are grateful to the authors of the books, papers and reports we collected and reviewed for the insights and lessons they presented – there is a great wealth of information available on this topic. We are also very grateful for the specific assistance from the following individuals who helped us with the case study analyses:

- Andrew Day, Aquatic Management Board
- Nigel Haggan, UBC Fisheries Center
- Anne Salomon, University of California Santa Barbara
- Nancy Turner, University of Victoria

We hope this report provides some clarity and helps build momentum and focus for future dialogue and action on this topic. Any errors of omission, oversight, or misunderstanding in our interpretation of the information we collected are our own, and unintentional. We apologize in advance to those involved in other case studies which may have also been good candidates for examination but which are not included in this report: unfortunately time constraints precluded examination of a broader suite. We hope additional voices can be included in future discussions.

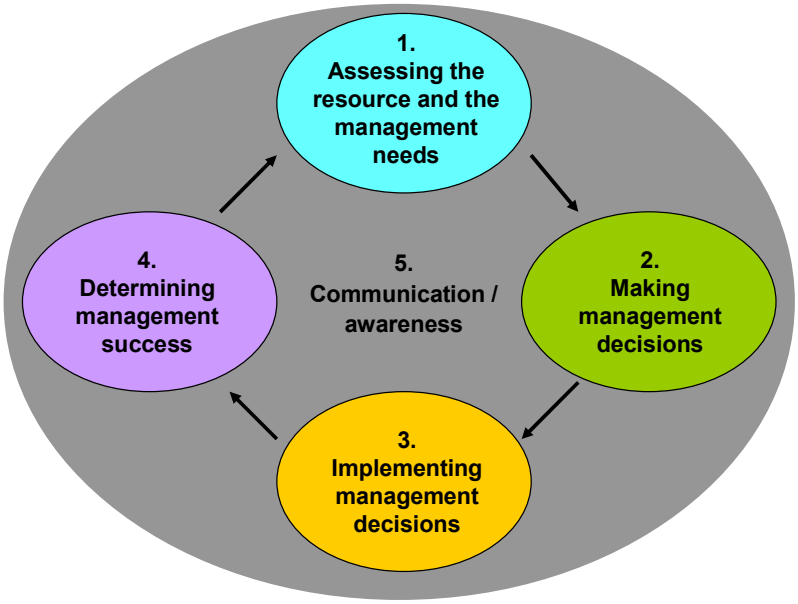
Executive Summary

The Pacific Fisheries Resource Conservation Council (the Council) hired the ESSA project team to explore the scope and potential of "traditional ecological knowledge", "local ecological knowledge" and "fishers' knowledge" for expanding and strengthening Pacific salmon management. This report describes the methodology for the project, what was learned, and recommendations for how these lessons can be used to improve Pacific salmon management. Much of what was learned, and the recommendations, also apply more broadly to management of fisheries in general as well as other natural resources.

The project had three main phases: collection and review of the literature, analysis of selected case studies, and development of an implementation strategy. Criteria were developed to help select the case studies included in this report:

- Aquatic Management Board (West Coast Vancouver Island)
- Northern Co-management Boards
- Copper River Watershed Management
- Endangered Status Assessments in Canada

A generic management functions framework was developed to help organize the research and the results. It provided a structure that applied regardless of what resources the case studies pertained to, thereby helping to determine how best to transfer the lessons to Pacific fisheries management.

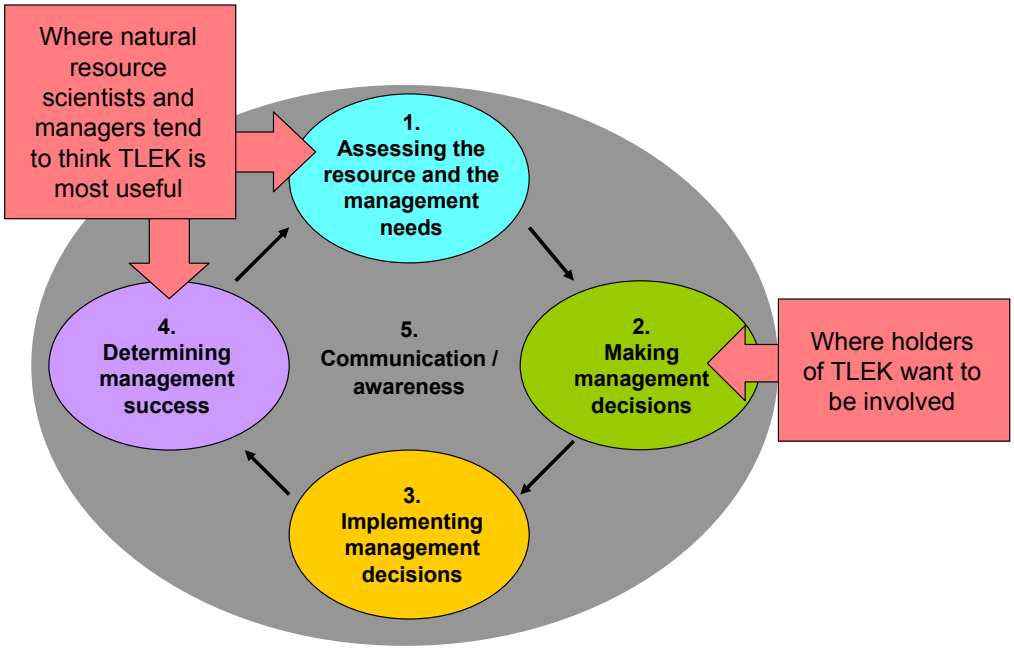


While there is no universally accepted definition of traditional ecological knowledge (TEK), common themes among the definitions used in the literature include the notion that it develops over a long period of time, that it is experience-based, and that it has important socio-cultural and biological dimensions. The intent of the project was to encompass knowledge with these characteristics as well as knowledge that may accrue over a lifetime but not necessarily across generations, whether held by Indigenous or non-indigenous peoples. This report uses the term "**traditional and local ecological knowledge**" (**TLEK**) to refer to knowledge described in the literature as TEK, local ecological knowledge (LEK) and fishers' ecological knowledge (FEK).

There are good ecological, economic and legal reasons for using TLEK in natural resource management. There are also many challenges relating to issues of culture, jurisdiction, institutional structure, perceived credibility and value, world view, and power. These are summarized, and collectively provide both the rationale for using TLEK in fisheries management and a preview of some of what must be considered when trying to do so.

The case studies provided a number of insights and lessons. From these, and the other literature reviewed for this project, two main messages emerged:

- The real question that is facing fisheries managers is not *how can we use traditional and local knowledge,* but *how can we include traditional and local knowledge-holders?*
- Successful involvement of holders of TLEK requires their inclusion in decision-making.



The implications of this for Fisheries and Oceans Canada (DFO) are discussed, and four recommendations are provided for moving forward:

1. Increase awareness among DFO staff (and staff of other fisheries management organizations) at all levels of the organization about what TLEK is and what values, nuances and principles they should be aware of when trying to include TLEK in meaningful ways in salmon management.
2. Determine how committed DFO is to including TLEK in salmon management, articulate this in a policy that makes the intent very clear for staff and other management participants, and then ensure the policy is both supported and followed.
3. Undertake a co-management pilot, focused on salmon, within a single watershed.
4. Perform a comprehensive survey of past/present watershed management initiatives in BC, the Yukon and Washington State that used/are using TLEK to better manage their natural resources, particularly salmon. Select several of these for more in-depth examination to

further elucidate specific lessons transferable to other areas or aspects of Pacific salmon management

Some simple principles emerged that would greatly enable the inclusion of TLEK in natural resource management, including but not restricted to fisheries management:

- Explicitly acknowledge the existence of TLEK.
- Explicitly acknowledge the value of TLEK to resource management.
- Understand the value of TLEK to the knowledge-holders.
- Do not use TLEK in isolation from the knowledge-holders.
- If TLEK disagrees with scientific information, investigate why.

Additional insights for fisheries managers are also provided.

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1.0 Introduction

1.1 Background

The Pacific Fisheries Resource Conservation Council (the Council) was created in 1998 to provide independent advice on conservation and the sustainability of Pacific salmon stocks and habitat to the Minister of Fisheries and Oceans, the British Columbia Minister responsible for fisheries, and the public. One of the objectives of the Council is to integrate scientific information with knowledge and experience of First Nations, stakeholders and other parties.

In October 2008 the Council requested proposals to explore the scope and potential of "traditional ecological knowledge", "local ecological knowledge" and "fishers' knowledge" for expanding and strengthening Pacific salmon management. The purpose of the project is to make progress towards the incorporation of such knowledge in decisions made by fisheries managers. The project called for a review of the literature, an analysis of case studies, and the development of an implementation strategy. The team from ESSA was contracted to undertake this work.

This report describes the methodology for the project, what was learned, and recommendations for how these lessons can be used to improve Pacific salmon management. In some cases what was learned, and the recommendations, also apply more broadly to management of other natural resources, beyond just salmon.

1.2 Methodology

The first task was to meet with the members of Steering Committee for the project to review and discuss the scope of work (process, products and intended audience) as well as key information sources. The Steering Committee continued to guide the work and review draft products throughout the project.

The next step was to collect literature relevant to the project. This effort was focused on two kinds of information: literature specific to the use of traditional or local ecological knowledge in natural resource management, and literature describing shortcomings in how Pacific salmon are currently managed. This search included, but was not limited to, sources suggested by the Steering Committee as well as those identified by the expert advisors in this topic on our team: Dr. Donna Hurlburt and Dr. Cristina Soto. Section 2 summarizes key points from the literature, covering topics that include what traditional or local ecological knowledge is, why it should be included in natural resource management, and some of the challenges of doing so, as well as summarizing some relevant aspects of current salmon management. Greater detail can be found in Appendices 1, 2 3 and 4. The full list of information collected for the project is provided in Section 5 (References).

The collected literature included information about real examples of the use of traditional or local ecological knowledge in the management of natural resources. A short-list of case examples was identified based on the following criteria:

Geographic location – at least one example should be from each of the Pacific, Arctic and East coasts, as well as one from outside Canada

Timeframe – examples should be current, or at least not too outdated

Spatial scale – examples should represent a range of spatial scales, with at least some examples at a scale similar to that of Pacific salmon

The resource – examples should have useful lessons for salmon management although the species being managed in the example could be something other than salmon

Management structure – examples should have similar management structures to that used in Pacific salmon management to ensure the lessons could be transferred

Successes – examples for the most part should be ones of successful integration of traditional or local knowledge into natural resource management, but could also include some that might be considered "failures" if they provided useful lessons

The project team worked with the Steering Committee to further narrow the short list down, and final set presented in this report are: (1) the West Coast Vancouver Island Aquatic Management Board, (2) co-management boards in Canada's North, (3) Copper River watershed management, and (4) endangered status assessments by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) for selected species. The results are summarized in Section 3. Appendix 5 shows how these case studies aligned with the selection criteria. Further information about the methodology for reviewing the case studies, as well as more detailed results, is presented in Appendix 6.

What was learned from the literature and from the case study analyses was then used to craft recommendations for how traditional and local ecological knowledge and values could be further incorporated into Pacific salmon management. These are presented in Section 4.

To help organize the work and the results, a generic management functions framework was developed (Figure 1.1). The purpose of this framework was to provide a structure that would apply regardless of what resources the case studies pertain to, thereby helping to determine how best to transfer the lessons to Pacific fisheries management. Table 1.1 lists some of the typical fishery management activities that would occur under each function.

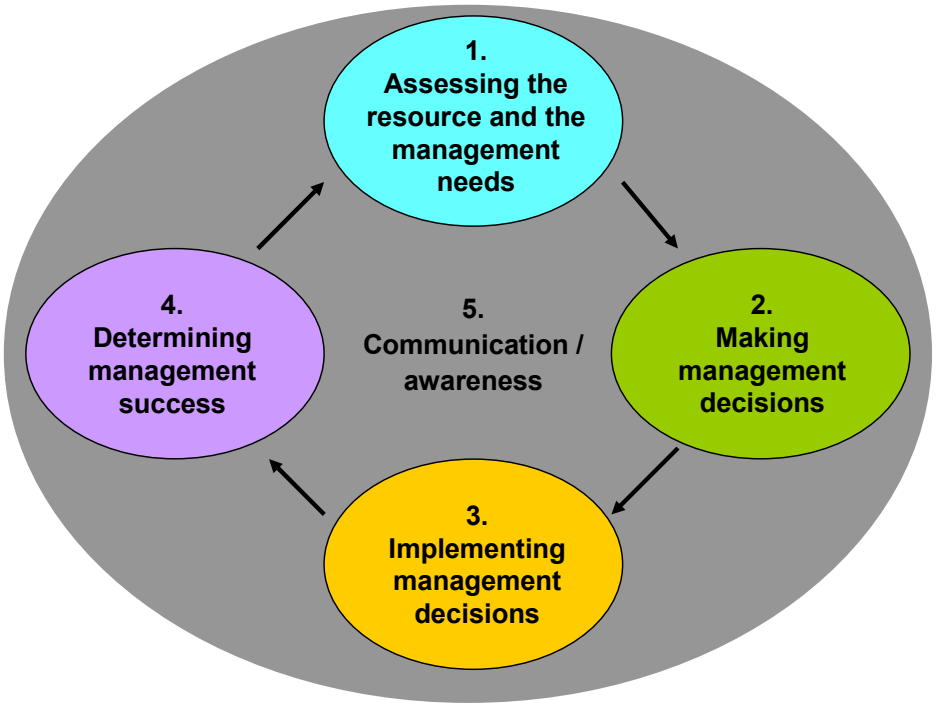

Figure 1.1 Generic natural resource management functions.

Table 1.1 Typical fishery management activities that might occur within each function. Adapted from Table 1 in Pinkerton and Weinstein (1995a) and Soto (2006). Additions were made based on the project team's experience in natural resource management and monitoring, and adaptive management.

Mgmt Function	Activities	What these activities would include
1. Assessing the resource & the management need	Stock assessment	Estimating abundance of the resource to be harvested (e.g. through sampling programs, modelling of stock dynamics) and scoping related issues/problems
	Habitat assessment	Estimating the quantity, quality and location of the habitat for the resource, and scoping related issues/problems
	Research	Includes research into biology/life history, productive capacity, impacts, mitigations, restoration methods, use, values
	Status & trend monitoring	Tracking the longer-term condition of the resource and its habitat
2. Making management decisions	Setting management goals & objectives	Determining the desired outcomes from the decisions, including ecological, economic and social goals
	Policy/law-making	Making decisions about the resource, its habitat, and things that might affect it that are specified in policy or regulatory instruments
	Natural resource planning	Making decisions about which activities are permitted and where (using the laws above as guidance), e.g. environmental assessments; and long-range planning for sustainability
	Harvest planning and allocation	Making rules about catch limits, size limits, location, timing, gear; and about proportions among harvesters
3. Implementing management decisions	Enforcement	Activities related to ensuring decisions/rules are adhered to
	Habitat management	Activities related to protecting, restoring, creating or creating new access to habitat
	Stock enhancement	Activities related to increasing abundance
4. Determining management success	Compliance monitoring	Monitoring to determine whether the decisions were implemented as intended (important for determining both compliance and effectiveness)
	Harvest monitoring	Fishery monitoring – recording catch over time
	Effectiveness monitoring	Tracking the outcomes of the decisions – e.g. effects of the implementation on the quality/quantity of the resource and its habitat, actual benefits to people; broader ecosystem effects
5. Communication / awareness at all levels	Communication	Activities to communicate management needs, decisions, requirements, success, etc. to expected participants
	Public education	Activities to increase broader public awareness of management objectives, policies/laws, successes
	Capacity building/training and education	Activities aimed at increasing the capacity of participants to engage as needed (in research, harvesting, monitoring, etc.)

2.0 Context and Rationale

This section summarizes the answers to four questions:

1. What is traditional and local ecological knowledge?
2. Why include it in natural resource management?
3. What are some of the challenges in trying to do this?
4. What is the current Pacific salmon management context?

The purpose is to provide the reader with a basic understanding of the rational for this project and contextual information for the subsequent sections. Appendix 1 provides greater detail for readers wanting further insights on answers to these questions from some of the literature.

2.1 What is Traditional and Local Ecological Knowledge?

There appears to be no one clear answer to this question, and no commonly-agreed upon definition across the literature. The following definition was the one most frequently cited in the papers, books and reports reviewed for this project:

> *TEK is a cumulative body of knowledge, practice and belief evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment.* (Berkes 1999)

While most authors and researchers use slightly different definitions, three common themes emerged: the notion that it develops over a long period of time, that it is experience-based, and that it has important socio-cultural and biological dimensions.

There was also no one clear answer to the question of how **traditional ecological knowledge (TEK)** differs from **local ecological knowledge (LEK)**. The most common differences found in the papers, books and reports reviewed for this project pertain to who the knowledge-holders are, and the timeframe over which it develops. Some authors use the term TEK to refer to knowledge held by Indigenous Peoples (Aboriginal Peoples, First Nations) and LEK to refer to knowledge held by non-indigenous people who nevertheless have a long-term relationship with the land. However, others specify that holders of TEK need not necessarily be Indigenous, and also use the term to refer to non-indigenous groups who also have accrued experienced-based information that is socially or culturally important over a long period of time. Some authors distinguish the terms based on the length of time during which the knowledge has developed, using TEK to refer to knowledge evolving over many generations and LEK to refer to knowledge that grows over the span of one lifetime of experience. Similarly, there is no rule as to how the term **fishers' ecological knowledge (FEK)** is used in the literature.

This report uses the term "**traditional and local ecological knowledge**" (**TLEK**) to refer to knowledge described as TEK and LEK in the paragraphs above, and considers FEK to be one type of TLEK.

Where distinctions among such knowledge holders are important (e.g. between aboriginal communities with a long history in a given area and non-aboriginal fishers with a relatively shorter history in the area), these are made explicit in the text. When citing information from other sources, the terms LEK, TEK and FEK are still used if and as used in the source paper.

It is important to understand that TLEK as it relates to Indigenous Peoples is inseparable from values. It is much more than just information about the environment and its various components (such as species presence, abundance, habitat requirements and movement patterns). It also includes the context and wisdom for how such knowledge is used, and the world view of those who hold it – including its symbolic, historic and spiritual meaning. A recent paper entitled "Six faces of traditional ecological knowledge" (Houde 2007) characterizes TEK as not only comprising factual observations, but also management systems, past and current uses, ethics and values, culture and identity, and cosmology or world view, as illustrated in Figure 2.1. (Additional information on these "faces" and how they relate to resource management is provided in Table 4.1.) This description helps convey the richness and nuances which must be understood when attempting to incorporate this type of knowledge into fisheries management.

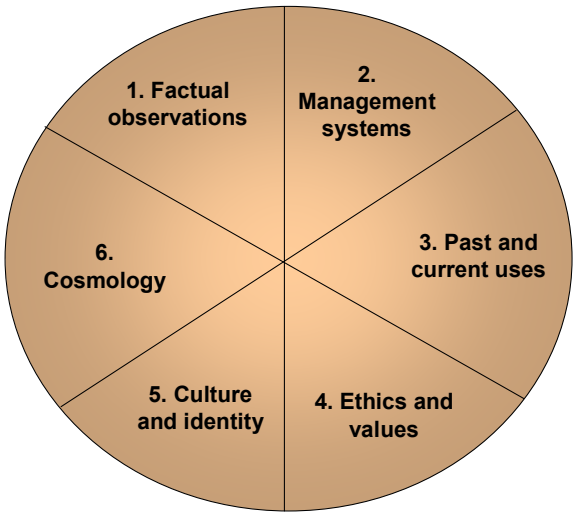

Figure 2.1 The Six Faces of Traditional Ecological Knowledge. Adapted from Houde (2007).

2.2 Why include TLEK in Natural Resource Management?

There are good ecological reasons for including TLEK in salmon management. People who have been living near and harvesting a resource for a lifetime (or for generations) are likely very aware of the spatial and temporal distribution of the resource and critical habitat, of linkages among species and between species and ecological processes, and of changes over time. TLEK may also be the only source of knowledge in places which are poorly studied because of their remoteness. The use of TLEK can be a powerful conservation tool, providing community support for conservation plans and enabling the inclusion of customary ecological management practices in their design.

Western scientists are often quick to dismiss information from TLEK-holders, believing it to be inferior to their own methods and results, even when the TLEK comes from generations of experience and the scientific knowledge is based on relatively few measurements over a much shorter time. It is believed that unheeded warnings from inshore cod fishermen that spawning stocks on their fishing grounds were plummeting was a contributing factor to the collapse of the north Atlantic cod fishery.

There are many other examples in which a lack of interest in knowledge from local fishers led to poor experimental design and incorrect conclusions being drawn by government-funded research

into fisheries issues. In one such example, described in a paper entitled "Ignore fishers' knowledge and miss the boat" (Johannes et al. 2000), government scientists underestimated populations of bowhead whales in Alaska because they made incorrect assumptions about whale behaviour in designing their census methods. They incorrectly assumed that the whales did not feed during migration and therefore swam by census view-points only in one direction, and also incorrectly assumed that whales could only breathe in areas of open water. Local whalers knew whales could get air by breaking through the thinner ice that forms after stress fractures and also from under-ice air pockets. A subsequent multi-million-dollar research program lasting more than decade confirmed to the scientists the accuracy of what the elders already knew about how the whales moved through the ice.

Including TLEK in salmon management makes economic sense. Many government agencies responsible for natural resource management are dealing with budget cutbacks, and will likely need to rely increasingly on shared management models that shift some of their responsibility to non-government partners.

There is a strong legal rationale for including TLEK in fisheries management, explained by King (2004) in his article on "Competing knowledge systems in the management of fish and forests in the Pacific Northwest". Many First Nations in BC never concluded treaties, and were allocated small reserves on the understanding that their fisheries would be protected. However, their fishing rights were not recognized outside the reserves, and First Nations who contravened DFO regulations were prosecuted. The Pacific Salmon Treaty reinforced and supported DFO regulations restricting fishing gear, timing and location, which severely affected the First Nations fishery. Particularly damaging was the allocation of salmon to other users before they reached the rivers where most First Nations fish. However, a series of court cases highlight the need for new institutional arrangements governing First Nations fisheries in BC. The first is the 1973 Calder case in which the court ruled that aboriginal title was a right to occupy the lands and to enjoy the fruits of the soil, the forest and of the rivers and streams. In the 1990 Sparrow case, the court ruled that First Nations have a right to fish for food, and that native fishing should be given priority over other users rights, subject only to federal authority to ensure conservation of stocks. A ruling in 1997 on the Delgam Uukw case recognized the role of traditional knowledge and oral history as evidence in establishing rights of First Nations people to land and resources.

The New Relationship between the provincial government and First Nations in BC appears to recognize these landmark decisions, by calling for shared decision-making regarding land and resources as well as sharing of revenue and benefits,

> *...recognizing, as has been determined in court decisions, that the right to aboriginal title "in its full form", including the inherent right for the community to make decisions as to the use of the land and therefore the right to have a political structure for making those decisions, is constitutionally guaranteed by Section 35. These inherent rights flow from First Nations' historical and sacred relationship with their territories.*

2.3 What are some of the Challenges of Including TLEK?

Incorporating TLEK into fisheries management presents a number of cultural challenges. Many of the elements shown in Figure 2.1 do not easily fit within the methods or philosophy of the natural sciences. Trying to force such a fit would require compartmentalizing and distilling aboriginal values, beliefs and experiences according to external criteria for relevance, leading to misrepresentation and distortion of the information. Complicating matters is the tendency for scientists to impose their own ideas regarding traditional knowledge, and to view TLEK as useful

only for plugging holes in scientific knowledge. Furthermore, TLEK systems are often studied by social scientists and anthropologists using methods unfamiliar to most fisheries scientists and managers.

Power is a significant barrier. The dominance of Western culture and world view in current Canadian fisheries science, technology and government makes it difficult for other cultures and knowledge systems to have much influence. The superiority of Western meanings and practices is engrained in basic assumptions made by managers and scientists, who may unaware of this or how it marginalizes TLEK. The promotion of TLEK can actually reinforce such power imbalances because it is frequently defined as being less empirical than scientific knowledge, and considered to be 'wrong' when it disagrees with Western science. This is illustrated by the common view among scientists that TLEK should be evaluated against knowledge based on Western scientific paradigms before being considered valid and useful. Another common view is that science is purely objective, but this is a misconception. Science is also driven by values and assumptions (and includes errors and biases) which are often hidden behind a cloak of objectivity that effectively privileges those methods of understanding the world.

A related issue is the control of data. Knowledge is power, and TLEK-holders may be very reluctant to share information if doing so means they will lose control over how it is used and interpreted. Concerns over intellectual property rights as well as ethical issues regarding how knowledge-holders are involved (e.g. seeking their permission, offering compensation, level of involvement) provide additional complexities.

There are a number of institutional challenges. Salmon range very long distances throughout their life cycle, and as a result, protection and management of salmon and various aspects of their habitat fall under numerous jurisdictions at the provincial, national and international level, and also at the aboriginal government level in areas where aboriginal treaties have been signed. This mosaic of jurisdictions will complicate any efforts to include new knowledge, participants or processes into salmon management.

The way agencies manage fisheries poses a challenge. Governments tend to conduct single-species fisheries management whereas the scale of TLEK tends to be at the population or stock level and the world view of TLEK holders would suggest a more holistic approach across multiple species and linkages. There may also be professional barriers for scientists or managers whose performance and credibility are measured by adherence to Western scientific methods and management approaches.

Another institutional challenge exists within the actual laws and agreements governing Pacific salmon management decisions. Most contain no requirements to include TLEK in the management process, and among those that do, very few give holders of such knowledge any decision-making power. (These laws and agreements are listed in Appendix 2, and discussed further in Section 2.4.).

The current practice of fisheries science poses some challenges to the incorporation of TLEK. Fisheries scientists tend to frame TLEK as knowledge that can be used to generate hypotheses – in other words, knowledge that needs to be "validated" by scientific methods. However, not all useful fisheries information, whether obtained by fishers or scientists, warrants being treated as something to be tested in experiments. In addition, fisheries scientists tend to ignore knowledge which cannot be expressed quantitatively. Qualitative data such as observations of the presence or relative numbers of particular species, changes in environmental conditions and locations of

fishing areas do not readily fit into current stock assessment models; and the design of such models is not conducive to the inclusion of new information.

2.4 The Current Salmon Management Context

Pacific salmon management functions in BC can be grouped into the following categories:

Stock Management:
- Pre-season Planning
- Development of IFMP
- In-season Management
- Post-season Review
- Enhancement

Habitat Management:
- Fish Habitat Conservation
- Fish Habitat Restoration
- Fish Habitat Development

Appendix 3 shows how these categories, and the management activities that occur with each, align with the generic management functions in Figure 1.1.

There are numerous shortcomings in the way in which Pacific salmon are currently managed. Some of these are listed in Appendix 4 (although incorporation of TLEK may not necessarily solve all of them). The Wild Salmon Policy was developed in recognition of and in an attempt to address some of these issues, although a recent study published by the David Suzuki Foundation identifies a number of challenges regarding its implementation. A State of the Salmon conference was convened in February 2009 in Vancouver to discuss the potential impacts of climate change on salmon and salmon management. New information and approaches are needed.

Management power is concentrated primarily in management function #2 in the generic framework (Figure 1.1): making management decisions. Appendix 2 lists 22 laws, regulations, treaties, agreements, policies and plans that drive decisions which directly affect management of salmon or salmon habitat on Canada's west coast. TLEK-holders have some degree of decision-making authority in only five of these. One is the Nisga'a Final Agreement. Under this Agreement DFO has authority for some decisions, the Nisga'a Lisims Government has authority for some decisions, and some decisions are made by the Nisga'a Lisims Government and DFO together. Four are related to the Policy for the Management of Aboriginal Fishing, including the Policy itself under which individual First Nations can decide whether to negotiate Comprehensive Fishing Agreements, Watershed Framework Agreements and Joint Fisheries Management Plans. Under these agreements and plans, decisions about salmon allocation within communities, and about management and enforcement, are made by the signatory First Nations. For the remaining seventeen, the provincial or federal governments retain decision-making authority.

Most of these do contain some direction regarding the use of TLEK or the engagement of TLEK knowledge-holders. Table 2.1 summarizes (from Appendix 2) which require use of TLEK or consultation with First Nations or the public, which at least suggest it, and which make no mention of it at all – from the language in the specific documents, notwithstanding reinterpretations that may be warranted as a result of the Calder, Sparrow and Delgam Uukw decisions mentioned in the previous section.

Table 2.1 Regulatory requirements for using TLEK or consultation with knowledge-holders.

Requirement	Laws, regulations, treaties, agreements, policies and plans driving decisions which directly affect management of salmon or salmon habitat
No mention of TLEK; no mention of consultation with First Nations or the public:	*Fisheries Act* (Canada) *Coastal Fisheries Protection Act* *BC Water Act* *Forest and Range Practices Act*, and its Government Actions Regulation *Fisheries Act* (BC)
States that decision-makers may use TLEK, or consult with First Nations or the public:	*Oceans Act* *BC Environmental Assessment Act*
Requires the use TLEK, or consultation with First Nations or the public:	*National Marine Conservation Areas Act* *Species at Risk Act* *Fish Protection Act* Pacific Salmon Treaty[1] Tsawwassen First Nation Final Agreement Policy for Selective Fishing Allocation Policy for Pacific Salmon Policy for the Management of Aboriginal Fishing
No requirements stated as such, but is clear from the intent (e.g. the preamble, objectives, participants or decisions made):	Nisga'a Final Agreement Umbrella Final Agreement Integrated Fisheries Management Plans for Salmon (Northern and Southern BC) Comprehensive Fishing Agreements Watershed Framework Agreements St'at'imc – DFO Joint Fisheries Management Plan for 2008 (as an example of First Nations – DFO Joint Fisheries Management Plans)

[1] Assumes the Transboundary Panel will have knowledge of local economic, social and cultural conditions and values, and will use this to make and communicate recommendations.

3.0 Case Study Analysis: Summary and Lessons

3.1 Case Study Summaries

This section presents brief summaries of the case studies. The underlying details are provided in Appendix 6. As is noted at the beginning of Appendix 6, due to time constraints the case studies have *not* been reviewed by the participants involved. Any errors, omissions or simplifications are purely unintentional.

West Coast Vancouver Island Aquatic Management Board (AMB)

The West Coast Vancouver Island Aquatic Management Board (AMB) was formed in February 2002 following eight years of activism in the region by First Nations, commercial, recreational, and environmental interests, plus two Regional Districts (Pinkerton et al. 2005). The AMB is an inclusive institution as mandated by its terms of reference which calls for members to broadly represent the interests of processors, salmon farmers, the Province, and the federal Department of Fisheries and Oceans (DFO). In addition the AMB's principles and vision are consistent with the Nuu-chah-nulth First Nations' principle of *Hishukish Ts'awalk* ("everything is one"), ecosystem management, and the *Oceans Act* principle of integrated management. The parties also adopted the Nuu-chah-nulth principle of *Isaak* (respect), agreeing to work together in a manner respectful of their different perspectives. AMB objectives include integrating TLEK from both local and scientific sources, and fostering initiatives to maintain and enhance opportunities for coastal communities to access and benefit from local aquatic resources. The AMB provides a unique policy learning opportunity in so far that it not only incorporates the input from stakeholder groups, but includes the stakeholders themselves in the decision making process. In addition, the AMB also provides an opportunity to learn how a multi-stakeholder process can work to produce policy solutions and build capacity for First Nations to participate in oceans governance (Pinkerton et al. 2005).

Northern Co-management Boards

Increasing development interest in the North, coupled with the recognition of First Nations' right to self-governance has lead to the emergence of various co-management agreements over the last decade. This case study compares the Gwich'in Renewable Resource Board (GRRB) and the Beverly and Qamanirjuaq Caribou Management Board (BQCMB). This comparison highlights several key factors for ensuring meaningful use of TLEK in management (see Table 3.1), e.g., the role that structural, legislative, and geographic factors play in determining how a co-management board functions and its relationships to the community's concerns and knowledge. The GRRB resulted from a land-claims-based set of circumstance, while the BQCMB resulted from a set of crisis-based circumstances. Each Board is composed of First Nation, federal, provincial, and/or territory representatives that have an interest in how the resource is managed; however the structure and decision-making authority of each Board differs substantially (Spak 2001). These differences have significantly directed the way each Board approaches, gathers, and uses TLEK in resource management, as well as the degree of success each Board has had with TLEK in resource management (both from the perspective of governments and TLEK-holders).

Copper River Watershed Management

Located in South-central Alaska, the Copper River is roughly 480 km long and is famous for its salmon runs which can have as many as 2 million salmon each year. As with many watersheds bordering the North Pacific, the Copper River watershed is under increasing pressures from resource extraction industries, growing populations, and recreational pressures (Lowe and Wilson

2007). Aboriginal (i.e., Ahtna and Eyak Tribes), commercial, and recreational salmon fisheries occur in the Copper and tensions exist between the groups over allocation. Harvest decisions are further compounded by conservation concerns over declining Chinook (*Oncorhynchus tshawytscha*) and sockeye (*Oncorhynchus nerka*) abundance (Simeone and Valentine 2007). Several TLEK studies in the Copper River watershed have document traditional fishing practices, historic abundance, stock status and trends, and stock identification (see Simeone and Valentine 2007, Holen 2004, Simeone and Kari 2002), as well as tribal land tenure systems for salmon harvest (see Lowe and Wilson 2007). These studies have put forth recommendations on how TLEK could and should be brought into current Alaska salmon management to help meet management objectives. However, to date there has been little formal recognition of TLEK in Alaska Department of Fish and Game management. The Copper River Roundtable[2] shows promise as an impartial forum where Department managers can sit down with TLEK holders to begin a dialogue on how salmon management is carried out in the Copper River Watershed.

Endangered Status Assessments in Canada

This case study focuses on the role and use of Aboriginal and community knowledge in assessment and listing phases of the Species at Risk Act (SARA) for three Canadian species at risk: American eel (*Anguilla rostata*), Atlantic salmon (*Salmo salar*), and Cultus Lake sockeye salmon. There are provisions for consultation with Aboriginal and local communities regarding the appropriateness of the assessment designation, monitoring methods, and management mechanisms; however, assessment and listing decisions are predominantly based on scientific and government-based processes. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has an Aboriginal Traditional Knowledge Subcommittee whose purpose is to help facilitate the transfer of TLEK from communities into the status reports. Until recently, status reports took little if any TLEK into consideration (e.g., American eel and Atlantic salmon (Inner Bay of Fundy population)), although the species held great significance to Aboriginal Peoples and fishers. These early failures have resulted in lessons learned related to the role of TLEK in policy implementation and led to acknowledgement of barriers that prevent the COSEWIC advisory bodies (including the Aboriginal Traditional Knowledge Subcommittee) from fully using TLEK. Currently, the status report for all stocks of Atlantic salmon is striving to use TLEK (albeit via an interim process) to ensure that TLEK is used in status assessment decisions.

3.2 Synthesis of Lessons from Case Studies

Several themes and lessons emerged from the case studies analyses which are relevant for developing the implementation strategy (Section 4.0). Table 3.1 highlights the key lessons identified through the case studies.

Readers are strongly encouraged to also review the specific Lessons Learned for each case study in Appendix 6 (sections A6.1.4, A6.2.4, A6.3.4 and A6.4.4).

[2] The Copper River Roundtable is an initiative facilitated by EcoTrust (http://www.ecotrust.org/copperriver/) and provides a watershed-wide forum for people to come together and discuss resource issues.

Table 3.1 Synthesis of main themes and/or lessons that emerged from the case studies. An 'X' indicates the case studies in which the themes/lessons were most strongly felt.

Themes and lessons	Case studies			
	AMB	Northern co-mgmt Boards	Copper River	Species Status Assess-ments
Respect: All participants must have respect for each other, for each other's perspectives, and for the process. There must also be acknowledgement of each other's right to participate, and a commitment over the long-term. Strong relationships take time to develop.	X	X	X	X
Inclusiveness: Participation should be broadly based and representative of all interests and values that are within or connected to the people and communities within the geographic area being managed.	X	X	X	X
Terms of reference: Terms of reference must clearly define the purpose for the process/collaboration (e.g., using TLEK to inform management decisions), as well as participant roles and responsibilities.	X	X		X
Ownership of the process: Participants need to be, and be seen to be, equal owners of the process, and that requires the ability to participate in it fully with a full range of capacities (e.g., from administrative to technical, and from communication to engagement, mentoring and leadership development).		X		
Decision making power: Bodies which are advisory in nature, with no real control over the resources they are trying to manage, can only hope to implement policies/recommendations that align with the views of government. Lack of control inspires little confidence from participants and will result in minimal buy-in.	X	X	X	X
Capacity: Sufficient resources must be dedicated to the process over the long-term (i.e., staff, funding). In addition, participants must have the capacity to engage internally within the groups and organizations they represent.	X	X	X	X
Flexibility: The process needs to be flexible enough to deal with changing circumstances and issues, and the differences that will inevitably arise. In addition, different ways of dealing with conflict/disputes must be built into the processes.	X			
Science: Science is an important part of resource management, however it must be expressed in a way that people can understand, relate to, and use.		X		X
Communication: Communication between local residents and resource managers is critical. A forum that includes all users and provides opportunities for discussion and incorporating local and scientific knowledge into management is critical. In addition, the style, language, and format of interactions within the process need to be welcoming to all involved.	X	X	X	
Collaboration among government agencies/decision makers: There must be willingness among government agencies with jurisdiction over elements that affect the resource being managed to work together.		X	X	X

Themes and lessons	Case studies			
	AMB	Northern co-mgmt Boards	Copper River	Species Status Assess-ments
Consideration of socio-economic and ecologic factors: The process must be built around both the resource (e.g. fish, caribou) and people, which requires that both conservation and socio-economic factors be considered, and that risks and uncertainties be recognized as realities.	X	X	X	X
TLEK is valuable in its own right: Participants in the process must recognize that TLEK is valuable in and of itself and that it should not be used by management to just fill gaps when "nothing better" is available. Furthermore, there must be awareness that the value of TLEK extends beyond providing ecological baseline information. TLEK is relevant in other management functions (e.g. helping guide how decisions are made; determining fishery openings and closures; and identifying new methods for sharing harvest opportunities).	X	X	X	X

4.0 Implementation Strategy

4.1 The Main Messages

How can we use traditional and local knowledge? This question is increasingly common in natural resource management circles where there is either a genuine interest or higher-level political direction to tap into this wealth of information which has previously been largely ignored by natural scientists and resource management agencies. However, this may not be the right question. The results of this project imply that the real question is, *how can we include traditional and local knowledge-holders?* This conclusion is supported by some of the key messages that emerged from the research: that TLEK is about much more than just biological or environmental data – it also includes values and rules for life and livelihood; that it can lose much of its meaning if it is separated from those who hold it and the context within which it developed; that it is neither appropriate (nor may it be ethical) for scientists and managers to just extract bits and pieces to plug data gaps.

Another likely more sobering conclusion for government management agencies is that successful involvement of holders of TLEK will, in many cases, require their inclusion in decision-making. Some of the case studies illustrated that knowledge holders are unlikely to participate (or participate fully and meaningfully) if they do not have any voice in decision-making. However, as is evident Table A2.1, almost all of the power over salmon management decisions lies with the federal government, specifically Fisheries and Oceans Canada. As illustrated in Figure 4.1, if fisheries managers want access to TLEK, they are going to have to share some of the decision-making power.

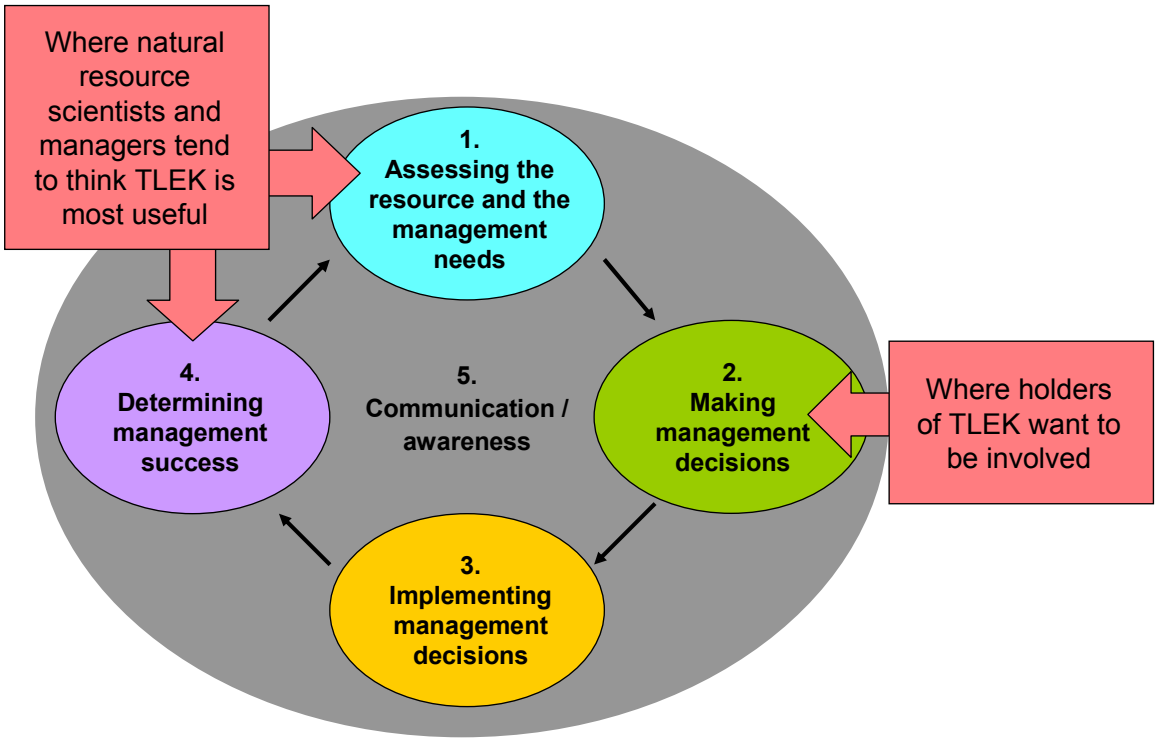

Figure 4.1 Management functions in which managers want TLEK compared with where TLEK-holders want involvement.

4.2 What this Means for DFO

It is clear from the results of this project that the question for the implementation strategy is not *how can DFO use TLEK to improve salmon management*, but *how can DFO collaborate with other TLEK knowledge-holders to improve management?* Managers cannot pick and choose which elements of TLEK to use, while ignoring the other elements that TLEK brings to the table. Determining how to bring TLEK and western science together for effective salmon management is a collaborative process that requires all knowledge-holders to have the opportunity to contribute what they feel is relevant, valuable, and feasible (Spak 2001). TLEK cannot be viewed as just a tool for filling in knowledge gaps that cannot be addressed with current scientific findings. Doing so would imply that DFO is an authority on what TLEK can offer to management, something that no holders of TLEK and few managers would likely agree with.

Successful use of TLEK in salmon management requires that DFO be receptive to new ways of seeing and thinking about the world. It also requires mutual respect among DFO, holders of TLEK, and other participants towards each other's perspectives. Simply having participation by government, First Nations, and local groups in a process does not ensure successful collaboration (Spak 2001). Dialogue between participants needs to take an inviting form which does not put any one group at a disadvantage relative to another. For example, if the style, language, and format of interactions are those most familiar to government then the process only serves as a forum through which government directs others regarding what to do. If the interactions revolve around policy, regulation, and other bureaucratic themes, participants not well acquainted or familiar with the details will feel dissociated from the collaborative process, resulting in a lack of buy-in. Furthermore, successful use of TLEK in management will require a new mandate from senior DFO officials which endorses the importance of TLEK and articulates the need for managers/scientists to include TLEK in their work. This will help ensure that managers are accountable and motivated to collaborate with local and traditional knowledge-holders.

Knowledge affects institutions – they are built upon and reflect the knowledge base, shared beliefs, ideas and accumulated knowledge of their designers and of those who participate in them (King 2004). They can privilege some knowledge forms over others by controlling data collection, restricting the methods used to gather and distribute information, controlling research agendas, subscribing to one technology or world-view, and having the power to impose that view upon those who may not subscribe to it (King 2004). If DFO is going to take steps towards including TLEK in management of fisheries resources, an institutional shift is needed to accommodate alternative forms of knowledge.

Perhaps the most challenging aspect of such a shift is the need for sharing of power.[3] If engagement of TLEK-holders requires their inclusion in decision-making, DFO's activities within the second management function, Making Management Decisions (indicated by the check marks under function #2 in Table A3.1) represent the areas where DFO should look for power-sharing opportunities. The best opportunities may be activities within function #2 which are governed by laws and policies that include explicit requirements for TLEK or consultation with TLEK-holders (Table 2.1 and A2.1).

The New Relationship between the Government of BC and BC First Nations demonstrates a clear intent by the provincial government for shared decision-making with First Nations. As DFO is the

[3] The recently-proposed BC Recognition and Reconciliation Act may provide a regulatory driver for such a shift, as it is expected to call for shared decision-making for lands and resources in BC.

agency with the greatest regulatory power over salmon management in BC, success of the New Relationship within the realm of salmon management depends on the degree to which DFO agrees with and supports this intent. Doing so would not only enable inclusion of TLEK through the provision of decision-making power to TLEK-holders, but could also help meet the New Relationship goal for BC to become a world leader in fisheries management.

4.3 Recommended Next Steps

The following recommendations provide a starting point for clarifying DFO commitment to and exploring first steps towards including TLEK and knowledge-holders in salmon management. DFO and other fisheries management organizations are encouraged to consider the findings of this project and identify additional ways to move forward.

Recommendation 1: Increase awareness among DFO staff (and staff of other fisheries management organizations) at all levels of the organization about what TLEK is and what values, nuances and principles they should be aware of when trying to include TLEK in meaningful ways in salmon management.

There are several potential mechanisms for doing this, and different options should be explored for different audience groups (for example, senior managers versus field technicians – and perhaps also for the general public). A brief needs analysis may help with the process, to gauge the current level of awareness of TLEK among different staff and program groups. Given the importance of values in TLEK it would also be prudent to compile a list of the full suite of values that TLEK-holders attach to fish and the related environment, to compare against the morenarrow suite of values for which fish are currently managed.

Awareness-raising will be most effective if it has a high-level champion within the organization (see Recommendation #2), and if it is done either by someone already highly respected by the audience group or by someone who's experience is highly credible to the group. For example, having seminars held jointly by a pair (or team) of senior scientists and TLEK-holders who can relay first-hand successful examples of how collaboration and sharing knowledge solved an important problem.

The aspects of TLEK which are not typically part of scientific knowledge and should be viewed not as obstacles or oddities that don't fit, but instead as opportunities to bring greater richness to current management. Some of these opportunities are described in Table 4.1. While pulling apart the "faces" described in this table may seem at odds with the very nature of TLEK (the idea that it is holistic and should not be compartmentalized), this may help fisheries managers who have little prior experience with TLEK see a broader potential role for its uses and value. TLEK is the sum of its parts, but using it requires an understanding what the parts are.

Success measures: degree of awareness of TLEK and related issues among staff.

Which management functions this recommendation applies to:

✓	1	assessing the resource and management need
✓	2	making management decisions
✓	3	implementing management decisions
✓	4	determining management success
✓	5	communication/awareness at all levels

Which Pacific salmon management activities this recommendation applies to (from Table A3.1):

BC program:	Program area:	Ongoing Pacific salmon management activities:
All	All	All

Recommendation 2: Initiate discussions to determine how DFO can make further progress towards realizing the stated commitment to TLEK, by articulating it more clearly in policy terms and demonstrating the department's resolve to incorporate TLEK in practical terms.

Some shifts in both thinking and decision-making are needed to enable meaningful and successful inclusion of TLEK and knowledge-holders in salmon management. There must be a strong and clear management commitment and practical guidelines provided for this approach to be adopted. DFO needs to consider carefully the organization's intent in using TLEK, solidify it in a meaningful way, and then support its implementation.

Such support for TLEK in salmon management should include attention to the following enabling factors (adapted from Marmorek et al. 2006):

Executive direction – having strong executive commitment to the success of the policy, and incorporating the goals of the policy into the organization's performance measures.

Leadership – having an advocate or champion for the policy, one capable of identifying and addressing issues that may arise during implementation.

Communication / organizational structure – having mechanisms for communication (two-way; and both laterally and vertically), and recognizing and taking the importance of communication seriously.

Corporate culture – embracing a learning paradigm that is open to alternative approaches.

Funding – having sufficient funds to implement the policy (it not, it may signal lack of executive support).

Staff training – (see Recommendation 1).

Success measures: existence of clear policy direction regarding DFO's intent to include TLEK and knowledge-holders in salmon management; existence of measurable policy goals and objectives; degree of success in achieving stated objectives.

Which management functions this recommendation applies to:

✓	1	assessing the resource and management need
✓	2	making management decisions
✓	3	implementing management decisions
✓	4	determining management success
✓	5	communication/awareness at all levels

Which Pacific salmon management activities this recommendation applies to (from Table A3.1):

BC program:	Program area:	Ongoing Pacific salmon management activities:
All	All	All

<u>Recommendation 3:</u> Undertake a co-management pilot, focused on salmon, within a single watershed.

This recommendation is derived from the northern co-management board case study examination. Spak (2001) observed that only land-claims-based co-management agreements are able to provide the conditions necessary for the reliance on the represented community's knowledge. In the concluding chapter Spak (2001, pg 214) states:

> *"Land claims agreements…, automatically create many of the pre-conditions necessary for the reliance on Indigenous knowledge. Not only do they create the necessary political incentive structure at their co-management boards that make it imperative for their biologists to value Indigenous knowledge, but they also establish a resource administration with decision-making powers for a particular region…"*

The purpose of this recommendation is to determine whether it is possible to create the necessary condition for the reliance on TLEK in a co-management institution that was not established under a land claims agreement. This would test the transferability of some of the characteristics that make the Gwich'in Renewable Resource Board (GRRB) successful in its uses of TLEK. The West Coast Vancouver Island Aquatic Management Board (AMB) may be the most suitable candidate for doing so. If not, create a new co-management body in another location where it will be feasible to evaluate the success of a co-management situation that has some of the GRRB characteristics.

The two most important GRRB characteristics to include in the co-management pilot are: (1) decision making abilities (i.e., the co-management body makes decisions on harvest, habitat, protection, and enhancement in their particular management area), and (2) accountability (i.e. the co-management body is accountable to the resource users it represents, not to government).

The GRRB has been successful at using TLEK to identify management issues, plan research, and develop management plans. One of the principle reasons for GRRB's success on this front is that it actually has decision making power over the natural resources in its region and has the autonomy to manage them using methods developed by the communities it represents. Participation in decision-making allows for the involvement of First Nations at strategic level, thereby giving them control over TLEK, and a greater sense of power (Houde 2007). Furthermore, because of the GRRB role in decision making, it is not subject to the fate of other co-management boards that are advisory in nature. Bodies that are advisory in nature, with no real control over the resources they are trying to manage, can only hope to implement policies/recommendations that align themselves with the ministries' views (Spak 2001). An advisory type of arrangement inspires little confidence in the "body" by participants, and results in minimal buy in. This is exhibited to a degree in the AMB where poor attendance at meetings by government employees has been observed (Pinkerton et al. 2005). This may be a consequence of a lack of buy-in by government employees who may see little value in their attendance (or it reflect the view of those higher up in their organizations).

A second factor contributing to the success of the GRRB is that it is accountable to the people living in the communities and using the resources within its geographical jurisdiction, not to the federal and/or territorial government. This is important because it ensures that the GRRB mandate for how to manage resources comes from the local communities and not some government agency mandate. In addition, biologists/scientists need to be accountable to the Board (i.e., the Board's employees). Otherwise they will not necessarily be free to give unbiased advice and be

open to issues of interest to the communities, because they will be obliged to give precedence to the interests and concerns of their employer (federal/provincial/territorial government) (Spak 2001). Flexible legal frameworks will be needed to allow for co-management arrangements, and to allow terms of accountability to change and adapt over time as trust builds between partners (Houde 2007).

Success measures: Pilot co-management board is reliant on TLEK to help inform management decisions (i.e., TLEK becomes integral to the process of making good decisions).

Which management functions this recommendation applies to:

✓	1	assessing the resource and management need
✓	2	making management decisions
✓	3	implementing management decisions
✓	4	determining management success
✓	5	communication/awareness at all levels

Which Pacific salmon management activities this recommendation applies to (from Table A3.1):

BC program:	Program area:	Ongoing Pacific salmon management activities:
Stock Manage-ment	Development of IFMP	Planning and consultation towards Integrated Fisheries Management Plans across stocks and harvest groups
	In-season Management	Test fisheries, modelling, data collecting Assessment and adaptation of IFMP as needed Enforcement
Habitat Manage-ment	Fish Habitat Conservation	Ensure compliance with statutes/regs/policies Participate in resource planning & mgmt Research into habitat importance/value, impacts and mitigations Development of new policy or legislation Public consultation & awareness re new policy/legislation Monitor impacts
	Fish Habitat Restoration	Initiate/promote habitat restoration projects (including fishways, barrier removal, and nutrient enrichment under the SEP) Research into restoration methods Promote public awareness Monitor restoration success
	Fish Habitat Development	Initiate/promote habitat development projects Research into development methods Promote public awareness Monitor habitat development success

<u>Recommendation 4:</u> Perform a comprehensive survey of past/present watershed management initiatives in BC, the Yukon and Washington State that used/are using TLEK to better manage their natural resources, particularly salmon. Select several of these for more in-depth examination to further elucidate specific lessons transferable to other areas or aspects of Pacific salmon management.

This recommendation is motivated by the fact that there are numerous other initiatives along the Pacific coast presently using TLEK to inform resource management (e.g., Haida Gwaii, Skeena River Watershed, Oona River Watershed, Harrison River Watershed, Dry Bay/Alsek River Delta). Some of these initiatives/programs are either poorly documented or not known about at all; however the potential for learning and transferring lessons for other people's experiences to the salmon management context is immense.

For example, in collaboration with fishermen and First Nations, explore in more depth alternative fishing techniques that allow for greater species and stock selectivity, and alternative spatial and temporal distributions of fishing effort (e.g. Gitxsan "House-based" fishing rights to catches at specific fishing sites) to evaluate which distributions best achieve management objectives. Current mixed-stock fishing methods are not able to adequately protect the genetic diversity of salmon stocks which is necessary for the viability of wild salmon.

Success measures: An inventory of initiatives using TLEK to improve management; a synthesis of relevant lessons and approaches that could be used by DFO to improve salmon management.

Which management <u>functions</u> this recommendation applies to:

✓	1	assessing the resource and management need
✓	2	making management decisions
✓	3	implementing management decisions
✓	4	determining management success
✓	5	communication/awareness at all levels

Which Pacific salmon management <u>activities</u> this recommendation applies to (from Table A3.1):

BC program:	Program area:	Ongoing Pacific salmon management activities:
Stock Manage-ment	In-season management	Test fisheries, modelling, data collecting Assessment and adaptation of IFMP as needed Enforcement
Habitat Manage-ment	Fish Habitat Conservation	Ensure compliance with statutes/regs/policies Participate in resource planning & mgmt Research into habitat importance/value, impacts and mitigations Development of new policy or legislation Public consultation & awareness re new policy/legislation Monitor impacts
	Fish Habitat Restoration	Initiate/promote habitat restoration projects Research into restoration methods Promote public awareness Monitor restoration success
	Fish Habitat Development	Initiate/promote habitat development projects Research into development methods Promote public awareness Monitor habitat development success

Table 4.1 How the different faces of TLEK apply in fisheries management.

Faces of TEK (Houde 2007)	Summary of what it means (Houde 2007)	How it is applied in the management of other natural resources	Where it applies to Pacific salmon management
1. Factual Observations	- Recognition, naming and classification of discrete environmental components. E.g. facts about animal behaviour and habitat, species anatomy and animal abundance, as well as understanding interrelationships among species, connections with the biophysical environment, and spatial distributions and historic trends of population patterns - Empirical knowledge from generalized observations over a long period of time, reinforced by accounts of other TEK holders (i.e. personal knowledge, enriched through social life)	Considered most compatible with knowledge already used by natural resource managers, e.g. in environmental assessments, risk assessments and managing species at risk. *	This "face" of TLEK applies very well to the aspects of fisheries management that require knowledge of status and trends of fish and fish habitat. It may be the only information available in remote areas, and in many places can likely provide historic information going back much further in time than most western monitoring datasets, although its value should not be viewed as only a means to fill data gaps in Western science. Where it fits in the generic framework: 1 ✓ / 2 ✓ / 3 / 4 ✓ / 5 ✓
2. Management Systems	- Strategies for ensuring sustainable use - Recognizes that one-size-fits-all management policies ignore local needs and differences - Also recognizes that adaptive policies are needed to cope with change	Harvesting rotations in beaver trap lines, controlled fires, and patterns of wild egg collection; Waswanipi Model Forest on Quebec Cree land; Quebec Forest Act where regulations can be adapted to local needs including those of First Nations. *	This can help inform new ways of managing fisheries in areas where harvesting conflicts or decreased stock abundance signal a problem with current approaches. Mixed-stock fisheries are not providing sufficient protection for weaker stocks and possible solutions include the use of First Nations' selective fishing techniques and distribution of effort. Where it fits in the generic framework: 1 ✓ / 2 ✓ / 3 ✓ / 4 ✓ / 5 ✓
3. Past and Current Uses	- Local knowledge of historical patterns of land/water use and settlement, occupancy and harvest levels, and the location of resources as well as cultural and historic sites - Also includes life stories transmitted over generations through narratives that provide a sense of family and community	Land use plans and multiple-use frameworks, albeit carefully, as lack of control over the information can lead to misinterpretation, and benefits may not be distributed equitably. * TUS information is also used in environmental assessments to determine potential project impacts.	This can help provide further historic richness and depth to assessing and interpreting status and trends. Understanding past resource and land uses that are not longer apparent today can also help in recovery and restoration efforts, for example knowledge about prior habitat capability can inform where to focus such efforts, and expectations of abundance. Where it fits in the generic framework: 1 ✓ / 2 ✓ / 3 ✓ / 4 ✓ / 5 ✓

Faces of TEK (Houde 2007)	Summary of what it means (Houde 2007)	How it is applied in the management of other natural resources	Where it applies to Pacific salmon management
4. Ethics and Values	- Relates to values concerning correct attitudes (including respect) towards non-human animals, the environment in general, and between people - Expression of an environmental ethic that keeps exploitation in check - The connection between the belief system (face 5) and the organization of facts and actions	Not currently well translated in resource management. The Haida have long opposed recreational bear hunting which they consider disrespectful to the animal, and have tried to encourage local outfitters to offer tourists bear-watching opportunities in place of hunting opportunities, but to limited effect (except in Gwaii Haanas). *	The WCVI AMB (one of the case studies) is a good example of this; members have adopted the principles of *Hishukish Ts'awalk* (everything is one) and *Isaak* (respect). Ethics and values are most likely to be included by involving TLEK holders in Pacific salmon management (rather than trying to extract the knowledge). Where it fits in the generic framework: 1: ; 2: ✓; 3: ✓; 4: ; 5: ✓
5. Culture and Identity	- The role of land, language and past images in giving life to culture - The strong connections between language and the use of meaningful place names, consumption of country food, life on the land, identity, and cultural survival - The importance of cultural landscapes in spiritual renewal - How what settlers perceived as "empty space" was full of meaning for First Nations, and these meanings provide a sense of place, home, and identity	Tends to arise when negotiating treaties or other co-management arrangements. The Cree Nation of James Bay challenged in the late 1990s that the Government of Quebec was allowing too much logging to take place on their ancestral land which wasn't respecting their treaty rights to pursue a way of life that included beaver trapping, and was affecting their ability to sustain their culture. The issue was settled through a new agreement, *Peace of the Braves*. *	This face (along with that below) may be best expressed where there is co-management of fisheries between DFO and TLEK knowledge-holders. Resources so closely tied with culture and identify of one group of people cannot be managed by people who do not share (or understand) that culture and identify. Where it fits in the generic framework: 1: ; 2: ✓; 3: ✓; 4: ; 5: ✓
6. Cosmology	- The foundation of the other faces (and inseparable from them) - World view that explains how things work, and are connected - Underlies principles that regulate human-animal relations, and the role of humans in the world	Visioning alternate futures in the field of land use planning starts to get at this, but the concept has never been fully integrated into natural resource management in Canada. The best opportunities to do so may be within the context of co-management. *	This face, as that above, is likely best expressed where fisheries are co-managed. Where it fits in the generic framework: 1: ✓; 2: ✓; 3: ✓; 4: ✓; 5: ✓

Management function legend:

1	assessing the resource and management need
2	making management decisions
3	implementing management decisions
4	determining management success
5	communication/awareness at all levels

* Also from Houde (2007).

4.4 Principles for Including TLEK and Knowledge-holders in Natural Resource Management

In addition to the recommendations, it became clear from the research for this project that there are a number of simple principles that would greatly enable the inclusion of TLEK and knowledge-holders in natural resource management, including but not restricted to fisheries management. These are directed at fisheries scientists and managers.

1. **Explicitly acknowledge the existence of TLEK.** Simply acknowledging that TEK exists is an important first step towards full participation of aboriginal communities in the management of land and resources (Nadasdy 1999).
2. **Explicitly acknowledge the value of TLEK to resource management.** There are numerous examples of errors being made in scientific assumptions and results because TLEK was disregarded (Johannes and Neis 2007). These examples include the collapse of the North Atlantic Cod fishery, incorrect assumptions about beluga behaviour and numbers in the eastern Canadian arctic and in Hudson Bay, underestimation of bowhead whale populations in Alaska, the importance of bait fish to fishers in the Solomon Islands, and unawareness of the possible imminent demise of the last known spawning run of baitfish at a south Pacific atoll (Huntington 2000 and Johannes et al. 2000). There have been similar errors regarding population estimates of caribou and bowhead whales in the Eastern arctic. Biologists must accept the value of TLEK, as well as methods for studying it, and stop promoting narrow versions of the "scientific method" as the only basis for structuring ecological research (Johannes et al. 2000). A major culture shift is needed.
3. **Understand the value of TLEK to the knowledge-holders.** It is important to acknowledge the value system and cosmological context within which TLEK was generated, and makes sense (Houde 2007). It is gathered through a range of activities such as hunting, collecting medicine, preparing for spiritual ceremonies and maintaining a household economy (Drew 2005). It extends beyond just factual observations to also encompass management systems, past and current uses, ethics and values, culture and identity, and world view (Houde 2007), and is essential to cultural and physical survival (Haggan and Baird 2007).
4. **Do not use TLEK in isolation from the knowledge-holders.** Pieces of TLEK cannot be extracted from the body of knowledge of a people (King 2004). It should not be treated as disembodied information, but should involve those who possess it as partners in both research and management (Johannes et al. 2000). Knowledge is not an intellectual product that can be isolated from its social context (Nadasdy 1999). This principle will help address the issues of control and power described in Section 2 and Appendix 1. Including TLEK requires entering into a dialogue on terms set by holders of TLEK (Drew 2005). This principle is also important because TLEK is not a fixed thing. It arises from observation, trial and error, and is therefore alive and dynamic and continues to grow and change (Drew 2005).
5. **If TLEK disagrees with scientific information, investigate why.** Biologists should not dismiss TLEK when it disagrees with their findings, but instead should investigate carefully what lies behind the disagreement (Johannes et al. 2000, Johannes and Neis 2007). The error may be in the scientific information, not the TLEK, or perhaps they are

focusing on different scales of space and time and therefore observing different processes or patterns.

4.5 Additional Insights for Fisheries Managers

Regardless of where TLEK and knowledge-holders are brought into fisheries management, there are a number of insights gained from this project that will help. Several of the most important ones, which would apply to any salmon management function and activity, are presented as principles in Section 4.5. Others are summarized below.

It's not just *whether* you involve knowledge-holders, but *how*.

The strong socio-cultural aspects of TLEK combined with issues regarding power (summarized in Section 2 and Appendix 1) highlight the importance of respectful, ethical, equitable and appropriate forms of engagement.

Involve TLEK knowledge-holders in the early planning stages of any initiative, process or product in which you plan to include TLEK.

Don't design the process and then engage the knowledge-holders; collaborate with them from the start.

Make the commitment.

Fundamental to integration of local fishers' knowledge into fisheries science and management is an earnest commitment on the part of scientists and managers to better understand and incorporate the knowledge (McGoodwin 2006).

Be open to new ways of thinking.

The experiences and lives of First Nations people cannot be compartmentalized in a way that corresponds to the categories of scientific management (Nadasdy 1999). Try to understand new and more holistic ways of interpreting information, and take the time to really *hear* what TLEK-holders are saying.

Increase transparency.

For management to be successful, users must understand and accept the goals, objectives, and decisions of the resource managers (Simeone and Valentine 2007). For this to happen there must a high level of transparency, such that users are aware of the tradeoffs made by management and the role that their knowledge played in arriving at the final decision. Users have to have a stake in management, i.e., they need to be informed and part of the decision-making process to the extent required for them to understand and accept how certain actions are likely to achieve the management goals and objectives.

Acquire social science skills.

To work effectively with TLEK holders as partners in research and management, biologists must either develop the necessary social skills and attitudes, or involve others in their work who have these skills. Social scientists can be valuable and sometimes essential as cultural brokers (Johannes et al. 2000).

Meet with knowledge-holders on their turf.

Don't just talk to local resource users, but actually fish and hunt with them, if possible; sometimes only then will critical issues emerge (Johannes et al. 2000). This will also help build trust, which is needed for building truly collaborative, mutually respectful long-term relationships (Cox 2000, cited in Drew 2005).

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Appendix 1: Context and rationale in greater detail

This appendix provides additional detail to the information summarized in Section 2.

A1.1 What is Traditional and Local Ecological Knowledge?

No one clear answer to the question "what is traditional and local ecological knowledge" (TLEK) could be found in the literature reviewed for this project. One of the most frequently-cited authors states explicitly that there is no universally accepted definition (Berkes 1999). The following is a selection of definitions for "traditional ecological knowledge" (TEK) from the papers reviewed for this project which are used by at least two authors, in an attempt to identify elements about which there is some agreement:

From Mailhot (1993), also used by Garcia-Allut et al. (2005):	*TEK is the sum of the data and ideas acquired by a human group on its environment as a result of the group's use and occupation of a region over many generations.*
From Miraglia (1998), also used by Shackoff and Campbell (2007)	*TEK is an integrated system of knowledge, practice, and beliefs, embedded within a particular social context that includes symbolic meaning through oral history, place names and spiritual relationships.*
From Berkes (1999), also used by Casimirri (2003), Moller et al. (2004), Drew (2005), Gilchrist et al. (2005), and Turner and Berkes (2006):	*TEK is a cumulative body of knowledge, practice and belief evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment.*
From Usher (2000), also used by Houde (2007):	*TEK refers specifically to all types of knowledge about the environment derived from the experience and traditions of a particular group of people.*

Common themes among these definitions include the notion that it develops over a long period of time, that it is experience-based, and that it has both socio-cultural and biological dimensions.

Depending on the particular context in which TLEK is raised, including authors' training, area of interest and cultural background, definitions and discussion of TLEK, and focus of research vary (Soto 2006). In a review of TEK within the context of Canadian co-management arrangements, Houde (2007) characterizes TEK as having six "faces": (1) factual observations, (2) management systems, (3) past and current uses, (4) ethics and values, (5) culture and identity, and (6) cosmology or world view.

Berkes (1999), who studies socio-ecological systems (within the context of natural resource management) notes that TEK can be conceptualized as having four interrelated levels, pictured schematically as four concentric ellipses, from the innermost outward: (1) local knowledge of animals and land; (2) land and resource management systems, (3) social institutions, and (4) worldview. It is a knowledge-practice-belief complex.

The social context of TEK is elaborated in Miraglia (1998, cited in Shackeroff and Campbell 2007) as including (1) symbolic meaning through oral history, place names and spiritual relationships, (2) a distinct world view; including a view of the environment different from that of Western science, and (3) relationships based on sharing and obligations toward other community members and other beings, and community resource management based on shared knowledge and meaning. The use of the term "traditional ecological knowledge and *wisdom*" by Turner et al. (2000) suggests a definition that encompasses worldview and values.

The emphasis on respect for all beings in the teachings and philosophies in North American aboriginal cultures has been noted (e.g., Winkelaar 1990, Wolfe 1991, Gombay 1995, Irlbacher 1997). Indigenous scholars have written about Indigenous worldviews and how they shape, for example, relationships to land and other beings or approaches toward education, contrasting them with Western approaches (Kuokkanen 2006, Atleo 2004), for example:

> *The gift is a reflection of a particular worldview characterized by a perception of the environment as a living entity which gives its gifts and abundance to people if it is treated with respect and gratitude (i.e., if certain responsibilities are observed.)…[T]he world is constituted of an infinite web of relationships…Social ties apply to everybody and everything, including the land….The gift represents a system of values different from those of economic exchange, foregrounding the values of interdependence, reciprocity and responsibility toward others* (Kuokkanen 2006).

In Indigenous as well as other cultures, stories and metaphors may provide important morals and lessons (Soto 2006). For example, a Yupik leader, in the context of negotiating an agreement to share power in wildlife management, likens the process to a husband and wife who share control of the household (Bista and Davidson 1976). Kurien (1998) examined worldview within five Asian proverbs to reveal the wisdom of coastal communities in relation to their ecosystems.

The "potlatch" system of the Northwest, which encompassed institutions of governance and resource management that resulted in sustainable management of ecosystems prior to European contact (Trosper 2009), can be understood as Traditional Knowledge as described by Berkes (1999) and Houde (2007). Durrenberger and King (2000) speak of social-ecological knowledge which "includes appropriate and legitimate capacities for allocating access, appropriation, and distribution of fisheries resources". These include relatively self- or locally-managed systems, where rules have evolved regarding many aspects of management (Pinkerton 1989, Schlager and Ostrom 1993, Dyer and McGoodwin 1994, Pinkerton and Weinstein 1995). Specific knowledge is passed on regarding when and how to hunt or fish, what numbers to take, and where (Bailey and Zerner 1992, Newell 1993, Berkes 1999).

Interest in TLEK emerged in the context of natural resource management as a result of national and international trends. These include a response to large-scale environmental problems and management failures and the push by Aboriginal Peoples and by citizens more generally for involvement in decision-making (Soto 2006). Failures in resource management such as the collapse of Newfoundland cod led some scientists, citizens and government managers to consider that resource users may have important knowledge to contribute. Within these contexts, however, much of the focus, particularly in non-aboriginal fisheries contexts has been on TEK as environmental or ecological knowledge[4] that can supplement or complement science including,

[4] The reason some authors choose to refer to TLK rather than TLEK is to acknowledge and emphasize the holistic or encompassing nature of this knowledge.

for example, harvesters' empirical knowledge of factors such as environmental conditions, species' biology, harvesting and abundance trends (e.g., Potter 1996, Poizat and Baran 1997, Drew 2005). Drew (2005) identifies three subcategories of TEK that pertain to ecological research: (1) folk taxonomy and systematics, (2) population-level knowledge, and (3) ecological relationships.

Holders of TEK need not be Indigenous (Huntington 2000, Gilchrist et al. 2005) (although many of the papers reviewed for this project appeared to be using the term in this manner). This raises the question, what is the difference between "*traditional* ecological knowledge" and "*local* ecological knowledge?" The difference appears to be temporal. Gilchrist et al. (2005) stress that the type of ecological knowledge often gathered through interviews for wildlife management is "current local knowledge" acquired more recently over the lifetime of individuals, sometimes interspersed with historical information provided by older relatives. Therefore they prefer to use the term "local ecological knowledge" (LEK) to encompass knowledge passed among generations as well as that developed by individuals during their lifetimes. Similarly, Ballard et al. (2008) define LEK as "the local expertise of people who may not have a very long-term relationship with the local environment compared with Indigenous Peoples, but nevertheless have local wisdom, experience, and practices adapted to local ecosystems."

TLEK is dynamic – not fixed or rigid (Soto 2006). It develops through trial and error, and this iterative aspect allows it to reflect changes in environment or culture (Drew 2005). For example, one type of TLEK, fishers' ecological knowledge (FEK) is subject to continuous change and includes the latest changes occurring in the local marine environment (Garcia-Allut et al. 2005).

The request for proposals mentioned the term "fishers' knowledge." As mentioned above, this report considers fishers' knowledge or FEK to be one type within the broader category of TLEK. Although Garcia-Allut et al. (2005) refer to FEK as knowledge of fish behaviour and ecology others conceptualize it as including social and biological dimensions. Soto (2006) in a review of 32 literature cases defines "Fishers' Knowledge" in a way that parallels Berkes (1999) above. Similarly, Murray et al. (2006), when exploring the use of fishers' knowledge on the East coast, use LEK for knowledge and experience regarding physical and biological components of ecosystems (the fish, the tides, water conditions, etc.) as well as fishing practices and issues related to the larger social and economic context of fishing.

The six faces described by Houde (2007) are used in Section 4 of this report as it best captures the richness and nuances which must be understood when attempting to incorporate this type of knowledge into fisheries management.

A1.2 Why include TLEK in Natural Resource Management?

There is a growing lack of confidence in centralized, scientific fisheries management, and some researchers and policy-makers have called for fishers' knowledge to play an increased role in management decisions (Murray et al. 2006). Appendix 2 lists some of the shortcomings specific to Pacific salmon management (although better incorporation of TLEK may not necessarily solve all of them). A recent study published by the David Suzuki Foundation (Nelitz et al. 2008) also identifies a number of challenges regarding implementation of the Wild Salmon Policy. A conference was convened in February 2009[5] to discuss salmon management in the face of climate change, which could profoundly affect salmon abundance and distribution. New information and approaches are needed.

[5] State of the Salmon 2009 Conference, February 2-5, 2009, Fairmont Waterfront Hotel, Vancouver, BC.

There are good ecological reasons for including TLEK in salmon management. Natural resource users may be the first to observe changes or depletion, and often know more about spatial and temporal distribution of the resource and about the location of critical habitat than biologists (Johannes et al. 2000). Similarly, in places which are poorly studied because of their remoteness, TLEK can contribute important knowledge such as information about species presence and distribution, especially juvenile habitats and spawning aggregations (Drew 2005). The collapse of the north Atlantic cod fishery was due in part to the refusal of biologists to take fishers' knowledge seriously, despite warnings by inshore cod fishermen that spawning stocks on their fishing grounds had become alarmingly low (Finlayson 1994; Hutchings and Ferguson 2000; Johannes et al. 2000).

Western scientists should not be quick to dismiss what they consider to be unsubstantiated judgements in TLEK that are based on generations of experience, when their own judgements are based on relatively few measurements over a much shorter timeframe (Johannes et al. 2000, Johannes and Neis 2007)). For ecologists, TEK offers a means to improve research and also to improve resource management (Huntington 2000). The following are some examples, summarized from Johannes et al. (2000), where lack of interest in and attention to local fishers' knowledge led to poor experimental/sampling design and incorrect conclusions being drawn by government-funded research into fisheries issues.

- Populations of bowhead whales in Alaska were underestimated by government scientists because of incorrect assumptions about whale behaviour in designing their census methods. They underestimated the spatial and temporal bounds of the migration, incorrectly assumed that the whales did not feed during migration and therefore assumed movement occurred only in one direction, and incorrectly assumed that whales could only breath in areas of open water whereas local whalers knew whales could get air by breaking through the thinner ice that forms after stress fractures and also from under-ice air pockets. When the Chief Scientist of the Alaskan Whaling Commission tried to combine local knowledge with scientific knowledge, they designed the whole research program around what a few senior Eskimo hunters told them. They then spent more than a decade of research and millions of dollars confirming the accuracy of what one of the elders taught them about how the whales moved through the ice.
- Beluga counts by government scientists in the eastern Canadian arctic were similarly inaccurate because of incorrect assumptions about whale behaviour. They wrongly assumed that the whales remain in one location throughout the short Arctic summer. This error was reinforced in part by the inability of the scientist to recognize that the groups of whales they were observing actually changed, whereas Inuit hunters could tell this by beluga skin characteristics, morphology, and swimming and diving characteristics. Subsequent satellite tracking supported the hunters' contention that some beluga move from place to place in the summer.
- Scientists believed that beluga in Hudson Bay left the bay before fall freeze-up, and that calf births were restricted to a few weeks in the summer. However, a traditional knowledge study by Indigenous hunters from Inuit and Cree communities supported their contentions that beluga wintered in the bay and that sexually mature females bore calves at any time during the year.

The holistic environmental nature of TLEK also leads to better awareness of linkages between various ecological processes, multiple species, and abiotic factors that affect species biology (Drew 2005). For example, an aquatic food web constructed by an aboriginal group in Brazil for a

particular river closely matched one created by university researchers, but also described several migratory movements of fish previously unknown to western science (Silvano and Begossi 2002, cited in Drew 2005). Knowledge of some environmental linkages results from a long-term association with the area and may not be apparent to those not intimately familiar with it (Drew 2005). Local fishermen are aware of subpopulations of species not addressed by fisheries managers (see Section A1.3.4). Those intimately familiar with an area are also in the best position to notice changes, and therefore TLEK may have an important role to play in adapting salmon management to climate change. The potential for TLEK may be especially relevant given the current shift to ecosystem-based approaches (Shackeroff and Campbell 2007).

The use of TLEK in the form of customary ecological management practices is a powerful conservation mechanism (Drew 2005). Community support for conservation plans is one of the most important factors for long-term success, and programs that incorporate customary ecological management practices in their design draw more support from local peoples (King and Faasili 1999, Evans and Birchenough 2001, Johannes 2002, and Aswani and Hamilton 2004, all cited in Drew 2005). Using fishers' knowledge and local approaches in fishery management may also help prevent a "tragedy of the commons" situation from developing (McGoodwin 2006). When methods for managing a commons ignores such approaches and emphasizes government intervention, such a "tragedy" may actually be encouraged.

Including TLEK in salmon management is important for local capacity-building and power sharing. For cultural reasons, scientific research tends to represent a one-way transfer of knowledge and power (Drew 2005). Developing capacity for holders of TLEK to participate in management through training, education and cultural empowerment can help reduce these inequities. The use of TEK is not a one-time extraction of information but presents an opportunity for long-term collaboration and information development Drew (2005).

Including TLEK in natural resource management makes economic sense. Many government agencies at the federal and provincial level are faced with budget cutbacks. As a result, some are relying increasingly on shared management models that shift some of the responsibility for field activities such as monitoring to non-government stewardship partners. Efficiencies can be gained by engaging local participants in natural resource management (Soto 2006).

The legal rationale for incorporating TLEK in fisheries management is explained well by King (2004). To summarize, a series of court cases has provided the legal basis for new institutional arrangements governing First Nations fisheries in BC. Many First Nations in BC never concluded treaties. They were allocated small reserves on the understanding that their fisheries would be protected (Harris 2001), but First Nations fishing rights were not recognized outside the reserves. First Nations fishers who contravened Fisheries and Oceans Canada (DFO) regulations were prosecuted. The Canada/US Pacific Salmon Treaty reinforced and supported DFO regulations regarding restrictions of fishing gear, timing and location, and this severely affected the First Nations fishery. Particularly damaging to First Nations fisheries was the power of DFO to allocate salmon to other users before they reached the rivers where most First Nations fishing takes place. In the 1973 Calder case, the court ruled that aboriginal title was a right to occupy the lands and to enjoy the fruits of the soil, the forest and of the rivers and streams. In *Regina v. Sparrow,* (1990) , the Supreme court ruled that First Nations people have an unextinguished right to fish for food, and that native fishing should be given priority over other users rights, subject only to federal authority to ensure conservation of stocks. In *Delgamuukw v. British Columbia* (1997), the Supreme Court recognized and affirmed aboriginal rights, and recognized the role of traditional knowledge and oral history as evidence in establishing rights of First Nations people to land and resources

A number of laws and agreements governing Pacific salmon management decisions specifically encourage or even require inclusion of TLEK in the management process. These are listed in Appendix 2.

The New Relationship between the provincial government and First Nations in BC provides strong political rationale for including TLEK in fisheries management. According to the New Relationship vision statement (Government of BC, n.d.), the Government of BC agrees to

> *… establish processes and institutions for **shared decision-making about the land and resources** and for revenue and benefit sharing, recognizing, as has been determined in court decisions, that the right to aboriginal title "in its full form", including the inherent right for the community to make decisions as to the use of the land and therefore the right to have a political structure for making those decisions, is constitutionally guaranteed by Section 35. These inherent rights flow from First Nations' historical and sacred relationship with their territories.*
>
> *Lead the world in sustainable environmental management, with the best air and water quality**, and the best fisheries management, bar none**.*

A provincial Recognition and Reconciliation Act has recently been proposed, which calls for shared decision-making over lands and resources in BC. The specifics are not yet publicly available.

A1.3 What are some of the Challenges of Including TLEK?

A1.3.1 Socio-cultural Challenges

Power and perceptions towards TLEK are major barriers to the integration of TLEK in natural resource management. The science, technology and cosmology of first world cultures, or Western science, often dominate and subjugate other knowledge systems (King 2004). Shadkeroff and Campbell (2007) describe how the global legacy of colonialism has created a set of values, meanings, and practices through which Westerners are positioned as superior and other perspectives are marginalized. This pervades Western science so deeply that it is engrained in the most basic assumptions made by scientists, and leads scientists to ignore local knowledge in a way they may not even be aware of. The promotion of TLEK often reinforces such power imbalances because it is frequently defined as less empirical than scientific knowledge, and considered to be 'wrong' when it disagrees with Western science. TLEK is viewed as something that needs to be evaluated against 'expert' knowledge based on Western scientific paradigms before it is considered valid and useful, and early efforts to collect it focused on evaluating Indigenous knowledge against Western science (Casimirri 2003). Soto (2006) notes that this trend continues within the context of commercial fishers' knowledge.

According to Nadasdy (1999), even the idea of trying to 'integrate' TLEK with science automatically imposes a culturally specific set of ideas regarding aboriginal knowledge. It forces the compartmentalization and distillation of aboriginal values, beliefs and experiences according to external criteria for relevance, which can seriously distort them. A similar idea is expressed by Cruickshank (2004) who cautions against trying to turn Indigenous knowledge into a 'system' which can be incorporated into westernized management regimes. Soto (2006) depicts a conceptual framework of two social systems interacting. At one end is a 'Western' or natural science-dominated system of natural resource management that is accessing TLEK. At the other end is a more intact traditional knowledge system that is accessing science. Although the latter

appears to be relatively rare, examples are available from Stevenson (1998) for aboriginal people involved in co-management and Rowe and from Feltham (2003) for a lobster fishery in Newfoundland.

Since knowledge itself is power (Schreiber and Newell 2006), governments tend to control data in order to maintain power, control and self-interest (Pinkerton 1999). Researchers collecting TLEK data may (deliberately or inadvertently) control that knowledge through the interpretation of results and deciding how, when, where, and to whom conclusions are presented, and sometimes researchers may claim outright ownership of data (Shadkeroff and Campbell 2007). Not surprisingly, holders of TLEK are sometimes reluctant to share information (Huntington 2000). A certain level of trust must be established for TLEK to be shared (Drew 2005). The legacy of the disparagement of TLEK (Soto 2006), inequities in how the benefits of using TLEK are shared, misinterpretation of oral history and occupancy patterns, and lack of acceptance of aboriginal societies as vibrant and multi-faceted (Houde 2007) all contribute to this distrust.

The social dimensions of TLEK which are captured in three of the six faces identified by Houde (2007) present some of the major challenges with incorporating TLEK into fisheries management. Given the primacy of natural science in current natural resource management (Soto 2006), the spiritual and value-laden content of TLEK does not make sense to natural scientists and falls outside the realm of the natural sciences (Berkes 1999)[6]. Indeed, TLEK systems are often studied by social scientists and anthropologists. Many wildlife and fisheries managers and researchers are unfamiliar with social science methods and are either unwilling or insufficiently trained in the appropriate methods required to gain access to information that otherwise remains out of reach (Huntington 2000).

Research that involves interviewing people and discussing their knowledge involves ethical issues of confidentiality, eventual use of the research, getting permission from particular individuals and/or collectives and the negotiation and creation of formal research agreements (Neuman 2000). Intellectual property rights, research protocols and the ethics of traditional knowledge use are addressed in a growing body of literature (Schnarch 2004, Bannister 2005). Finding out who is knowledgeable and reliable, developing trust, and arriving at agreements or protocols require time. Anthropologists do so by staying for longer periods of time in their study sites and using participant observation (Johannes and Lewis 1993). These inputs of time may be difficult or impossible for most professional natural scientists. Many of these issues and methodological approaches to addressing them are raised in McGoodwin et al. (2000), Neis et al. (1999), and Holm (2003).

Thus, developing research programs integrating TLEK presents challenges for natural scientists in the way in which data are collected, presented and analyzed (Drew 2005). Biologists may have to expand their knowledge and skills, deliberately or out of necessity, depending on the project, or work with social scientists in an interdisciplinary approach (Johannes and Lewis 1993, Neis et al. 1999, Drew 2005). Biologists may also be uncomfortable in cross-cultural interactions.

Another complexity of using TLEK is raised by some social scientists and Indigenous People who challenge whether it is appropriate to extract parts of the knowledge from its social and spiritual context for ethical as well as practical reasons (Legat et al. 1991, Irlbacher 1997, Nuttall 1998, Berkes 1999). Soto (2006) notes that the use of TLEK in natural resource management has occurred and continues to occur through interviews with TLEK holders or through their

[6]However, several authors including Morrow and Hensel (1992), Nadasdy 1999 and Houde (2007) clarify that science is not neutral and is situated within a social system with its own values.

involvement in various studies or co-management groups such as Hunters and Trappers Committees (e.g. Kofinas 1998). There are pragmatic circumstances in which it is arguably legitimate to ask, for example, an aboriginal community about how fish populations have changed over time – which can be considered a "piece" of TLEK. What may be as important as concerns regarding extraction from context are ethical issues of *how* knowledge-holders are involved – has their permission been formally sought? Are they receiving compensation, if it is desired? Have they been involved in study design? Are the groups they are involved in structured in ways that do not reinforce existing social hierarchies of power?

Interestingly, the complexity of TLEK provides additional rationale or inertia for a reluctance to integrate TLEK for a variety of reasons addressed in detail in Soto (2006). She suggests that a conceptual separation similar to Berkes (1999) or Houde (2007) assists in talking about and understanding the multi-faceted nature of TLK.

A1.3.2 Institutional Challenges

The number of agencies currently involved in salmon management poses a significant institutional challenge. Salmon range very long distances throughout their life cycle, and as a result, protection and management of salmon and their habitat fall under numerous jurisdictions. While Fisheries and Oceans Canada has jurisdiction over fish and fish habitat (including spawning grounds and nursery, rearing, food supply and migration areas in fresh or marine water), the Government of BC has jurisdiction over licensing of freshwater uses and licensing of dams and hydraulic structures. While DFO has a primary jurisdiction over the environmental aspects of Canada's marine waters, Environment Canada has jurisdiction over marine pollution, and neither have jurisdiction over waters beyond 200 miles from the Canadian coast. The United States has jurisdiction over salmon spawning areas in the U.S., although these salmon may migrate through Canadian coastal waters, just as some salmon that spawn in Canadian streams and rivers migrate through U.S. coastal waters. Jurisdiction over salmon in areas where aboriginal treaties have been signed is shared between the aboriginal and federal governments. This mosaic of jurisdictions will complicate any efforts to include new knowledge, participants or processes into salmon management.

The way agencies manage salmon is another challenge. Governments have a tendency to conduct single-species management for maximum biological or economic yield, rather than managing for a broader array of stocks and ecosystem linkages (Pinkerton 1999) (see Section A1.3.4, Ecological Challenges). As described in Section A1.2, knowledge of ecosystem linkages is one of the many benefits of TLEK.

Another institutional challenge exists within the actual laws and agreements governing Pacific salmon management decisions. Most contain no requirements to include TLEK in the management process, and among those that do, very few give holders of such knowledge any decision-making power. (These laws and agreements are listed in Appendix 2.) While this should not prevent the inclusion of TLEK, the absence of such direction in most laws and agreements means that it is up to those undertaking the work to recognize the benefits of including TLEK and act on it.

The design of institutions to represent fishers and their knowledge as well as new requirements for ecosystem-based and precautionary management are ongoing challenges in fisheries management, as are the limited financial resources that resource management agencies have to implement their current programs, let alone innovate (Soto 2006).

Finally, resource management agency recruitment and promotion criteria may hinder working with fishers and their knowledge in more participatory ways (Soto 2006). Specifically, agency research scientists gain credibility and career advancement through publishing in scientific journals which may not recognize TLEK as legitimate (Irlbacher 1997). In addition, the increased time required to use participatory management approaches and address ecological complexities such as local stocks is not rewarded (Stanley and Rice 2003).

A1.3.3 Fisheries Science Challenges

Soto (2006) demonstrates in considerable detail the assumption that natural science is the basis of knowledge in fisheries management and how this affects agency scientists' and managers' perception of the value of TLEK. For example, there is a trend in the fisheries literature on TLEK for fisheries scientists to conceptualize TLEK as knowledge that can be used to generate hypotheses, or knowledge that needs to be 'validated' by scientific methods[7] (in other words, knowledge that does not stand on its own). This is problematic for a number of reasons, including the fact that not all useful fisheries information, whether obtained by fishers or scientists, warrants being treated as hypotheses to be tested in experiments.[8] It would also be incorrect to assume that science-based ecological studies are error-free and without any bias or limitation, although this is an assumption that many scientists make (Harding 1991, Rykiel 2001, both cited in Brook and McLachlan 2005).

Another key barrier to its use is that TLEK may not fit with the routine procedures and methods of fisheries management. Qualitative data such as observations of the presence or relative numbers of particular species, habitats, changes in environmental conditions, locations of fishing areas, etc., do not readily plug into current stock assessment models. TLEK has been used in relatively new ecosystem and spatial modelling (e.g., Christensen and Pauly 1992, Walters et al. 1999) in attempts to reconstruct past ecosystems (Pitcher and Haggan 2003). However, the tendency remains for fisheries scientists to ignore knowledge which cannot be expressed quantitatively, and in the case of integrating TLEK, to concentrate on what Stanley and Rice (2003) term the "data collection model" rather the incorporation of dynamic (newer) fishers' knowledge within more participatory approaches (Soto 2006).

Stock assessment models used in fisheries science have particular parameters which necessarily limit the ways in which new information can enter (Soto 2006). For example, Baelde (2003) learned through interviews with fishers that their behaviour on the grounds diverged substantially from assumptions which permit the use of catch per unit effort (CPUE) as an abundance indicator. However, the results of interviews were not taken into account in stock assessment:

> *…after initially welcoming the results of the survey, scientists then appeared to quickly lose interest…They failed to appreciate the need for dedicated and specialised work to turn this knowledge into a useful form for science.*

[7] However, power affects the process of selection of hypotheses for testing. In Newfoundland, fishers pointed out evidence of declines many years before the moratorium, based on their own experiences and indicators of increased effort. This consensus among many inshore fishermen was not considered a hypothesis to be tested until the post-hoc analysis of Hutchings and Ferguson (2000). It is important to note that TLEK holders generate their own hypotheses which they test over time or through their own experiments (Stanley and Rice 2003).

[8] Stock assessment is perhaps the key activity within "fisheries science". However, the actual testing of hypotheses regarding the status of fish stocks through experimentation is generally not done.

> *Institutional inertia quickly overcame their initial interest in favour of established fisheries science practices* (Baelde 2003).

Making assumptions in stock assessment models and fisheries research can also preclude the gathering or incorporation of relevant information. Since the model's output and its application are the focus of efforts, once the assumptions are made, they may remain untested. For example, Hutchings and Ferguson (2000) noted that three previous studies of trap catches incorporated the implicit assumption that all traps have equal fishing power; however, interviews with fishers revealed that this was not the case.

Soto (2006) gives additional examples[9] from the fisheries literature that demonstrate how an attachment to specific procedures used in fisheries science and management, including centralized management and inappropriate spatial scales, can result in the screening out of knowledge obtained by other procedures, including fishers' knowledge. She refers to this as "procedural inertia", which is exacerbated by ongoing financial cuts to fisheries management budgets.

A1.3.4 Ecological Challenges

The life cycle of Pacific salmon spans large geographic distances and many types of environments, exposing them to multiple stressors. This poses a challenge for determining the cause(s) of change in abundance of stocks. Ocean conditions can change on annual and decadal scales, and climate change is increasingly having an impact on salmon species. The complexity of interactions in the natural environment means that understanding why abundance is changing is extremely difficult regardless of information source – science or TLEK – although both are clearly necessary.

Slaney et al. (2006) identified a total of 9,662 salmon stocks in BC and the Yukon, but assessments were possible for slightly more than half of these (including all large, commercially important stocks). Close to half (43%) of the stocks could not be classified due to the lack of reliable data. While these smaller stocks have little commercial value, they are important to the maintenance of salmon diversity. The lack of systematic, high-quality assessments at the biological stock level also precludes reliable identification of the specific causes for many of the stocks that appear to be at risk, although they express little doubt that over-harvest by commercial and recreational fisheries has in many cases resulted in severe stock depressions that, when added to other factors, has put many stocks at risk.

Sutton (2000) referred to the "large-scale management strategy" in which salmon management measures in Newfoundland tend to apply to "wide geographic areas within the province". He notes that "the current management system does nothing to recognize the value of the [local salmon] population for its unique ecological characteristics or the unique fishing experience it produces".

[9] For example, Stanley and Rice (2003) elaborated in some detail on the use of a "statistical short-cut" which yields incorrectly narrow confidence limits around biomass estimates. Fishers pointed to the much higher variation in abundance based on their knowledge. The procedure was further examined by scientists, found to be flawed, and the practice was abandoned for the stocks in question. However, the practice "results from the prohibitive expense of conducting replicates or extending the duration of surveys" and continues as a common practice in stock assessment in other fisheries (Stanley and Rice 2003).

> *Anglers' knowledge about the range and distribution of the population appeared to be much more extensive than the data collected over two summers of direct sampling. Whereas sampling over such a large area can be time-consuming, costly, and methodologically problematic due to the high spatial and temporal variability of natural systems… [Fishers' Knowledge] appears to integrate spatial and temporal patterns observed over numerous years…* (Sutton 2000).

He further notes that angler's knowledge could increase the efficiency and effectiveness of sampling programs, particularly of populations not studied previously. However, the cost of managing local stocks can be prohibitive. In an ongoing time of cutbacks in natural resource management, the innovation and time (and therefore financial resources) necessary to change management methods to more ecologically appropriate ones is daunting.

Appendix 2: Laws & policies driving current salmon management decisions

The management decisions made under function 2 in the generic framework (Figure 1.1) are driven by a collection of laws, regulations, treaties, policies and plans. Table A2.1 lists those currently enabling decisions related to the management of Pacific salmon and salmon habitat, and examines who leads the work, who participates, what decisions are made (relevant to salmon management), who makes the decisions, and whether there is an explicit requirement to consider TLEK or holders of this knowledge.

Table A2.1 Laws and policies that enable decisions relating to Pacific salmon management on Canada's west coast.

Instrument	Who leads the work	Who participates	Management decisions made under it , relevant to Pacific salmon and their habitat	Who[10] decides	Requirements for TLEK, or for consultation with T/L knowledge-holders?
LAWS, REGULATIONS, AGREEMENTS & TREATIES					
Fisheries Act	DFO Environment Canada (en-forcement of s 36)	-	- Designating Fisheries Officers - Issuing fishery leases and licenses - Whether obstructions require fish-ways and/or flow releases for fish passage - Whether to authorize work that may cause HADD to fish habitat or deposition of deleterious substances - Decisions related to inspection and enforcement	DFO DFO, EC	No mention of TEK or LEK in the Act. The only mention of consultation pertains to that with provincial governments.
Oceans Act	DFO	-	- Designating marine protected areas - Prescribing measures that may include zoning of marine protected areas or prohibition of activities within marine protected areas	DFO	"The Minister may conduct studies to obtain TEK for the purpose of understanding oceans and their living resources and ecosystems". States that the Minister may consult with affected aboriginal organizations and coastal communities to establish marine environmental quality guidelines, objectives and criteria respecting estuaries, coastal waters and marine waters for purpose of the implementation of integrated management plans, or any other aspects of the Oceans Mgmt Strategy (which includes Marine Protected Areas). Also calls for the development of an integrated management approach, including the establishment of community management boards to implement the Department's Oceans Management Strategy.

[10] Where a federal government department or provincial government ministry is listed, the decision rests with the Minister of that department or ministry.

Instrument	Who leads the work	Who participates	Management decisions made under it , relevant to Pacific salmon and their habitat	Who[10] decides	Requirements for TLEK, or for consultation with T/L knowledge-holders?
National Marine Conservation Areas Act	Parks Canada Agency	-	- Establishing marine conservation areas (MCA) or reserves - Zoning of these areas or reserves	DFO	It confirms the need to "consider traditional ecological knowledge in the planning and management of marine conservation areas". It also calls for consultation with affected coastal communities, aboriginal organizations, and aboriginal governments when designating or modifying an MCA or a management plan for an MCA.
Coastal Fisheries Protection Act	DFO	-	- Decisions related to foreign fishing vessel inspection and enforcement activities	DFO	No mention of TEK or LEK, or consultation, in the Act.
Pacific Salmon Treaty (PST)	Pacific Salmon Commission (PSC) (advisory role to each country)	- Area-specific Panels (no guidance on membership) - Technical Committees (no guidance on membership) - DFO (regulatory approval, implementation)	- Area, gear, and regional stock/species specific fishery opening and closure timing to meet Canadian fisheries TAC levels under the treaty. - Limits to net salmon catch in specific areas, for specific species (affects Total Allowable Catch DFO is managing in any given year)	DFO (provides regulatory approval)	Assumes Transboundary Panel will have knowledge of local economic, social, and cultural conditions and values and will use this to make & communicate recommendations to the Parties concerning enhancement projects; otherwise no mention of TLEK. Consultation is required among respective management entities regarding pre-season management planning and in-season responses to run assessments in the Yukon River. All other consultation requirements are among the Parties, and with the science and technical committees.
Species At Risk Act (SARA)	Environment Canada	- DFO, Parks Canada - Canadian Endangered Species Conservation Council (CESCC) (membership comprising federal and provincial gov't only) - National Aboriginal Council on SAR - Advisory committees - COSEWIC - Subcommittees to advise COSEWIC (including an aboriginal TK subcommittee) - Aboriginal organizations that will be directly affected by any Management Plan	- Listing of species - Ordering prohibitions to protect wildlife on provincial lands - Recovery Strategies, Action Plans, Mgmt Plans for species of special concern - Habitat protection standards/guidelines - Permits authorizing activities affecting a listed wildlife species - Where fishery openings and closures for commercial, sport, and FNs would be tailored to prevent capture of listed stock(s) - Issuance of special waivers to allow harvest	EC EC/DFO/ PC DFO	Calls for a National Aboriginal Council on SAR to advise the Minister and CESCC. Calls for considering community knowledge in developing and implementing recovery measures, and aboriginal TK in the assessment of which species may be at risk and in developing and implementing recovery measures. Calls for both in listing species and preparing Status Reports and Stewardship Action Plans. Qualification for COSEWIC membership includes community knowledge or aboriginal TK of the conservation of wildlife species, and COSEWIC must carry out its functions on the basis of the best available information on the biological status of a species, including scientific knowledge, community knowledge and aboriginal traditional knowledge. Also calls for an aboriginal TK subcommittee.

Instrument	Who leads the work	Who participates	Management decisions made under it , relevant to Pacific salmon and their habitat	Who[10] decides	Requirements for TLEK, or for consultation with T/L knowledge-holders?
B.C. Environmental Assessment Act	BC Environmental Assessment Office (EAO)	- Ministries with permitting responsibilities - Project proponent - First Nations, local government, ENGOs, stakeholders, public	- Whether to issue an environmental assessment certificate, and terms and conditions on the certificate	MOE & RA	No mention of TEK or LEK in the Act. Consultation with the public and first nations, and the means for doing so, must be included when the scope and procedures for an EA are determined (in the Section 11 order).
BC Water Act, Water Reg., Part 7	BC Ministry of Environment	-	- Whether to provide approval for changes in and about a stream - Terms and conditions on any such approval	MOE (WSD)	No mention of TEK or LEK, or consultation, in either the Regulation or the Act.
Fish Protection Act	BC Ministry of Environment	-	- Designation of sensitive streams for fish sustainability (or repealing a designation); and designation of a Water Management Area if a Water Management Plan is needed to address concerns about fish or fish habitat - Whether to develop a Recovery Plan - Whether to issue a temporary reduction order in cases of drought, or a streamflow protection license - Whether to issue licenses, approvals or amendments for projects likely to have insignificant impacts on fish and fish habitat	MOE Comp-troller or Reg. Water Mgr	No mention of TEK or LEK in the Act. Development of Water Management Plans for Water Management Areas must include a process for public consultation.
Fisheries Act (BC)	BC MOE	-	- Issuing aquaculture licences (including salmon farms)[11] - Permission for dams or hydraulic projects on freshwater streams and rivers	MOE	No mention of TEK or LEK in the Act, and no mention of consultation.
Forest and Range Practices Act (FRPA)	- BC Ministry Forests and Range - BC Ministry of Environment	-	- Make regulations prescribing objectives relating to water, fish, biodiversity; to identify and set objectives for sensitive watersheds or areas with significant fisheries values; and for riparian reserve zones and designating temperature sensitive streams - Approval of Forest Stewardship Plans (which must include objectives set by government)	MOFR, MOE MOFR	No mention of TEK or LEK in the Act, and no mention of relevant consultation.
Government Actions	Ministry responsible for	-	- Identify fisheries sensitive watersheds (FSW) - Designate a portion of a fish stream as a temperature	MOE	No mention of TEK or LEK in the Regulation. The only requirements for consultation are with

[11] This is expected to change based on a February 9, 2009 BC Supreme Court decision that the federal government, not the province, has exclusive jurisdiction over the management of salmon farming. (Alexandra Morton et al. vs the Ministry of Agriculture and Lands A.G. of British Columbia on behalf of BC and Marine Harvest Canada.)

Instrument	Who leads the work	Who participates	Management decisions made under it , relevant to Pacific salmon and their habitat	Who[10] decides	Requirements for TLEK, or for consultation with T/L knowledge-holders?
Regulation (under FRPA)	the Wildlife Act (MOE)		sensitive stream (TSS) (if adjacent trees are needed to manage water temperature for protection of fish)		organizations considered to be representative of holders of agreements under the Forest Act or the Range Act that may be affected by an order (including FSW or TSS designations).
Nisga'a Final Agreement	The Parties: - Nisga'a Nation - Government of British Columbia - Government of Canada	- Joint Fisheries Management Committee (JFMC) (comprised of 2 members from each of the Parties)	- Minimum escapement for Nass salmon - Whether to permit harvest of surplus salmon - Whether to allow enhancement initiatives	DFO	The Preamble includes the following: "WHEREAS the Parties acknowledge the ongoing importance to the Nisga'a Nation of the Simgigat and Sigidimhaanak (hereditary chiefs and matriarchs) continuing to tell their Adaawak (oral histories) relating to their Ango'oskw (family hunting, fishing, and gathering territories) in accordance with the Ayuuk (Nisga'a traditional laws and practices)".
			- Nass salmon allocation adjustments based on Nisga'a Account overages or underages - Adjustments to the species composition of the Nisga'a salmon harvest - Terms and conditions of surplus salmon harvest	Nisga'a Lisims Gov & DFO	
			- Distribution of the Nisga'a fish entitlements under this Agreement and Nisga'a fish allocations under the Harvest Agreement - License requirements under these agreements - Nisga'a Annual Fishing Plans	Nisga'a Lisims Gov	
			- Adjustments to Nisga'a Annual Fishing Plans	JFMC	
Umbrella Final Agreement	- Council for Yukon Indians - Government of Canada (INAC) - Government of the Yukon	- Renewable Resources Councils (for each YFN) - Fish and Wildlife Management Board (6 nominees of YFNs and 6 of Government; majority must be Yukon residents) - Salmon sub-committee of the Board (reps from YFNs, government, and the Yukon, Alsek and Porcupine River basins) - DFO (technical support) - Public involvement (in Board's development of recommendations and decisions)	- Allocation of salmon to users (amount by area) - The need for, and the content and timing of, salmon harvest or management plans - The need for or position on inter-jurisdictional agreements affecting the use of Yukon salmon resources - Management measures for commercial uses of salmon - Issuance of new additional commercial salmon fishing licences to FNs with traditional territory in the Yukon River basin (in the individual FN Final Agreements, for the Alsek and Porcupine basins) - Priorities and policies related to enforcement and on alternatives to penal sanctions	DFO (based on advice from the Salmon Sub-cttee)	One of the stated objectives of the Fish and Wildlife chapter is: "to integrate the relevant knowledge and experience both of Yukon Indian People and of the scientific communities in order to achieve conservation". Under the UFA, the Salmon Subcommittee may recommend that the Minister establish, modify or remove the TAC from time to time for salmon in a drainage basin "due to the inability of various salmon species and populations to meet sustainable yield requirements as determined by scientific research and surveys and the special knowledge of Yukon Indian People".

Instrument	Who leads the work	Who participates	Management decisions made under it , relevant to Pacific salmon and their habitat	Who[10] decides	Requirements for TLEK, or for consultation with T/L knowledge-holders?
Tsawwassen First Nation Final Agreement	- Tsawwassen FN - Government of Canada (INAC) - Gov. of BC	- Joint Fisheries Committee (represented by each of the 3 parities)	- Reduce one or more harvest allocations (set in the Agreement) in a year where quantity of the stock or species available for harvest is not sufficient to meet all food, social or ceremonial needs - Approval for TFN to conduct enhancement initiatives and stewardship activities in their territory	DFO	Requirements for taking aboriginal traditional knowledge or TEK into consideration are specified for Wildlife Harvest Plans, determining total allowable migratory bird harvests, and park management; nothing similar specified for decisions related to fish.
POLICIES & PLANS					
A Policy for Selective Fishing	DFO	- Harvesters and anglers of all fishing sectors	- Approve action plans for each fishery that best meet selective fishing standards - Determine need for adjustment of the plans based on evaluation of harvester and angler performance	DFO	DFO commits to "work with all fishing sectors to combine scientific knowledge and research with local and traditional knowledge to determine where and when stocks of concern are present and to develop fishing plans to avoid encounters with these stocks".
An Allocation Policy for Pacific Salmon	- DFO	- Pacific Licensing and Allocation Board	- Closing recreational fisheries for all salmon when conservation goals cannot be met - Setting recreational and commercial catch limits (or restricting access) according to abundance and allocation priority (conservation goals, FN needs, recreational and commercial fisheries) - Set annual coast-wide target allocations by gear type	DFO	The policy conveys some FNs concerns that arose during its development, but does not call for the use of TEK or LEK in actually implementing it. However, each year, the policy promises DFO will consult with FNs on their needs for food, social and ceremonial fish and matters that may affect their fishing and their preferred fishing methods. DFO "respects that fishing has a cultural component for First Nations." It recognizes that consultation with FNs will be required to implement the part of the policy related to the disposition of fish harvested in test fisheries where FN food, social and ceremonial fisheries are closed for conservation reasons; and that consultations and negotiations with FNs inside and outside the treaty process must continue on matters of salmon allocation, in response to FN concerns that the policy could affect the scope of treaty negotiations.
Integrated Fisheries Management Plans for Salmon (Northern and Southern B.C.)	DFO	- Salmon harvest management advisory boards (North and South) comprised of Area Harvest Committees - Commercial Salmon Advisory Board; Sport Fish Advisory Board; Integrated Harvest Planning Committee	- Pre-season: initial openings, escapement targets, exploitation ceilings, enforcement objectives - In-season: opening and closure of fisheries, level of effort deemed acceptable, gear type restrictions, deployment of special projects, level of appropriate enforcement, decisions to open Excess Salmon to Spawning,	DFO	The only mention of TEK is in a description of the AAROM program, specifically its focus on "developing affiliations between First Nations to work together at a broad watershed or ecosystem level – a level at which there is a certain number of common interests and where decisions and solutions can be based on integrated knowledge of several Aboriginal Communities".
Policy for the Management of	- DFO	-	- Negotiations with representatives of First Nations for mutually agreeable arrangements for Aboriginal fishing,	DFO and signatory	The policy states that "DFO shall consult with Aboriginal people before taking decisions or actions that may affect

Instrument	Who leads the work	Who participates	Management decisions made under it , relevant to Pacific salmon and their habitat	Who[10] decides	Requirements for TLEK, or for consultation with T/L knowledge-holders?
Aboriginal Fishing (PMAF)			such arrangements to be described in Aboriginal fishing agreements under the AFS - Where such agreement cannot be reached, provision of access to fish for food, social and ceremonial purpose through a Communal Licence, including conditions necessary to achieve conservation objectives, provide sufficient food fish for other First Nations, achieve health and safety objectives, or to achieve other substantial and compelling objectives	First Nations DFO	Aboriginal fishing for food, social or ceremonial purposes."
Comprehensive Fishing Agreements under PMAF	- DFO - Local First Nations	- Local First Nations	- Designating individuals to fish under allocations made to a First Nation - Monitoring and reporting to DFO on harvests - Participating in enforcement	Aboriginal Fishing Authority	
Watershed Framework Agreements under PMAF	- DFO - Local First Nations	- First Nations which share the Fraser and Skeena watersheds	- Fisheries management and enforcement activities on a watershed basis	DFO and signatory First Nations	
FNs –DFO Joint Fisheries Management Plans under Comprehensive Fishing Agreements	- Local First nations - DFO	- Local First Nations - Joint Fisheries Management Committee	- Whatever practices (e.g. licensing and enforcement) that are necessary to ensure viable fisheries	individual bands	No explicit requirements written in the 2008 St'at'imc Plan.

Appendix 3: Current salmon management functions and activities

Table A3.1 lists salmon management activities that DFO currently carries out, and identifies where they fit into the management functions under the framework described in Section 1. Insights and recommendations in Section 4 refer to these functions and activities.

Table A3.1 Current Pacific salmon management functions and activities.

BC program:	BC program areas:	Pacific salmon management activities (ongoing, not one-off):	Natural resource management function: [12] 1	2	3	4
Stock Management	Pre-season Planning	Stock forecasting for the coming season (estimating # of salmon that will return to spawning grounds each given year)	✓			
	Development of IFMP	Planning and consultation towards Integrated Fisheries Management Plans across stocks and harvest groups		✓	✓	
	In-season Management	Test fisheries, modelling, data collecting	✓			
		Assessment and adaptation of IFMP as needed	✓	✓	✓	✓
		Enforcement			✓	
	Post-season Review	Estimation of escapement, identification of Canada/US catch imbalance, determining impacts of water levels/temp on survival and whether escapement goals were met				✓
	Enhancement	Provision of controlled spawning, protected incubation, and, usually, rearing to fry or smolt size		✓	✓	✓
Habitat Management	Fish Habitat Conservation	Ensure compliance with statutes/regulations/policies			✓	
		Participate in resource planning & mgmt	✓	✓	✓	
		Research into habitat importance/value, impacts and mitigations	✓			
		Development of new policy or legislation		✓		
		Public consultation & awareness re new policy/legislation		✓		
		Monitor impacts				✓
	Fish Habitat Restoration	Initiate/promote habitat restoration projects (including fishways, barrier removal, and nutrient enrichment under the SEP)		✓	✓	
		Research into restoration methods	✓			
		Promote public awareness	✓	✓	✓	✓
		Monitor restoration success				✓
	Fish Habitat Development	Initiate/promote habitat development projects		✓	✓	
		Research into development methods	✓			✓
		Promote public awareness	✓	✓	✓	
		Monitor habitat development success				✓

Management function legend:

1	assessing the resource and management need
2	making management decisions
3	implementing management decisions
4	determining management success

[12] As per Figure 1.1, communication is an important 5th function that should occur as part of each of the other four functions.

Appendix 4: Some current Pacific salmon management shortcomings

The following shortcomings have been organized according to which objectives of the Wild Salmon Policy (WSP) the best fit under. This list is not exhaustive.

Shortcomings relevant to WSP Objective 1 – Genetic diversity[13]:

1. DFO management largely ignores small systems to focus on management of larger, more productive rivers (Nelson and Nicola 2005).
2. Poor monitoring and enforcement on smaller streams in favour of more concentrated enforcement and detailed monitoring on a few large commercial runs (e.g., Fraser, Skeena, Nass) (also applies to Objective 3)
    - Between 1985 and 1999 enumeration of smaller streams (i.e., counting salmon) declined by 47% and only 10% of streams on the north and central coasts of BC have good data from the last 50 years (Thompson and MacDuffee 2002 in Nelson and Nicola 2005).
3. Mixed-stock harvest strategy does not discriminate between weaker and stronger populations (Walters et al. 2008)
4. Hatcheries used for conservation purposes (as well as enhancement) have unknown effects on the genetic diversity of the runs they are intended to help

Shortcomings relevant to WSP Objective 2 – Habitat and ecosystem integrity:

1. Salmon are not currently managed in a way that considers their role and importance to the larger ecosystem/watershed (e.g., marine derived nitrogen, food for predators, etc.) (Nelson and Nicola 2005).
2. Insufficient enforcement and monitoring to ensure compliance with No Net Loss policy (Quigley and Harper 2006a; 2006b).
3. Compensatory projects are not successful in offsetting the losses of habitat (there is a continual decrease in habitat availability and quality) (Quigley and Harper 2006a; 2006b).
4. Lack of pre-impact data make it difficult to quantify the magnitude impacts on habitat (Fuller and Huntington 2006).
5. DFO's RMF does not provide cumulative effects assessment or intensity and frequency of HADDs. Low and medium risks are not adequately addressed, especially where these may be additive and result in cumulative harm (Fuller and Huntington 2006).
6. Multi-levels of government with split and contradictory mandates hinder DFO's ability to take an ecosystem approach to protect all facets of an ecosystem or watershed that are most often responsible for the creation and maintenance of habitat (Fuller and Huntington 2006).
7. The impacts of fishing on fish habitat are not applicable under the Fisheries Act (i.e., not considered a HADD). Act does not adequately address the issue of habitat destruction by fishing activities (e.g., bottom trawl) and there is no enforcement (Fuller and Huntington 2006).

[13] There is a growing awareness that past management of large fisheries and "stocks" has failed to adequately protect or recognize the value of diversity in Pacific salmon

Shortcomings relevant to WSP Objective 3 – Manage fisheries for sustainable[14] benefits:

1. Escapement targets have been consistently met in < 4% of monitored streams (n = 7 in 215) since 1950 (i.e., escapement targets have not been consistently met in 208 streams) (Price et al. 2008).
2. Aboriginal food, social and ceremonial needs as reflected in Fisheries and Oceans Policy[15] are not consistently met (C. Soto, pers. comm.)
3. An estimated 48% of salmon runs in management areas 3 to 10 are classified as being either "highly exploited" or of "conservation concern" (English et al. 2006).
4. Management relies heavily on stock assessment programs to guide decision making processes (How can stock assessment be improved or are what, if any, are viable alternatives / combinations?)
5. Monitoring efforts are consistently declining over time (PFRCC 2004); this may be a consequence of limited DFO resources
6. Salmon runs that have not historically met escapement targets are most likely to be dropped from monitoring efforts (Price et al. 2008).
    a. Consequence is an increasingly biased perspective of healthy salmon populations
7. Scale and extent of monitoring and stock assessment currently employed doesn't reflect the actual stock composition (e.g. conservation units outlined in the WSP starts to get at this)
8. Mixed-stock harvest strategy combined with non-existent monitoring efforts on smaller streams might lead to harvest management decisions that risk extirpation of small runs.
9. Salmon stock abundance for the majority of river systems has been declining for the past 20 years (Price et al. 2008).
10. Gear selectivity may alter the size structure of the population (e.g., smaller fish are able to run the gauntlet at the mouth of the river and bigger ones get caught – over time may cause a decrease in average body size as fish).

[14] Sustainable is defined as ecologically, socially, and economically sustainable

[15] Section 35 of the Canadian *Constitution Act 1982* recognizes Aboriginal Rights, which include a collective right to fish for "food, social, and ceremonial purposes." Furthermore, this "right to fish must be accorded first priority after conservation needs are met". This interpretation is based on a decision taken in May 1990 in which the Supreme Court of Canada ruled in the Sparrow Decision.

Appendix 5: How the chosen case studies align with the selection criteria

For the purposes of this table, "success" or "failure" was determined by a cursory review of the literature available on these case studies, and how the authors of this literature appeared to portray the example in terms of incorporating TLEK into natural resource management. This was cursory because the team was not yet at the stage of examining case studies in depth, but rather reviewing candidates for examination. The designation does not represent the opinion of the authors of this report. The contents of the more in-depth examination are presented in Appendix 6, and summarized in Section 3.

Table A5.1 How the chosen case studies align with the selection criteria.

	Relevance to WSP objective: *			Generic management function:[16] **				Other case study selection criteria (from ESSA's proposal, and the project initiation meeting):				
Case Study	1	2	3	1	2	3	4	Time-frame	Scale	Resource	Location	Success or failure?
Aquatic Management Board	✓	✓	✓	✓	✓	✓	✓	current	Regional	Salmon, goose barnacle	West Coast Van-couver. Island, BC	S
Co-management boards (BQCMB, GRRB)		✓		✓	✓	✓	✓	current	Regional	Caribou	Northern Canada	S & F
Copper River watershed	✓	✓	✓	✓	✓	✓		current	Regional	Salmon	Alaska	S
Endangered status assessments by COSEWIC for selected species	✓	✓		✓	✓			current	Regional	Eel, Atlantic & Pacific salmon	East Coast and BC	F

* Wild Salmon Policy (WSP) Objectives: 1 = safeguard genetic diversity of wild Pacific salmon; 2 = maintain habitat & ecosystem integrity; 3 = manage fisheries for sustainable benefits.

** Management functions (from Figure 1.1): 1 = assessing the resource, and the management need; 2 = making management decisions; 3 = implementing management decisions; 4 = determining management success.

Abbreviations: WSP = Wild Salmon Policy
COSEWIC = Committee on the Status of Endangered Wildlife in Canada
BQCMB = Beverly and Qamanirjuaq Caribou Management Board
GRRB = Gwich'in Renewable Resource Board

[16] As per Figure 1.1, communication is an important 5th function that should occur as part of each of the other four functions.

Appendix 6: Detailed case studies

PLEASE NOTE: The information for the following case studies came from the published literature as well as electronic resources. Where no written information was readily found, contact was attempted with key participants. In most case studies there were a few questions for which the answers could not readily be found. In addition, the reader should be aware that because of time constraints, **these case studies have not been reviewed by participants/groups involved**. Any errors, omissions or simplifications are unintentional.

This appendix provides the details behind the information summarized in Section 3. Table A6.1 lists a specific set of questions that was used to examine the case studies. The purpose of the questions was to keep the analysis focused, and to highlight information and lessons that would be most informative for the implementation strategy.

Table A6.1 Specific questions that guided the case study analyses.

Introduction/Background

- What is the resource being managed?

Ecological context

- Brief description of the life history and habitat characteristics of the resource being managed
- What is the geographic extent of the resource?

Socio-cultural context

- Who are the key participants/agencies/stakeholders that use the resource?
- What are the different values attributed to the resource?

Overview

- What is the resource issue or challenge that managers are trying to address, and what are the stresses on the system? What is the history – what conditions/circumstances gave rise to the management arrangements discussed in the case study?
- What are the overall management goals?
- What is the timeframe – when did the issue or challenge arise, when did the management arrangements take form, and are they still ongoing?
- What is the legislative/policy/regulatory context? Discuss those that strongly influenced the outcome.

Management system

- What is the management structure described in the case study? How/where do TLEK knowledge holders fit into this structure? Who are the key participants/agencies/stakeholders that make decisions?
- What decisions are made, and what is the decision-making process? What are the roles of different participants? Who is involved and in what capacity?
- What is the overall approach for ensuring the sustainable use of the resource? What are the management functions? How does TLEK fit into this approach?
- Does the scale of management relate to the ecology of the resource being managed? Are there clear boundaries/interception agreements?
- How are conflicts and challenges dealt with? Are local/traditional practices/customs used?
- What are the mechanisms of accountability? Are local/traditional practices/customs used?

Barriers and opportunities for the use of TLEK

- Was TLEK used, and if so, how?
- What were the barriers and opportunities specific to the case study?
- How do local / aboriginal participants perceive the management arrangement, and management success?
- Was capacity an issue, and if so, how was this addressed?

Lessons learned

- What principles, observations, ideas and lessons are transferable to Pacific salmon management?
- What worked, and what didn't work, and why?

A6.1 West Coast Vancouver Island Aquatic Management Board

A6.1.1 Introduction/Background

What is the resource being managed?

The Board is responsible for aquatic ecosystems and their uses in the West Coast of Vancouver Island, British Columbia (e.g., salmon, goose barnacles, sea otters, aquaculture, rockfish, etc.).

Ecological Context

Brief description of the life history and habitat characteristics of the resource being managed

Multiple species and habitats are considered as part of the AMB's management plan (e.g., goose barnacles (*Pollicipes polymerus*), salmon, groundfish).

What is the geographic extent of the resource?

The management area corresponds with Nuu-chah-nulth 'Ha-houlthee' (house territories), which collectively extends seaward from Cape Cook on Brooks Peninsula to Solander Island, to the international boundary along the entrance to Juan de Fuca Straits, then true north to Sheringham Point (Figure A6.1.1) (AMB 2009). Inland boundaries generally follow the height of land along watersheds dividing Vancouver Island. The offshore boundary of the management area is not specified.

Socio-cultural Context

Who are the key users of the resource?

Resource users include aboriginal communities as well as, recreational, commercial, aquaculture, major processors, tourism, labour, and environmental sectors.

What are the different values attributed to the resource?

All AMB members have adopted the principle that aquatic resources should be managed on an ecosystem basis, which is consistent with the principles of Hishukish Ts'awalk (everything is one) and Isaak (respect).

Overview

What is the history – what conditions/circumstances gave rise to the management arrangements discussed in the case study?

The concept of creating the Board was influenced by a growing pressure to consider different approaches to the management of aquatic resources. These pressures include:

- An increased demand from coastal communities, Province of British Columbia, and various public interest groups for an enhanced role in decision-making;
- The government need to establish more extensive, localized and integrated consultation and advisory processes as outlined in the Federal Oceans Act;
- The B.C. First Nations' desire to redevelop management processes with an enhanced First Nations jurisdictional role.

What are the overall management goals?

The goal of the AMB is to develop a sustainable and integrated approach to marine and coastal aquatic resource use, as called for in Canada's *Oceans Act* and Oceans Strategy. The goal of DFO is to establish a pilot Board to test the implementation of a community and area-based process, which would allow local communities to provide input and have an influence over aquatic management issues affecting the area (DFO 2008).

What is the timeframe – when did the issue or challenge arise, when did the management arrangements take form, and are they still ongoing?

The AMB was formed in 2002 by multiple stakeholder groups to work together toward sustainable integrated aquatic management following eight years of activism in the West Coast Vancouver Island (WCVI) region.

What is the legislative/policy/regulatory context? Discuss those that strongly influenced the outcome.

In 1998, Fisheries and Oceans Canada released "A New Direction for Canada's Pacific Salmon Fisheries". Principle 11 states that, "Government and stakeholders will together be responsible and accountable for sustainable fisheries". Principle 12 states that "Enhanced community, regional and sector wide input to decision making will be pursued through a structured management and advisory board system". The explanation of this principle states, "In the future, many decisions related to fisheries resources and their habitat could be made through a series of regional boards. These boards could cover a geographic area containing one or more watersheds. The scope of these boards is intended to cover a variety of issues."

Additional factors (AMB 2009):

- Marine Protected Areas: A Strategy for Canada's Pacific Coast (a Joint Federal and Provincial Initiative), 1998, states, "The federal and provincial governments will work in partnership with First Nations, coastal communities, marine stakeholders and the public on Marine Protected Area identification, establishment and management."
- *Oceans Act* (specifically Section 31 of Part II) calls for the development of an integrated management approach, including the establishment of community management boards to implement the Department's Oceans Management Strategy.
- The Nuu-chah-nulth principle of Hishukish Ts'awalk and Supreme Court 'we're all here to stay' comment were also influential (Nigel Haggan, pers. comm.).

A6.2.2 Management System

Who are the key decision-makers?

The AMB (a co-management board) is comprised of eight governmental members (two representatives from each of the Federal, Provincial, Nuu-chah-nulth and local governments) and eight non-governmental members broadly representative of commercial, recreational and aboriginal harvesting, processing, tourism, environmental, labour and aquaculture interests (AMB 2009). The Board is supported by management committees addressing specific aquatic management issues.

Board members are not selected to represent individual organizations or groups. Instead, they are chosen on the basis of: commitment to the Board's vision, purpose, principles and objectives; skills, knowledge and experience relating to aquatic management issues in the management area; and base of support.

What are the roles of different participants?

Government (aboriginal, local, provincial, and federal) and representatives from local groups are all involved in the same capacity as Board members and decision-makers on issues under the purview of the AMB. This is demonstrative of "integrated management", defined as an ongoing and collaborative planning process that brings together interested stakeholders and regulators to reach general agreement on the best mix of conservation, sustainable use and economic development of marine areas for the benefit of all Canadians (Pinkerton et al. 2005).

AMB members are from a variety of interested groups, including: aboriginal and local members. All members are equal, i.e., no person's opinion is more important than another's.

How/where do TLEK knowledge holders fit into management?

The ABM acts as a culture broker promoting communication between parties with different values, perspectives, and world views. It has made a successful proposal to develop a CD and poster of Nuu-chah-nulth and English words and information about more than 25 sea creatures. This included diverse information and views on aquatic creatures and management on the AMB website

Representatives from the Nuu-chah-nulth communities on the AMB bring their communities' concerns to the Board, e.g., regarding the commercial herring harvest, ecosystem approaches, merging of scientific and local knowledge. The AMB also distributes material, e.g., a Back to Basics booklet that was handed out at board meeting, explaining Nuu-chahnulth perspective on resource issues.

Two of the key management principles of the AMB are:

1. *Hishukish Ts'awalk* and I*saak* – Aquatic resources should be managed on an ecosystem basis, which is consistent with the principles of Hishukish Ts'awalk (everything is one) and Isaak (respect); and
2. *Adaptive Management* – Aquatic resource management decision-makers should integrate relevant local knowledge, together with appropriate ecological, social, and economic information, with the goal of continual improvement.

What decisions are made, and what is the decision-making process?

Decisions are made through consensus. Where consensus decisions are not reached, members actively seek agreement on a statement describing the areas of disagreement, any lack of information or data that prevents such agreement and, where possible, a process for achieving agreement on such issues. Members who withhold agreement are responsible for explaining how their interests are adversely affected or how the proposed agreement fails to meet those interests (Diller 2001). The member withholding agreement must propose alternatives and the other members must consider how all interests may be met. If agreement is still not reached, the concerns of all members will be included in a written report to the appropriate statutory authority, or, in the case of a management committee, to the Board.

This pilot Board could be assigned responsibilities ranging from an enhanced advisory role to an increased involvement in decision-making processes.

The AMB manages the goose barnacle fishery – any decisions related to management are made by the AMB in consultation with professional staff who work closely with harvesters. It facilitates bottom-up rule-making by fishermen.

> Who is involved and in what capacity?

Representatives from government (aboriginal, local, provincial, and federal) and representatives from local groups are all involved in AMB decision-making

What products are being produced?

These include a Web-atlas; a language project focusing on sea creatures; goose barnacle harvest decisions; and mapping the distribution of weak salmon stocks and the threats to their habitat (AMB 2009).

What is the overall approach for ensuring the sustainable use of the resource?

Management that follows the principles of Hishukish Ts'awalk (everything is one) and Isaak (respect), coupled with informed decision making (with both science and TLEK) helps ensure sustainable management (AMB 2009).

> What are the management functions?

The AMB has multiple roles in management which fall into four categories (Pinkerton et al. 2005): (1) interactions among board members at board and committee meetings; (2) the activities of board staff and members on other (non-AMB meeting) occasions, bringing together disparate sectors and individuals in the region (and even outside the region) – both in their (formerly conflict-filled) interactions with one another and in their (formerly conflict-filled) interactions with governments; (3) the activities of staff and board members in creating new economic, ecological, and social procedures in the region of significant value to management; (4) the administrative and financial activities of staff related to specific projects of their own or of other parties.

> How does TLEK fit into this approach?

The AMB is founded on principles drawn from TLEK, and as such everything the board does takes into consideration the knowledge and perspectives of the people it represents.

Does the scale of management relate to the ecology of the resource being managed?

The AMB has a large geographic focus, therefore the opportunity for management at a scale relevant to particular aquatic resources does exist (e.g., goose barnacle fishery). The interactive map atlas project is an example of a central database/tool that could help facilitate coordination between areas in which a resource is located.

How are conflicts and challenges dealt with?

The second role of the AMB (from the functions question above) is to bring together disparate groups, sectors, individuals in the region. A discussion and learning forum allows multiple sectors to come together to voice general concerns, vent their frustrations, find commonalities, and debate issues, rather than allowing conflict to build outside (Pinkerton et al. 2005). It promotes information exchange and problem identification among sectors, provides a sounding board for possible development of solutions, offers educational input from outsiders who report on relevant activities, and offers support for cross-sectoral and cross-cultural understanding of the issues at technical, economic, and social levels.

The roles of the AMB taken together have a significant impact on resolving conflict in the region, building policy consensus in the region, improving communication between senior governments and regional actors, and building capacity and economic development in the region (Pinkerton et

al. 2005). Any attempt to measure the value of all these roles would have to start by estimating the cost and stress on public agencies and stakeholders of dealing with the conflicts that would be constantly festering and periodically erupting if the AMB did not exist (continuing the work of its predecessor, the Regional Aquatic Management Society). These costs have been avoided in the WCVI region, while they surface in other areas of the coast as opposition to treaty-making, sport versus commercial conflict, opposition of many parties to aquaculture development, and environmental vs. commercial conflict (Pinkerton et al. 2005). No other process has attempted to bring this diversity and complexity of conflicts under one umbrella.

> Are local/traditional practices/customs used?

The principles of Hishukish Ts'awalk and Isaak are / were influential / inspirational in maintaining good relations at Board level (Haggan, UBC Fisheries Center, pers. comm.).

What are the mechanisms of accountability?

Board members are accountable to those groups/governments they represent, as well as to the community at large. [Additional information on mechanisms of accountability not readily found.]

A6.1.3 Challenges and Opportunities for the Use of TLEK

Was TLEK used, and if so, how?

TLEK is used in the management of the goose barnacle fishery (Lessard et al. 2003). The AMB developed a management regime that harvesters consider legitimate and effective. AMB staff worked closely with harvesters to record and include their knowledge and gain their cooperation in the generation of harvest rules.

The Nuu-chah-nulth co-chair of AMB believes that individual tribes will want some of their use and occupancy research added to the web atlas housing all data and resources for WCVI to support agency decision making and integration (AMB 2009).

A draft Wild Salmon Strategy was compiled by scientific experts in wild salmon recovery and renewal, and included the insight and traditional wisdom from WCVI First Nations (AMB 2009). The document summarizes the current issues with wild salmon stocks on the West Coast of Vancouver Island, makes suggestions about actions for change, and identifies priorities for stronger habitat protection, changes to hatchery production, and need for a review of salmon harvest plans.

A non-profit consulting service was also developed. It utilized people with local knowledge and providing mentoring opportunities.

What were the barriers and opportunities specific to the case study?

A major challenge of the AMB has been reaching agreement on one or two major strategies for approaching integrated management in it next phase (a difficult task considering the diversity of participants). Challenge is partly because the AMB doesn't know who exactly is listening to its advice, and therefore, how it might set its priorities and make the greatest impact with its suggestions. The AMB could more easily identify a major strategy if senior government informed them about what kind of advice they are seeking from the AMB (Pinkerton et al. 2005). This is complicated by the fact that not all four governments are informed of the AMB's activities.

The AMB is excluded from several government processes (e.g., consultation under SARA and the Wild Salmon Policy) suggesting lack of understanding by governments of the services that the AMB can provide (Pinkerton et al. 2005). The AMB is perceived as another stakeholder group

instead of as a co-management board that is capable of serving many functions. However, the AMB is often overlooked even in this stakeholder capacity (Pinkerton et al. 2005). Considering the financial and human investments governments have made into the AMB, it's surprising that the AMB is not being used to full potential.

DFO has acknowledged the possibility of the AMB's participation in the management of salmon enhancement facilities as a means to implement the Wild Salmon Policy. DFO has been reluctant to allow the AMB to become involved in aquatic species connected to coast-wide issues (Pinkerton et al. 2005). Many AMB members feel frustrated and blocked in addressing their mandate to do integrated management. Slow progress is being made, however several members of the AMB are sceptical about the level of government interest in and support of AMB activities, consequently they're not rigorous in their own attendance (Pinkerton et al. 2005).

Was capacity an issue, and if so, how was this addressed?

Capacity is an issue with respect to intermittent and lower levels of core support funding than originally agreed upon, making it difficult to maintain programmatic focus. The AMB is forced to direct a major amount of energy towards fundraising. The executive director is stretched too thin, also acting as project manager and fundraiser.

A6.1.4 Lessons Learned

What principles, observations, ideas and lessons are transferable to Pacific salmon management?

- In situations where agreement cannot be reached, efforts of participants can still richly inform the decision-making process by clearly defining problems, narrowing the scope of issues, and identifying a range of possible alternatives for resolution (Diller 2001).
- The process of building relationships through the collective helped to increase capacity among board members to better deal with future issues and reduce conflict between user groups (Diller 2001).

Figure A6.1.1 The AMB management area on the West Coast of Vancouver Island (dark grey). Source: AMB (2009).

A6.2 Northern Co-management Boards

In this section, the abbreviation "BQCMB" is used to refer to the Beverly and Qamanirjuaq Caribou Management Board, and the abbreviation "GRRB" is used to refer to the Gwich'in Renewable Resource Board. While the original intention was to also include the Nunavut Wildlife Management Board in this case study, time constraints required limiting the examination to just the BQCMB and the GRRB.

A6.2.1 Introduction/Background

What is the resource being managed?

The BQCMB is focused on the great Barren Ground caribou herds. The GRRB addresses all natural resources within the Gwich'in Settlement Area (e.g., moose (*Alces alces*), caribou, grizzly bears (*Ursus arctos horriblis*), whitefish (*Coregonus nasus*), char (*Salvelinus malma*)).

Ecological Context

Brief description of the life history and habitat characteristics of the resource being managed

The Beverly and Qamanirjuaq caribou herds migrates northward each spring to the calving grounds, and then travels back toward the more southerly winter range in July. Every year caribou return to the same general area for calving, although not to the same specific location. Consequently, the herd's traditional calving grounds (the total area known to be used for calving over many years) are much larger than the area used in any particular year.

GRRB: [Information not readily available]

What is the geographic extent of the resource?

The BQCMB covers the Northwest Territories, Nunavut, northern Saskatchewan, and northern Manitoba which is coincides with the geographic area used by two caribou (*Rangifer tarandus*) herds (Figure A6.2.1). The Beverly herd's range straddles Saskatchewan/NWT, with portions in Nunavut, Manitoba and Alberta (the range stretches at least 600 kilometres from west to east, from Great Slave Lake, NWT to east of Dubawnt Lake, Nunavut; and from Slave River in Alberta, across northern Saskatchewan, to near Nueltin Lake, Manitoba). The Qamanirjuaq herd's range straddles Manitoba/Nunavut, with portions in southeastern NWT and northeastern Saskatchewan.

GRRB: The Gwich'in land claim agreement covers approximately 56,935 square kilometres and includes the communities of Aklavik, Fort McPherson, Inuvik and Tsiigehtchic. The settlement area follows the Arctic Red River and includes a portion of the MacKenzie River Delta (Figure A6.2.2).

Socio-cultural Context

Who are the key participants/agencies/stakeholders that use the resource?

BQCMB: Traditional user groups of caribou are Dene and Metis of the South Slave regions, the Dene in Northern Saskatchewan, the Dene of Northern Manitoba, and the Inuit of the Southern Keewatin

GRRB: The Gwich'in people, Inuvialuit, and non-aboriginals.

What are the different values attributed to the resource?

The most important aspect of the Gwich'in, Dene, Metis, and Inuit relationship with the environment is one of respect. There is a commitment to a respectful way of governing, based on a world-view that balances respect for autonomy with recognition of universal interdependence.

Satellite collaring of caribou is an issue of contention in both GRRB and BQCMB process because some feel the practice is disrespectful and endangers the human-caribou relationship. Collaring denies the animals the right of choice and exhibits disrespectful notions of control and ownership

Overview

What is the resource issue or challenge that managers are trying to address, and what are the stresses on the system?

The BQCMB is dealing with dramatic declines in caribou abundance as a result of hunting and development pressures. The GRRB, established as part of the Gwich'in Comprehensive Land Claim agreement, was motivated by the Gwich'in's desire to achieve immediate improvements to the lives of their people.

What is the history – what conditions/circumstances gave rise to the management arrangements discussed in the case study?

Increasing development interest in the North, coupled with the recognition of First Nations' right to self-governance, has lead to the emergence of various co-management agreements over the past decade as potential solutions to stakeholder conflict.

BQCMB: There was a caribou crisis during the 1950's during which aerial surveys "confirmed" long-held suspicions regarding severe depletion of the great Barren Ground caribou herds because of over-hunting by Inuit and Dene (Usher 2004). Biologists could only afford to fly over part of the extensive area used by the caribou when they attempted their surveys; therefore population estimates were based on the faulty assumption that population densities in un-surveyed parts were similar to those in surveyed parts. Inuit and Dene views on the matter were neither sought nor accounted for in the decisions made by provincial and territorial governments (Usher 2004). At the time the Dene and Inuit strongly disagreed with the census results. Biologist countered with claims that they didn't believe the local communities.

This crisis provided justification for imposing hunting restrictions, as well as relocation, movement restriction and supervision of both Dene and Inuit who lived on or near the range of Quamanirjuaq, Beverly, and Bathurst caribou herds, and for whom these herds were the only staple food and source of clothing. Scientific management of caribou became an integral part of a broad program of social engineering that required consensus and cooperation among various federal, provincial, and territorial agencies.

In 1979, a long-standing Administrative Committee on Caribou Conservation was re-activated as the Caribou Management Group. The vastness of the task led the committee to conclude that they could not succeed in management without involving Indigenous user groups (Usher 2004). In 1982, after assurance from government that participation in a government board would not affect treaty negotiations/rights, Dene, Metis, and Inuit agreed to join and the BQCMB was formed.

GRRB: The GRRB was established under the guidance of the *Gwich'in Comprehensive Land Claim Agreement (GCLCA)* to be the main instrument of wildlife, fish and forest management in the Gwich'in Settlement Area.

What are the overall management goals?

BQCMB: There were three goals: to coordinate management of the Beverly and Kaminuriak herds in the interest of traditional users and their descendants, to establish a process of shared responsibility for the development of management programs, and to establish communications amongst traditional users and between traditional users and the Board member organisations to ensure coordinated caribou conservation and caribou habitat protection.

GRRB: To conserve and manage renewable resources within the Gwich'in Settlement Area in a sustainable manner to meet the needs of the public today and in the future.

What is the timeframe – when did the issue or challenge arise, when did the management arrangements take form, and are they still ongoing?

For the BQCMB, the challenges arose in the 1950s, and the BQCMB was formed in 1982.

The GRRB has been in operation since 1994.

What is the legislative/policy/regulatory context? Discuss those that strongly influenced the outcome.

GRRB: Land-claim-based negotiations lead to the formation of the GRRB, therefore the GRRB operates within a land claim agreement.

A6.2.2 Management System

What is the management structure described in the case study?

The BQCMB consists of 13 members. Nine are representatives from the caribou user community and four are from government departments (Manitoba Ministry of Natural Resources, Saskatchewan Ministry of Parks and Renewable Resources, Northwest Territories Ministry of Renewable Resources, and Nunavut's Minister of Sustainable Development). Membership on the Board is by appointment. In theory, user representatives can be chosen by their communities, however government does not seem to encourage community knowledge of this. For example, a study in 2001 found that only one community was aware of this and all other communities were under the impression that government appointed their representatives (Spak 2001).

Seven of 13 members of the GRRB are from the Gwich'in Nation. The GRRB also has a support staff (a total of 12, which includes biologists and a traditional knowledge specialist) who are directly responsible to the Board and therefore deal only with Board priorities, not government driven priorities. The GRRB works with a Renewable Resource Council (RRC) from each of the Gwich'in communities. The GRRB is mandated to work with RRCs, and therefore is in frequent contact with the communities it represents through the RRCs. This structure allows communities to have active participation in shaping the GRRB agenda. Since its inception, the GRRB has funded several large scale knowledge projects in an attempt to document the knowledge within its communities.

< How/where do TLEK knowledge holders fit into this structure?

The BQCMB has nine representatives from the caribou user community. One of the Board's policies is to heavily rely on the traditional knowledge of user constituents. However, the Board lacks any formal mechanisms through which local issues/concerns can be raised.

Within the GRRB, the role of the Renewable Resource Council is to encourage and promote local involvement in conservation, harvesting studies, research and wildlife management in the local community (GRRB 2009).

Who are the key participants/agencies/stakeholders that make decisions?

The BQCMB is entirely advisory in nature. The Boards advice is (with the exception of specific habitat protection issues) generally acted upon by the resource ministries of Manitoba, Saskatchewan and the Northwest Territories. Governments follow recommendations of the BQCMB as long as they follow the beliefs and policies of government departments.

Participants in the GRRB are from the Gwich'in Nation, Fisheries and Oceans Canada, the Canadian Wildlife Service, and the Northwest Territories Ministry of Resources Wildlife and Economic Development (GRRB 2009).

> What are the roles of different participants?

BQCMB: Community representatives are at a disadvantage relative to government representatives because the latter are career bureaucrats familiar with resource policy and legislation.

What decisions are made, and what is the decision-making process?

BQCMB: The Board does not make any decisions. They put forth recommendations on what topics should be researched and areas protected, among other things.

GRRB: Decisions from the Board and drafts of proposed new regulations are forwarded to the Minister who has 60 days to review the new regulations and make changes if he/she deems necessary. If changes are made, the Minister must send the proposed changes back to the Board with a written explanation. The Board than has 30 days to accept or reject the changes and send their final decision back to the Minister. At this point, the Minister does have the authority to overrule the Board if there is still disagreement, but only if there is good reason. As of 2001, the Minister has never interfered in the Board's decisions.

What is the overall approach for ensuring the sustainable use of the resource?

BQCMB: Western science-driven population estimates are used to set harvest limits.

GRRB: A combination of TLEK and western science is used to inform management decisions. Enforcement and compliance are discussed to ensure that resource decisions are followed. The Board tries to encourage voluntary compliance rather than using regulatory mechanisms.

> What are the management functions?

BQCMB: The Board is involved in assessing the resource. There is the potential to be involved in other management functions, but this is currently not being done.

GRRB: The Board makes resource-management rules, plans and decisions, and decides what resources to monitor and which specific research questions to pursue. The Board deals with how their decisions should be enforced (e.g., regulation, voluntary adherence, etc.) and they enforce the decisions made with the assistance of the RRCs. The Board also takes an active role of communicating their work through the RRCs and newsletters, as well as offering opportunities for capacity building (e.g., scholarships and education).

> How does TLEK fit into this approach?

BQCMB: TLEK hasn't been used effectively thus far, nor does it fit in with this approach.

GRRB: The Board has a full-time traditional knowledge coordinator. In addition, significant amounts of capital have been invested in the Gwich'in Environmental Knowledge Projects during

first two years of its operation. One of the top priorities for the knowledge coordinator is to consider ways in which the collected TEK could be returned to the communities in a more useable form.

All research projects directed by the GRRB are reviewed to ensure that they consider and include TEK. Biologists there have the philosophy that including people and asking them about their experience, knowledge, and understanding of wildlife is just common-sense. They only formalise it and call it TEK for funding purposes.

Does the scale of management relate to the ecology of the resource being managed?

BQCMB: The Board has representatives from each geographical jurisdiction in which the Beverly and Qamanirjuaq caribou heard is found.

> Are there clear boundaries/interception agreements?

BQCMB: The boundaries are clear, although there is some disagreement between the Dene and Nunavut because some of the Dene's traditional territory is in Nunavut. How this may affect caribou status and migration patterns as a consequence of resource development in Nunavut is a point of concern for the Dene.

GRRB: The boundaries of the Gwich'in settlement area are very clear.

How are conflicts and challenges dealt with?

BQCMB: The Board does have mechanisms in place for communities in one jurisdiction (e.g., Manitoba) to raise concerns about activities in another jurisdiction (e.g., NWT) (Kendrick 2003).

GRRB: Approval of Board meeting agendaa includes statements regarding potential conflict of interest that any Board member might have concerning specific agenda items. This demonstrates transparency of Board members to the community. In addition, community meetings (RRC and community members) are held with greater frequency when conflicts over use are brewing. The intention is to keep holding discussions until the issue is resolved.

> Are local/traditional practices/customs used?

None were identified in the materials reviewed for this case study.

What are the mechanisms of accountability?

BQCMB: No mechanisms to hold the BQCMB accountable to communities they represent were identified in the materials reviewed for this case study.

GRRB: The Board works for and is accountable to the communities, not to the federal and/or territorial governments (GRRB 2009).

> Are local/traditional practices/customs used?

None were identified in the materials reviewed for this case study.

A6.2.3 Challenges and Opportunities for the Use of TLEK

Was TLEK used, and if so, how?

BQCMB: Nine of the 13 members are from the caribou-user community. Since 1996, the Board has considered the use of a small section of geographical TEK in their habitat project, but only

because there are too many field data gaps in the present maps. Currently, there is increased pressure on the Board from outside forces to make attempts towards using TEK.

GRRB: Seven of the 13 seats are for the Gwich'in Nation (GRRB 2009). The GRRB also has a support staff (including a TEK specialist) directly responsible to the Board and therefore deal only with Board priorities. The GRRB works with a Renewable Resource Council (RRC) from each of the Gwich'in communities. GRRB is mandated to work with RRCs, and therefore is in frequent contact with the communities it represents through the RRCs. This structure allows communities to have active participation in shaping the GRRB agenda. Since its inception GRRB has funded several large scale knowledge projects in an attempt to document the knowledge within its communities.

What were the barriers and opportunities specific to the case study?

BQCMB: The Board was intended to rely heavily on the traditional knowledge of user constituents. In practice, budget cutbacks and the structure of meetings have left little room on the agenda for TEK during meetings. As a result, community members don't feel the Board has much relevance to the issues they are concerned with. The term "co-management" is misleading because it gives the impression that there was equal control over the Board's affairs by government and First Nation, i.e., the term co-management is highly negotiable and does not have a narrow definition (Cruikshank 2004). In fact, the BQCMB is a government-controlled organisation.

From its inception the BQCMB approach to caribou conservation followed Western scientific models as based on Euro-Canadian principles and ideas. Population estimates still form the basic tool employed by biologists when creating their management plans (Spak 2001). Many Dene are frustrated with what they see as biologists' obsession with numbers. Hunters involved in the census methods are especially critical of the practice of extrapolating the sample to the entire range. They don't buy into the estimates.

The Board operates in English. Fluency in English a requirement for participation and is a prerequisite for representatives. This excludes elders from participating. It will be difficult for the Board to achieve its adopted policy of relying heavily on TLEK for management if it continues to use English as its sole language even though the primary knowledge holders do not speak English.

The BQCMB currently operates in a manner where government biologists are only educators and administrators, not learners. Dene decisions are traditionally based on consensus rather than being imposed by one individual, which puts the community representatives in a difficult position because they are uncomfortable speaking on behalf of the whole community.

GRRB: The Board was negotiated as part of a land-claim agreement. Land-claim negotiations provided the opportunity to establish a Board with authority to make resource management decisions. This gives the Board greater autonomy to operate within a context that it has defined. The land-claim context created the necessary political incentive structure for the Board (e.g., biologists work for the Board, not for other government ministries) and it also established resource administration with decision-making power.

The GRRB operates in a geographic and political region where Gwich'in constitute the majority and their interests play an important role. The reasonable geographic proximity of communities to each other, the existence of RRCs in each community, and the fact that everyone on the Board lives in the area has allowed strong relationships to form, instilling a sense of trust and willingness to work together.

How do local and aboriginal participants perceive the management arrangement, and management success?

BQCMB: Many members in the Dene community either do not know much about the BQCMB or consider it to be just another government organisation from the South controlling their resources. There are strong feelings of dissociation and distrust among the Dene towards the Board. There is a perception by some Dene that the Board serves Nunavut, not the Dene. This is in part fuelled by the fact that Nunavut's southwestern border co-opted traditional Dene territory as part of Nunavut. Poor communication and misunderstanding between community representatives and their communities exacerbates the problem of dissociation. There is also a perception that the BQCMB not really interested in TEK because they (elders) are never really consulted, and when they are consulted, are they are suspicious about the reasons because of the rarity with which it happens.

Was capacity an issue, and if so, how was this addressed?

BQCMB: Due to budget cuts, the Board now meets only twice a year and alternates between meeting in caribou-user communities and cities such as Thompson or Winnipeg. This decrease in the frequency of meetings has resulted in agendas being overloaded with government concerns, leaving little time for user concerns. A by-product of this is that it increases government control of the process even though they only have 4 of the 13 seats on the Board.

Budget cuts have also resulted in decreased distribution and frequency of "Caribou News" (a newsletter sent free of charge to user residents within the caribou range containing articles translated in English, Dene, and Inuktitut). Caribou News is only published twice a year in a condensed format to the Band Office. Because of limited or non-existent internet access few people are now able to keep informed of the Board's activities. Many are under the impression that the newsletter has stopped being published because they no longer receive it.

Limited funding is cited as the reason the Board is unable to operate in multiple languages.

GRRB: The board appears to be well funded and has internal capacity (12 support staff) to carry out its mission. It receives funding from the territorial and federal governments, but is also very active in seeking out alternative funding from different granting agencies.

A6.2.4 Lessons Learned

What principles, observations, ideas and lessons are transferable to Pacific salmon management?

- Simply having participation by government, First Nations, and local groups in a process does not ensure successful co-management (Spak 2001). Boards need to consider and implement the organisational requirements that will allow them to draw from the differing types of knowledge in their operations (e.g., need to hold meetings in language of those from whom you are trying to get information)
- If the style, language, and format of interactions of a management board are those most familiar to government, than the process only serves as a forum through which the government tells the people what to do.
- The use of bureaucratic language and technical jargon hinders participation of community members. They remain silent, and silence is in turn interpreted as agreement by government. Even the term "salmon management" indicates a Western-style approach.
- Users need to be able to share what they feel is important in an environment that does not make them feel as though their contributions are not valuable.

- Bodies which are advisory in nature, with no real control over the resources they are trying to manage, can only hope to implement policies/recommendations that align themselves with the ministries views. Lack of control inspires little confidence in participants and will result in minimal buy-in.
- Strong personal relationships between biologists and knowledge-holders greatly facilitate the transfer and understanding of knowledge
- There is a need for strong links between communities and the Board. It is not enough to only have one representative for each community – it becomes too big of a job for one person to handle. Community representation by a group of individuals is preferable.
- Biologists/scientists need to be accountable to the Board (employed by the Board). Otherwise they are not necessarily free to give unbiased advice and may not be open to issues of interest to the communities. If their employers are federal, provincial or territorial governments, these will be the interests and concerns they are most likely to serve.
- Government biologists need to be learners. This means they need to be able to listen and learn from the elders and not assume they have all the answers.
- Decision-making processes need to consider the different socio-cultural backgrounds of participants. For example, community representatives were often not comfortable making decisions "here and now" without being able to consult with their community first.
- There is a need to ensure that perception of and use of TLEK by management isn't to just fill gaps (the attitude that "there isn't anything else around so we might as well use it"). There needs to be buy-in on both sides.
- Forging broad alliances can potentially result in leaders becoming disengaged from local issues (Cruikshank 2004). Forming clear management boundaries and continually reinforcing channels of communication between leaders and communities helps to keep leaders focused locally.

What worked, and what didn't work, and why?

BQCMB:

- The format and location of public meetings strongly determines the extent of public participation. For example, one of the bi-annual BQCMB meetings held in a small community did not take place in the band hall, which sent the message that the meeting was not open to the public. In addition the format was not conducive to making community members feel included. It was a "white-style" meeting (Spak 2001). Meeting style needs to be catered toward the people that have the knowledge so that they feel comfortable.
- Because the Board does not have any actual power, it is likely to actualy implement only those recommendations which align with government views.
- The Board's recommendations to government are sometimes incorrectly interpreted as being representative of all communities and therefore requiring little further consultation (Kendrick 2003).

GRRB:

- Although the wording in the Gwich'in Comprehensive land-claim agreement still reflects Western terminology, the fact that communities are represented through a council of concerned community-appointed Gwich'in rather than only though a Board representative makes a large difference.

- Dedicated support staff makes it possible for the Board to function. They don't have capacity shortfalls which are common to other Boards.
- The Board actually has the power to establish policies and propose regulations for the Gwich'in settlement area.
- A large portion of Board meetings are devoted to information items that update the RRCs and the communities on the Board's activities, upcoming workshops, courses, conferences, financial statements, funding sources (current and prospective) and research projects.
- The language barriers between government and elders don't exist – they all speak English. However, the GRRB makes a conscious effort to keep bureaucratic and technical language to a minimum. Board members are given special training to make sure they can communicate effectively with community members.

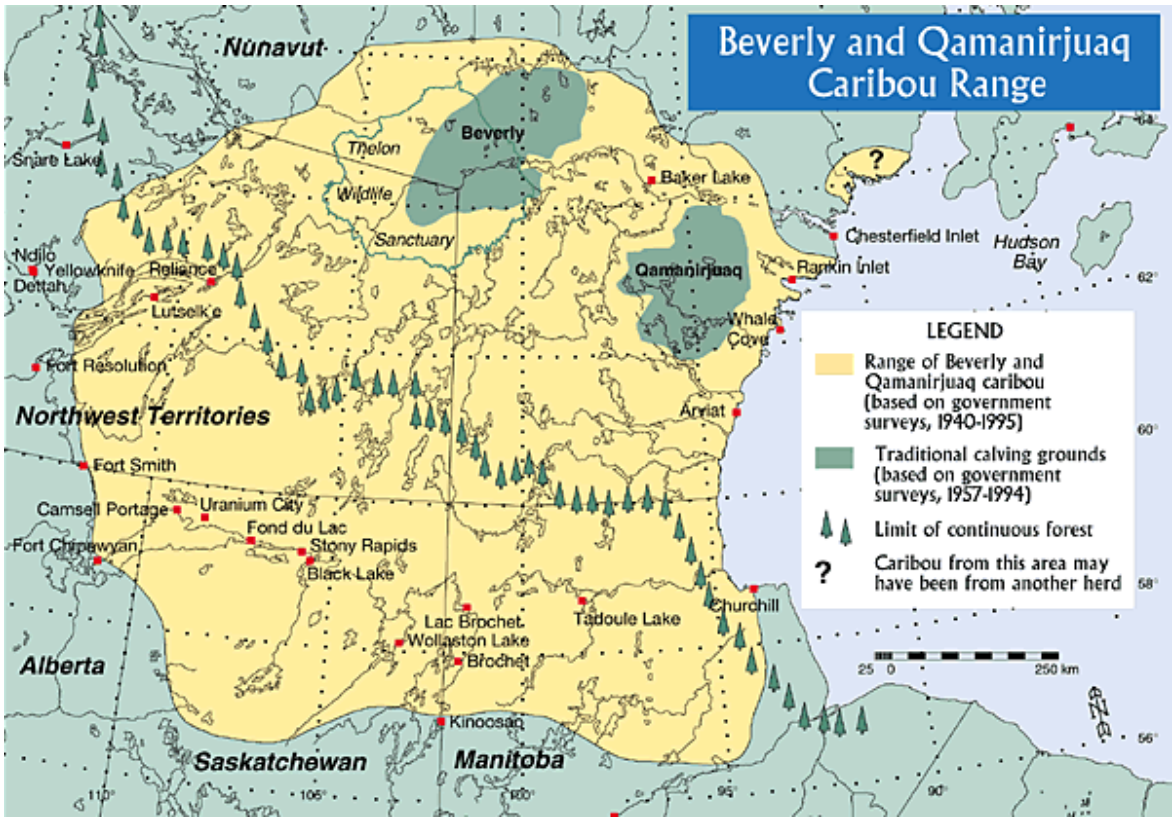

Figure A6.2.1 The distribution of the Beverly and Qamanirjuaq caribou herd. (Source: http://www.arctic-caribou.com/aboutcaribou.html)

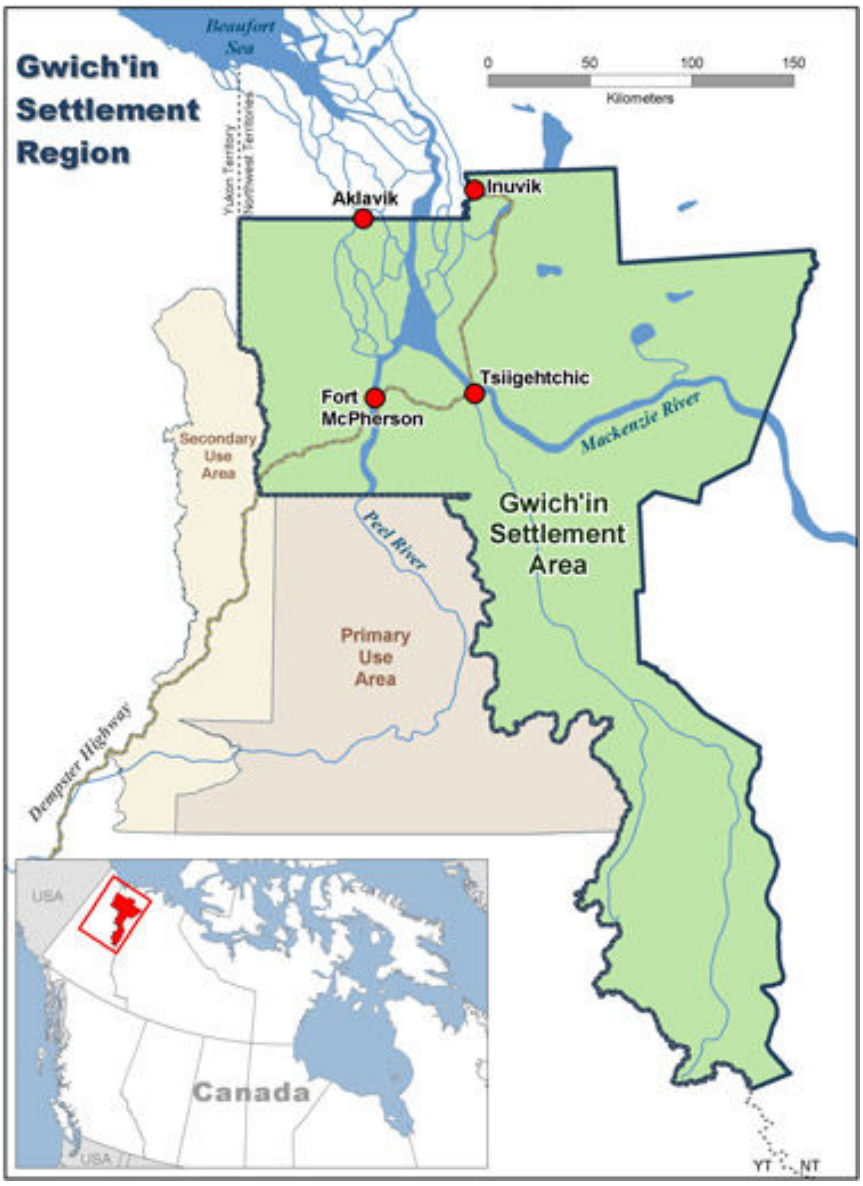

Figure A6.2.2 The Gwich'in settlement region and the area managed by the GRRB.

A6.3 Copper River Watershed Management

A6.3.1 Introduction/Background

What is the resource being managed?

Management in the watershed is being approached from a holistic perspective that takes into account the effects of forestry, mining, and oil and gas developments on salmon, among other flora and fauna.

Ecological Context

Brief description of the life history and habitat characteristics of the resource being managed.

The Copper River Watershed (CRW) is famous for its prolific salmon runs which can have upwards of 2 million salmon each year. Chinook salmon are present in the river mid-May to mid-June, sockeye salmon mid-May to mid-August, and coho salmon mid-August to late-September.

What is the geographic extent of the resource?

Located in South-central Alaska, the Copper River is roughly 300 miles long (480 km) in a watershed over 23,000 square miles. Prior to spawning, salmon that return to the Copper are found in the North Pacific Ocean prior to returning.

Socio-cultural Context

Who are the key participants/agencies/stakeholders that use the resource?

First Nations (i.e., Ahtna and Eyak), commercial and recreational fishermen use the resource.

What are the different values attributed to the resource?

The Ahtna believe that all things have a measure of *engii* or power and if not treated with the proper consideration, the power or force inherent in the thing can disrupt the balance between humans and nature and create havoc. According to Ahtna elders, salmon have more engii than other animals or fish because they go down to the ocean and return to die. For this reason salmon must be treated with considerable deference or respect.

Overview

What is the resource issue or challenge that managers are trying to address, and what are the stresses on the system?

The watershed is under increasing pressures from resource extraction industries which threaten some of the more productive salmon runs in the Prince William Sound area. In addition, increasing population and recreational pressures are also being noted in the watershed (Lowe and Wilson 2007). There are indications that certain wild stocks of Chinook and sockeye salmon may have declined from historical levels (Simeone and Valentine 2007).

What is the history – what conditions/circumstances gave rise to the management arrangements discussed in the case study?

Since Statehood, the State of Alaska has constructed fishing regulations for the Copper River, thus defining seasons, open areas, seasonal harvest limits, gear types, and rules regarding who may participate in the fishery. They do this through Board of Fisheries meetings where public

testimony is taken and regulations are created. In 1963, the Alaska Board of Fisheries and Game adopted proposal No. 176 to limit subsistence salmon fishing to the main Copper River downstream from its confluence with the Slana River. The regulation, effective in 1964, closed all tributary streams of the Copper River and the main river above Slana to subsistence fishing.

What are the overall management goals?

The management goal of the Alaska Department of Fish and Game (ADF&G) is to conserve and develop the fishery resources of the state. Alaska Native Corporations have the goal of sustainable development for shareholders.

What is the legislative/policy/regulatory context? Discuss those that strongly influenced the outcome.

Salmon habitat management in the CRW today is largely guided by the legacy of four pieces of federal legislation designed to both protect public lands and provide lands for the State of Alaska as well as its Alaska Native residents: (1) the *Alaska Statehood Act* of 1958, (2) the *Alaska Native Claims Settlement Act* (ANCSA) of 1971, and how the mandates of these acts work in combination with those of, (3) the *Alaska National Interest Lands Conservation Act* (ANILCA) of 1980, and (4) the *Alaska Land Transfer Acceleration Act* of 2003.

Title VIII section 801 of the *Alaska National Interest Lands Conservation Act* (ANILCA) mandates that local people who have personal knowledge of local conditions be given a meaningful role in the management of fish and wildlife and subsistence use on public lands. Under section 812, the act also advises that agencies make use of special knowledge of local residents who are engaged in subsistence uses.

Beyond Alaska at the federal level, the 1996 provisions added to the Magnuson-Stevens Fishery Conservation and Management Act addressed concerns about the impact of habitat loss on the nation's fisheries; thereby identifying habitat conservation as a national responsibility (Lowe and Wilson 2007).

A6.3.2 Management System

What is the management structure described in the case study?

The resources of the Copper River Watershed are accessed by a variety of users and managed by diverse agencies representing the interests of the nation, the State of Alaska, and Alaska Native corporations. The two main Alaska Native corporations active in the Copper and who have land managers on staff with responsibility for managing corporation land in the Copper are the Ahtna, Inc. (regional corporation) and the Eyak Corporation (village corporation).

The federal government has responsibility for subsistence fisheries through ANICLA; Regional advisory councils exist to advise federal resource managers on subsistence issues. In addition, local advisory councils were created, made up of hunters and fishermen from satellite communities surrounding ANILCA lands such as the Wrangell-St. Elias National Park and Preserve.

Currently, the Copper River is divided into two sub-districts The first runs from the Slana River at the headwaters of the Copper River near the Wrangell Mountains downstream to the Chitina River Bridge just below the town of Chitina, and the second is the Chitina sub-district which runs from the Chitina River Bridge downstream to Haley Creek, just above Wood Canyon. The latter sub-district is only open to subsistence dip netting, whereas the former is open to subsistence on the mainstem and sport fishing in the tributaries.

> How/where do TLEK knowledge holders fit into this structure?

There is little formal recognition of TLEK in ADF&G management which gives little emphasis to social issues concentrating on top-down, quantitatively-oriented science (Simeone and Valentine 2007).

TLEK knowledge-holders may interact with management through the regional and local advisory councils set up under ANILCA. Local councils can present proposals to the federal board for adoption and this provides an opportunity for some Ahtna' hunters and fishermen from throughout the Copper River Basin to act in an advisory role. However, this limited involvement in the regulatory process has not given the Atna' any real power as a collective in decision making and resource allocation (Holen 2004).

Every three years there is a Board of Fisheries[17] meeting where the public can put forth suggestions for how the fishery should be managed. The Board of Fisheries uses the biological and socioeconomic information provided by the Alaska Department of Fish and Game, public comment received from people inside and outside of the state, and guidance from the Alaska Department of Public Safety and Alaska Department of Law when creating regulations that are sound and enforceable.

Who are the key participants/agencies/stakeholders that make decisions?

ADF&G (the Board of Fisheries is part of ADF&G). Constitutionally, the state cannot privilege any segment of its population: Alaska Native or non-Alaska Native. Therefore, one segment of the population cannot be given a role in decision making without the same opportunity being awarded to all segments of the population.

> What are the roles of different participants?

The Board of Fisheries makes decisions on openings and closures, bag limits, methods and means for the state's subsistence, commercial, sport, guided sport, and personal use fisheries, and it also involves setting policy and direction for the management of the state's fishery resources. The board is charged with making decisions regarding allocation, and the department (ADF&G) is responsible for management based on those decisions.

What decisions are made, and what is the decision-making process?

ADF&G makes in-season management decisions (see footnote 17).

What is the overall approach for ensuring the sustainable use of the resource?

The commercial fisheries are co-managed by the Alaska Department of Fish and Game and the USDA Forest Service Federal Subsistence Board. Management data are obtained primarily by Alaska Department of Fish and Game (ADF&G) at the Miles Lake Sonar Station and the Native Village of Eyak at the Baird Canyon/ Canyon Creek research stations. This allows managers to make in-season decisions for harvest rates.

[17] The Board of Fisheries' main role is to conserve and develop the fishery resources of the state. This involves setting seasons, bag limits, methods and means for the state's subsistence, commercial, sport, guided sport, and personal use fisheries, and it also involves setting policy and direction for the management of the state's fishery resources.

The State of Alaska is constitutionally mandated in Article 8, Section 4[18] to manage on sustained yield basis, subject to preferences amongst beneficial uses (from Lowe and Wilson 2007).

> What are the management functions?

ADF&G engages in all four generic management functions.

> How does TEK/LEK fit into this approach?

Ecotrust, in collaboration with First Nations and locals in the Copper River watershed has created the Copper River Knowledge Systems (CRKS). This CRKS is an information system designed to help local citizens, conservationists and resource managers to better understand the Copper River Watershed in which they live and work. The purpose of CRKS is to facilitate the exchange of information about the natural and human resources of this region. CRKS provides easy access to extensive biophysical and socioeconomic information describing the Copper River Watershed. The information catalogued on CRKS was gathered and developed by numerous organizations, agencies, and residents.

Does the scale of management relate to the ecology of the resource being managed?

ADF&G management only applies to US waters and does not have any jurisdiction in international waters or in Canadian waters where Copper River salmon may be found. The scale of management does not cover the geographic distribution of salmon, nor does it distinguish between different stocks in river (mixed-fishery). Some attempts have been made to address the problem of mixed-stock such as opening the fishery one week later to increase the proportion of early runs to successfully migrate upriver (early runs typically or those that go the farthest upriver and therefore experience greater physiological stress associated with migration.

> Are there clear boundaries/interception agreements?

There is disagreement/conflict between different user groups. First Nations are supposed to have priority, however they are the last to fish. In addition, ANILCA created a dilemma for Alaska in that the state constitution guaranteed equal access to resources for all Alaska's people, rural and urban. In 1989 (*McDowell v. Collinsworth*), the State of Alaska Supreme Court came down with the judgment that it was unconstitutional to give preference to rural residents (as laid out in ANILCA) under the equal access to resources clause of Article 8 of the state constitution (Holen 2004). The inability of the State of Alaska to institute a rural subsistence priority based on traditional and customary use of a resource is problematic and does not allow for clear boundaries to be established regarding rights to fish. As a result the federal government has taken over the management of subsistence fisheries as of 1999 (Holen 2004).

How are conflicts and challenges dealt with?

The Copper River Roundtable (founded by Ecotrust) provides a watershed-wide forum for people to come together and discuss resource issues. ADF&G does not have any formal mechanisms for dealing with conflicts between user groups.

[18] Article 8, Sec. 4. Sustained Yield: Fish, forests, wildlife, grasslands and all other replenishable resources belonging to the State shall be utilized, developed, and maintained on the sustained yield principle, subject to preferences among beneficial uses.

Inter-agency conflict between Federal (manages subsistence) and State (manages sport and commercial) governments do not have adequate levels of cooperation and communication when it comes to salmon management in the Copper.

> Are local/traditional practices/customs used?

None identified in the material reviewed for this case study.

What are the mechanisms of accountability?

None identified in the material reviewed for this case study.

> Are there local/traditional practices/customs used?

None identified in the material reviewed for this case study.

A6.3.3 Challenges and Opportunities for the Use of TLEK

Was TLEK used, and if so, how?

Several studies have been carried out documenting the wealth of information that is available from elders and locals (e.g., Simeone and Valentine 2007, Simeone and Kari 2002, Holen 2004, Lowe and Wilson 2007), however little, if any of the information collected in these studies has been incorporated into management decisions. These studies have documented how TLEK could benefit several areas of salmon management including establishment of historic abundance baselines, stock status and trends, and stock identification.

What were the barriers and opportunities specific to the case study?

There is no mandate from senior government officials to actively use TLEK in management. Furthermore, the State's constitution clearly describes that the state cannot privilege any segment of its population: Alaska Native or non-Alaska Native. This may make managers hesitant in using TLEK because it may be perceived as privileging one segment of the population over another.

How do local and aboriginal participants perceive the management arrangement, and management success?

They perceive management to be too lenient with development projects and not focused enough on sustainable long-term use (Lowe and Wilson 2007).

Was capacity an issue, and if so, how was this addressed?

Funding to support a public forum for discussion of collaborative management approaches such as the Copper River Watershed roundtable is scarce. ADF&G does not have the resources, capacity, or the mandate to lead this type of forum themselves.

A6.3.4 Lessons Learned

What principles, observations, ideas and lessons are transferable to Pacific salmon management?

- For successful management, users must understand and accept the goals and objectives of the resource managers and for this to happen, the users have to have a stake in management.
- Communication between local residents and resource managers is critical. A forum that includes all users and provides opportunities for discussion and incorporating local and

scientific knowledge into management of the Copper River fishery is critical. These venues/forums must be considered as equal exchanges of information, so that both managers and local people feel comfortable sharing information (Simeone and Valentine 2007).

- ☞ Secure funding and building trust between organizations are two of the key elements in co-ordinating the formation and activities of a watershed management organisation (e.g., Copper River Roundtable) in the CRW.
- ☞ A strong effort is required on the parts of government agencies to work together for a common end (e.g., multiple agencies with jurisdiction over a single resource, such as salmon and their habitat, need to work together to achieve sustainable resource management).
- ☞ A major difficulty in bridging the gap between TEK and science is appreciating the different styles of communication (Simeone and Kari 2002).

What worked, and what didn't work, and why?

- Implementation of successful harvesting practices (e.g., fish wheels, weirs, dip nets, etc.) require an understanding of ecological processes and often include a code of ethics governing human-environmental relationship. Managers must be made aware of this if they are going to support traditional fishing practices as solutions for conservation problems.
- Providing venues for information sharing is a crucial for creating relationships. Without these venues it would not be possible for TLEK fisheries management techniques to become understood by managers.
- TLEK and science have to be synthesised and converted into a form that is useful to all parties (First Nations, local groups, and managers). Prior to doing this parties were talking over each other's heads and not understanding the relevance of the information.

Figure A6.3.1 The location of the Copper River Watershed in Alaska. Source: http://www.copperriver.org/watershed-tour.

A6.4 Endangered Status Assessments in Canada

A6.4.1 Introduction/Background

This case study was prepared by Dr. Donna Hurlburt, a Mi'kmaq conservation biologist and ecologist. She is a member of the Aboriginal Traditional Knowledge (ATK) Subcommittee (SC) of COSEWIC which serves to integrate ATK into status reports for Species at Risk assessment, a scientific member of several recovery teams, and an Aboriginal community member on a marine species consultation team, which in part evaluates the impacts of SARA listing on her Mi'kmaw community. This multi-faceted experience with Species at Risk assessment and listing allows a unique perspective on the overall functioning of SARA processes and transition of information among phases, rather than a narrow focus on only a single component of SARA.

Overview

What is the resource being managed?

The Canadian species and populations of species at risk being considered in this case study include the following:

- American Eel (*Anguilla rostata*) (designated as Special Concern by the Committee on the Status of Endangered Wildlife in Canada [COSEWIC] in 2006; undergoing extended consultation for legal listing by the Species at Risk Act [SARA] and management under the Canadian American Eel Working Group Management Plan). (COSEWIC 2006a).
- Inner Bay of Fundy Atlantic salmon (*Salmo salar*) (designated as Endangered by COSEWIC in 2001; legally listed by SARA in 2003) (COSEWIC 2006b).
- Atlantic Salmon (*Salmo salar*) (status report for all Atlantic Salmon populations under preparation by COSEWIC).
- Sockeye Salmon (Cultus population) (designated as Endangered by COSEWIC in 2003 on an emergency basis; the Governor in Council declined to put the species on the SARA list because of high social and economic costs (COSEWIC 2003, Gross et al. 2004). Cultus Lake sockeye salmon and their habitat is protected under the Canada Fisheries Act (Cultus Sockeye Recovery Team 2005).

What is the resource issue or challenge that managers are trying to address, and what are the stresses on the system? What is the history – what conditions/circumstances gave rise to the management arrangements discussed in the case study?

The listing of a Species at Risk and subsequent protection under the *Species at Risk Act* (SARA) is a multi-part process that includes a status assessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), consultations with Aboriginal and stakeholder consultations, and socioeconomic decisions by federal government departments. This Act was fully implemented in 2004, however some processes relating to some of its responsibilities have yet to be fully resolved (e.g. critical habitat designation and protection). COSEWIC pre-dates SARA and has been performing independent species assessments since 1978.

Generally, the purposes of SARA are to prevent wildlife species in Canada from being extirpated or becoming extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened. The assessment and listing phase of SARA does not serve to mitigate these threats but rather to pull together information on which to base the listing. COSEWIC, an independent advisory body recognized by SARA, uses a rigorous

science-based process (IUCN-based criteria) using the best available scientific, Aboriginal and community knowledge to assess wildlife species suspected to be at risk.

Although this case study focuses on species assessment and listing, other non-SARA related processes can feed into this process to provide a more complete understanding of a species status, such as activities that gather knowledge of a species and its habitat from Aboriginal Peoples and local communities.

What are the overall management goals?

In all cases, the overall management goal is to access and gather the best available information to help inform status assessment by COSEWIC and the listing of the species under SARA by the Minister of the Environment.

What is the timeframe – when did the issue or challenge arise, when did the management arrangements take form, and are they still ongoing?

SARA is a new piece of legislation only fully implemented in 2004. In the five-year review, federal departments have stated that they have invested considerable efforts in resolving and implementing processes related to the Act up to present. Only now is the SARA process ramping up to work at a more efficient rate (Standing Committee on Environment and Sustainable Development 2009).

What is the legislative/policy/regulatory context? Discuss those that strongly influenced the outcome.

This case study focuses on the use of Aboriginal and community knowledge from the perspective of the assessment and listing phases of the Species at Risk Act. The need to consider Aboriginal and community-based knowledge is specified in the Act.

Sometimes other legislation is necessary to fully protect a Species at Risk, such as the *Migratory Bird Convention Act*. Species deemed to be *at Risk* can also be afforded protection through other pieces of legislation such as the *Fisheries Act* and the *Canada National Parks Act*.

Ecological context

Brief description of the life history and habitat characteristics of the resource being managed (point out any similarities to salmon)

All four species use both marine and inland freshwater systems to complete aspects of their development. Salmon are anadromous and the American eel is catradomous, and as a result there is much known about the reproductive life history of salmon and next to nothing about that of eel.

American Eel – All eels spawn and their eggs hatch in the Sargasso Sea. Larvae are transported through coastal waters and to the mouths of rivers by ocean currents. Some juvenile eels or elvers migrate up rivers to become resident yellow eels of freshwater habitats and others stay in brackish or salt waters. After 8 to 23 years, eels mature into silver eels that migrate back to the spawning grounds. COSEWIC considers all eels a single breeding population and there is no site fidelity for young to return where their parents once lived. In Canada, most eels are female as a result of environmentally-based sex determination (COSEWIC 2006a).

Atlantic salmon (inner Bay of Fundy) - The inner Bay of Fundy (iBoF) Atlantic salmon are genetically and geographically distinct from other Atlantic salmon. They usually spend two years in freshwater and one year at sea, and have a high incidence of repeat spawners (~50% of the population contributes ~75% of eggs). These salmon rarely leave the Bay of Fundy and the Gulf

of Maine because of the availability of suitable year-round habitat. Declines in marine survival are the primary concern for the inner Bay of Fundy Atlantic salmon. The mechanisms behind the decline are not clear but may include ecological changes in the Bay of Fundy and interactions between commercial salmon farming and survival of wild salmon (Irvine 2004, COSEWIC 2006b).

Atlantic salmon (ongoing assessment) – The status report for all populations of Atlantic salmon is currently under preparation by COSEWIC. At present, it is uncertain as to the designatable units that will be used for assessment and what the life histories and threats are in each assessment unit.

Sockeye Salmon (Cultus Lake) – Cultus Lake sockeye salmon are reproductively isolated from other sockeye. They usually spend one year in freshwater and two years at sea. Their marine distributions are unknown. Cultus Lake sockeye are lakeshore spawners and rear in a small nursery lake, but adults return to freshwater in the fall (COSEWIC 2003, Irvine 2004).

What is the geographic extent of the resource?

American Eel (*Anguilla rostata*) – The historic range of the American eel in Canada includes all accessible fresh water, estuaries and coastal marine waters connected to the Atlantic Ocean, up to the mid-Labrador coast. Continental shelves are used by juvenile eels arriving from the spawning grounds, and by silver eels returning to the spawning grounds. Niagara Falls is the natural limit of the American eel's distribution in the Great Lakes (COSEWIC 2006a).

Inner Bay of Fundy Atlantic salmon (*Salmo salar*) – This population of Atlantic salmon occupies all rivers draining into the Bay of Fundy, starting with the Mispec River and extending around the bay to the Pereaux River (National Recovery Team 2002) (COSEWIC 2006b).

Atlantic Salmon (*Salmo salar*) – The Canadian range of Atlantic salmon extends northward from the St. Croix River (at the Maine border) to the outer Ungava Bay of Quebec, plus one population in Eastern Hudson Bay . It is suggested that Atlantic salmon occupy about 550 Canadian rivers, about 21% all rivers globally (COSEWIC 2006b).

Sockeye Salmon (Cultus population) – Sockeye salmon typically occur in lake-containing river systems of British Columbia that are accessible to the Pacific Ocean. Cultus sockeye spawn exclusively in a small coastal lake that lies near the Canada-U.S. international boundary. The lake is part of the Vedder-Chilliwack System located in the eastern Fraser Valley (COSEWIC 2003).

Socio-cultural context

Who are the key participants/agencies/stakeholders that use the resource?

American eel

- Commercial fisherman – some who maintain eel weirs for adult eel have done so for multiple generations; there are also elver licenses
- Multinational companies
- Aboriginal Peoples – food, social and ceremonial use; livelihood; maintenance of access to traditional resources
- Industry – bought elvers and released them above major hydroelectric dams; there are concerns about the need to remove existing structures to restore listed species habitats

Salmon species

- Commercial fisherman
- Sports fishermen
- Aboriginal Peoples – food, social and ceremonial use; livelihood; license holders (CEPI 2006, Collaborative Salmon Initiative–CSI Cape Breton et al. 2006)

- Industry – concern about impact of SARA on operations
- Aquaculture companies
- Scientists – although most Species at Risk have some benefit to scientists, Cultus Sockeye is one of the best-studied populations in the world and has one of the longest datasets (COSEWIC 2003)
- Communities adjacent to salmon containing rivers (tourism, guiding and associated spin-offs)

> Who are the key participants/agencies/stakeholders that make decisions?

Primarily these are the scientists and jurisdictional members associated with COSEWIC regarding assessment. There are ways to include non-scientific or community-based information, but it is rarely utilized. The ATK SC is a newly developed subcommittee that has not fully or effectively accessed ATK to date, although processes are being developed to do so. The ATK SC of COSEWIC holds one vote of 31 in COSEWIC decision-making.

Listing decisions are open for consultation by Aboriginal groups and stakeholders and for public comment via the SARA Registry or through Fisheries and Oceans Canada in the case of Aboriginal Peoples and marine fishes. The public can also provide input via on-line workbooks, although the requested information primarily informs socioeconomic analyses rather than information relevant to status assessment (http://www.sararegistry.gc.ca/virtual_sara/files/public/cd_american_eel_0107_e.pdf). Ultimately, the decision to list a species rests with the Minister of Environment under the advisement of the Minister of Fisheries and Oceans for aquatic species.

>What are the roles of different participants?

Aboriginal communities and local citizens can provide information to inform status assessment, can be consulted regarding the appropriateness of the assessment designation, and consulted on the mechanism through which a species of Special Concern can be managed and monitored (e.g. SARA, Fisheries Act, etc.). Although these provisions are specified within SARA, as well as the crucial role of stewardship, assessment and listing decisions are presently dominated by scientific and government-based processes. There appears to be better involvement of Aboriginal communities relative to non-Aboriginal community groups.

What are the different values attributed to the resource?

The American Eel is physically, spiritually and traditionally significant to Mi'kmaq, Maliseet and Passamaquoddy culture and was the basis of many stories and some petroglyphs in Atlantic Canada (GMRCa, GMRCb, Prosper 2002, Prosper and Paulette 2002, Social Research for Sustainable Fisheries (SRSF) 2002, Prosper and Paulette 2003a, b, Davis et al. 2004, Paulette and Prosper 2004a, b, Prosper 2004, Prosper and Paulette 2004). The American Eel is thought to have been a species that has been crucial to the development of Mi'kmaq culture and identity, i.e. a cultural keystone species (Garibaldi and Turner 2004). In Atlantic Canada, a Supreme Court ruling stated that the Mi'kmaq, Maliseet and Passamaquoddy Peoples have a treaty right to earn a modest livelihood from the harvest of traditionally used species; although the ruling was not limited to the American eel, it was the basis for the case (Barsh 2002). Interestingly, a DFO economist, responsible for socioeconomic analyses, stated in 2007 that he and other government staff were unaware of the significance of the eel to Aboriginal Peoples in the region (D. Hurlburt, personal communication). Eel were of similar importance to the Aboriginal Peoples of southern Quebec and Ontario, although because of an extreme decline in eel populations, it is not commonly used by these peoples at present (Allen 2008, MacGregor et al. 2008).

American eel was one of the top three species in commercial value to Ontario's fishing industry during the 1980s and early 1990s where its peak value reached $600,000. Commercial catch of eel has declined from approximately 223,000 kilograms in the 1980s to 11,000 kg in 2002 (OMNR 2007).

The Atlantic salmon was an historical food source for Aboriginal Peoples and European settlers. In modern times, in addition to being a food source, the Atlantic salmon is of economic importance for its commercial fishery and recreational sport fisheries on a number of rivers.

Sockeye salmon (Cultus population) – Cultus sockeye has been central to the domestic economy and the ceremonial life of the Soowahlie Band of the Sto:lo First Nation for thousands of years. For more than a century, Cultus sockeye has also made important contributions to the commercial fisheries directed on the Fraser River's Late Run sockeye stocks (COSEWIC 2003).

Listing of any of these species under SARA and their loss may infringe upon Aboriginal and Treaty Rights (Fediuk and Thom 2003, Crawford 2006). There may be health impacts associated with dietary change from loss of access to traditional food sources. The loss of traditionally used protein sources in the diet has been attributed to the high degree of diabetes, cancer and heart disease in Aboriginal communities (Waddell 1982, Kuhnlein 1989, Kuhnlein and Receveur 1996, Fediuk and Thom 2003). Over 60% of Mi'kmaq individuals over the age of 40 have diabetes in some Nova Scotia communities (D. Hurlburt, pers. comm.).

A6.4.2 Management System

What is the management structure described in the case study?
>How/where do TEK/LEK knowledge holders fit into this structure?

COSEWIC has an Aboriginal Traditional Knowledge Subcommittee (ATK SC) comprised of Aboriginal Peoples to facilitate access to Aboriginal Traditional Knowledge for status reports; community knowledge can be accessed through unsolicited status reports, direct contact with community groups by status report writers, or through a community knowledge web-based questionnaire (http://www.cosewic.gc.ca/eng/sct6/sct6_quest_intro_e.cfm).

All members and co-chairs of the ATK SC are appointed by the Minister of Environment after nomination by recognized Aboriginal groups for four year terms with the possibility of renewal. Individual members each hold voting privileges on Species Specialist Committees on which ATK SC members participate. ATK SC Co-chairs share a single vote on the greater COSEWIC committee which formally assesses species status; there are thirty-one votes in total held by federal/provincial/territorial jurisdictional members, non-government scientists and co-chairs of species specialist subcommittees.

During listing discussions with community groups, TEK/LEK can be provided and has the potential to influence to decision of whether a species should be listed under SARA or not.

Does the scale of management relate to the ecology of the resource being managed?

COSEWIC can designate status at a range of scales depending upon the biology of the population or species being assessed. Designations can be based on the entire distribution of a species in Canada, a distinct population or even at the subpopulation level. Although COSEWIC designations are only relevant nationally, they do take global distributions and trends into consideration (Hutchings and Festa-Bianchet 2009b). Depending on the level of designation and the societal importance of the species (or population), sometimes there is a disconnect between the scale of designation and the scale at which people interact with the species (management or conservation scale), which can lead to challenges in listing the species under the Species at Risk. The American eel is an example of such a species.

Although American eel was assessed as a single designatable unit in Canada because all individuals are derived from a single breeding population in the Sargasso Sea, the impacts of listing are variable based on location within Canada. Eel populations are reported to have declined in excess of 99% throughout Ontario and Quebec; however, population trends for Atlantic Canada are ambiguous and locally variable. Some locations have reported increases and others have documented declines (GMRC, CEPI 2006) . Although stringent protection is warranted and supported in Central Canada, similar levels of protection, generated by a common SARA listing for all Canadian locations, are not necessarily warranted nor supported in Atlantic Canada. It is thought that Atlantic communities may pay the price to protect the eel for central Canada, whose problems are likely caused by habitat degradation and destruction by hydro-development and pollution. In this situation, there is a disconnect between the biological scale of the species and the scale at which management or human use takes place.

There may be a better fit between designation units and human use for species that are managed for economic reasons. Commercially used fish species typically have stock management boundaries that reflect human use of the species and are the basis for data collection. COSEWIC often uses data derived from management units in its decision-making since data are already available. However, it has also been stressed that management actions will be unsuccessful if they are solely implemented at regional scales because those approaches fail to account for the broader factors influencing the sustainability of fish populations in other areas of their distributions (Venter et al. 2006, MacGregor et al. 2008).

COSEWIC bases its decisions on the best available information and does not consider political, social or economic factors in its decisions. However, immediately after assessment by COSEWIC, their decision is consulted upon with Aboriginal Peoples and stakeholders where socioeconomic factors do play a role. With species of particular societal or economic importance, there is a higher propensity that species assessed as *at risk* will not be granted protection under SARA (Gross et al. 2004, Mooers et al. 2007, Hutchings and Festa-Bianchet 2009a).

Are local/traditional practices/customs used?

Often, information sharing and exchange takes place within formal meetings arranged by government departments. These meetings are typically held during working hours (which may limit the participation of some community members), are dominated by science-based, formal presentations (which may not be comprehensible to some) and are conducted in hotels or government offices. In February 2009, DFO hosted an information-sharing session on Atlantic salmon in Halifax in preparation for the writing of the COSEWIC status report under these circumstances; however this was scheduled concurrently with a National Aboriginal Council of Species at Risk Workshop which limited participation of some communities because they couldn't attend both meetings. Government consultation meetings however rarely incorporate Aboriginal cultural practices in their deliberations, unless the meeting intent and agenda is developed collaboratively. It is speculated that meetings with local fishing communities might also need to account for tide tables, fishing seasons, school holidays and other community events.

Meetings that have been partially or completely developed with the participation of Aboriginal Peoples often have the following characteristics: 1) meetings are opened with ceremonies, smudging and prayers by local elders, 2) there are considerable opportunities for round table expression of ideas or discussion, 3) there are often elders and youth as participants, in addition to the technical people from communities, 4) meals and plentiful snacks are provided; sometimes participants bring traditional foods to share with others and 5) meetings are often closed with a talking circle where each individual gets to share what is one his or her mind without interruption. The ATK SC of COSEWIC includes most of these factors in its workshops, meetings and own

deliberations and strives to meet the needs of the elders and knowledge holders with whom they work.

One of the most challenging issues to deal with in most natural resources discussions is that most decisions are grounded in science and Western science philosophies, which may not be compatible with Aboriginal *ways of knowing*. For example, the Mi'kmaq use of the natural world is governed by *Netuklimk. Netuklimk* is a way of providing for one's life and existence and that acknowledges that humans are part of nature, not dominant over nature. Netuklimk involves respect for all of Creation, recognizing the interconnection of the web of life, reciprocity, and how humanity's actions impact everything (MacDonald 2000). COSEWIC assessments, and more generally Western Science, use a very different framework to guide decisions. COSEWIC assessments are typically single-species based with minimal information on interspecific or habitat relationships rather than a more comprehensive understanding typical of the Mi'kmaq and most other Aboriginal Peoples. The information in status reports is highly compartmentalized and is dominated by scientific studies which make every effort to eliminate as many confounding variables as possible.

A6.4.3 Barriers and Opportunities for the Use of TLEK

Was TEK/LEK used, and if so, how?

American Eel – The American eel status report contained only a single reference of published literature relating to Aboriginal Traditional Knowledge and no references to other non-scientific forms of knowledge (COSEWIC 2006a). During a workshop with Aboriginal elders and knowledge holders for the COSEWIC ATK SC in 2007, most participants identified information and knowledge that they held or were aware of that was not contained in the status report (D. Hurlburt, pers. comm.). Consequently, a considerable amount of information was unavailable to decision makers regarding the status and appropriate management strategies for the species. Information is also lacking from other sources, such as rural communities and commercial fishers.

A regional DFO biologist in Atlantic Canada highlighted in November 2008 the ways in which ATK has been used to inform eel management. This ATK is primarily from published literature rather than primary sources and has been already subject to interpretation by the author (Regional Aboriginal Species of Concern Working Group 2008). The use of ATK in eel population assessment include:

- *Presence/absence* – In the past, traditional knowledge from Aboriginal and non-Aboriginal fishers who are still alive indicate that large numbers were present in the upper parts of the Ottawa River. Records from the 1600s indicate that large numbers of eel and fish existed in the tributaries of Lake Ontario, but now, there are hardly any. This indicates that fewer eel overall are present as they no longer have the need to travel further upstream to find a suitable habitat.
- *Relative abundance* – Historical records indicate that 300 to 400 years ago in an area south of Lake Ontario in New York State, a single fisher could harpoon 1,000 eel in one night, whereas in Quebec City during the same time period, about 300 eel could be caught in one night, "although sometimes more or very few were caught in this area." Relative abundance also provides information for trends over time.
- *Absolute population* – Presently, an adaptation of the flambeau fishery method used by Aboriginal peoples in the 1800s can be used to count eel and to study them. Previously, this involved a torch and light, bark canoes. Presently, a glass bottomed boat can be used in surveys to count eel or to understand how eel use their habitat.

Although there was a lack of ATK within the status report, that absence has driven several communities to actively gather their own eel ATK for future SARA and management processes. For example, the Gespe'gewag Mi'gmaq Resource Council (GMRC) in New Brunswick was concerned that First Nations groups were not consulted prior to the listing of the eel and decided to undertake research of eel populations and traditional knowledge with participating communities, Listuguj First Nation, Eel River Bar First Nation, Pabineau First Nation. This study involved Mi'gmaw people, primarily elders, in identifying past locations of key eel fishing grounds and habitat, any major migration barriers, knowledge of population size and reasons for population changes (GMRCa, GMRCb).

Atlantic Salmon (Inner Bay of Fundy) – Other than a brief mention of the significance of the species to the Mi'kmaq and Maliseet Peoples, no ATK was included in the status report (COSEWIC 2006b).

Atlantic salmon – The status report for all stocks of Atlantic salmon is presently being prepared. The ATK SC is in the process of developing guidelines that are acceptable to Aboriginal elders, knowledge holders and communities across Canada. Although the guidelines are acceptable to the vast majority of communities asked to review them, finalization of these guidelines has been slow due to financial constraints. There is a pilot project concerning the gathering of Atlantic salmon ATK under development by the ATK SC that will provide ATK to status assessment decisions, but also inform the development and refinement of the guidelines that are under development. Because there was a heightened awareness of the plight of salmon and the status report preparation in advance, communities from the Atlantic region have developed several projects to gather salmon ATK (CEPI 2006, Collaborative Salmon Initiative–CSI Cape Breton et al. 2006).

What were the barriers and opportunities specific to the case study?

There are primarily two categories of barriers in this case study. The first is that of appropriate and effective engagement of local communities which may hold relevant knowledge for decision-making and who make be impacted by listing decisions. The second set of barriers pertains to those that relate to the logistics of gathering of LEK. Engagement includes aspects of information sharing and access, development of relationships and overcoming mistrust and identification of common issues and goals across parties. Logistical elements of LEK gathering and use include development and adherence to protocols or information sharing agreements, recognition of differences in knowledge sets, protection of sensitive information, protection of information and use of non-public information in decision-making. Typically, engagement barriers need to be resolved before gathering or using LEK.

Numerous documents and guiding institutes exist that can help with the engagement of local communities in appropriate and effective ways in the development of policy or policy decisions; however, these available tools are rarely used and those charged with engagement typically are not trained in such methodology. Effective citizen engagement can lead to better policy that is more aligned with social problems and values, which in turn leads to enhanced 'buy-in' from society. In the case of Species at Risk, this buy-in is essential to ensure persistence of these species into the future. A fundamental component of SARA is stewardship, driven by grassroots citizens; society must embrace the decisions being made in order for this approach to be effective.

One of the key suggestions in the SARA Minister's Round Table discussion in 2006 was to "Facilitate an increased involvement of Aboriginal communities, organizations, and wildlife management boards in SARA and improve consideration of Aboriginal traditional knowledge in SARA implementation" (Barrett 2006). In September 2009, the following issues were indicated by DFO AAROM bodies to be major impediments to full engagement in SARA, including the

use of ATK in species assessment and listing (Fisheries and Oceans Canada 2009): Internet access, Geographic isolation, travel challenges, high costs and time, limited opportunities for relationship building, seasonal issues (meetings during hunting and trapping), language (there are many unilingual Aboriginal people), different interpretations of information, differences in world view and understanding, meeting and consultation fatigue, research overload (inappropriate interview questions, overnight southern expectations, less vocal individuals are also experts), difference in time scales between science and ATK, and failure to recognize that species are intricately linked to human and cultural survival. Similar barriers to participation were expressed by Aboriginal communities across Canada at a NACOSAR workshop in Winnipeg in 2006 (Powless 2006).

Unfortunately, these barriers take considerable time and resources to resolve and are compatible neither with the timelines of SARA, nor the financial resources put towards the implementation and functioning of SARA. Resources are even more constrained at the grassroots level where the knowledge is held and the impacts most felt. Government departments are trying to find a solution to these issues and have suggested the establishment of centralized departments of engagement and traditional knowledge or broad overarching protocols of engagement and knowledge use. These approaches are perceived as being government-centric with little input by TEK/LEK holders and are accused of being structured as to maintain government, rather than citizen, control.

A6.4.4 Lessons Learned

What principles, observations, ideas and lessons are transferable to Pacific salmon management? What worked, and what didn't work, and why?

- Education and Communications – The gathering and sharing of TEK/LEK for scientific or natural resources management is challenging because the knowledge is held by grassroots individuals who may have little knowledge of science or decision-making processes. Individuals who hold TEK/LEK must be educated about the role of COSEWIC and SARA to fully understand the process in which they are participating and in the case of the ATK SC of COSEWIC to issue *Prior and Informed Consent.* Often these processes must be described in layman's terms and/or translated to languages other than English and French. To date, this information has not been effectively conveyed to grassroots individuals.
- COSEWIC status reports are prepared over a relatively short period (less than a year; draft reports are produced often within six months of the contract initiation), which permits little time to access and gather TEK/LEK for integration into the report. There remains a need within the ATK SC of COSEWIC to alert Aboriginal communities and organizations about status report preparation and the need for ATK in a timely manner. The ability to reach all communities or organizations within the range of a species can be cumbersome. The ATK SC can prepare for some status reports in advance (polar bear, caribou) depending on availability of funds; however, there are many species for which ATK exists but has not yet been accessed.
- *A Priori* Relationship Building and Trust – Access to TEK/LEK is often hampered by mistrust of decision-makers, often based on past negative interactions. Good relationships and trust take considerable time to develop, often well beyond the time allotted to resolve a management issue. Often individuals will not share information because it is unclear how the information is intended to be used and how it will impact the individual or their community. The ATK SC is comprised of Aboriginal people who have established connections (and trust) within their communities, tribe or region; however because there are only up to twelve people on the committee, not all regions or tribes are well represented.

- Clear Objectives and Uses - The ATK SC of COSEWIC will clearly state that the information will only be used to benefit the species in question and that the only information that will be publicly shared is that that related to its decision-making criteria (e.g. trends in population size, threats to species). Individuals who share their knowledge are given the opportunity to review how it is conveyed before the document becomes public and are permitted to withdraw their knowledge at anytime up to that point. Raw, un-summarized information is retained by the individual or community themselves rather than by COSEWIC. After assessment, however, it is unclear if the knowledge of individuals will be made public and how or if it will be used in decision-making. Clear objectives and uses for knowledge need to be shared at the initiation of discussions.
- Because TEK/LEK is privately-held information rather than publicly-available information such as that in scientific journals, there are often specific procedures, especially with Aboriginal communities, that must be followed to protect that information from misuse, misinterpretation or loss of integrity. Protocols vary among communities or in many cases, have not yet been developed. Development of protocols or the receipt of permission from communities to pursue knowledge-sharing take considerable preparation and time. It is best to 1) identify the key contact of communities (often chiefs and councils, but not always) in advance, 2) be aware of existing protocols, and 3) encourage preparation of protocols and/or memorandums of understanding in advance of need, especially with communities with whom decision-makers expect to interact regularly.
- Collaboration among Decision makers - Federal Interdepartmental Committee – Individuals from federal government departments in the Atlantic Region established an ad hoc interdepartmental committee to work with Aboriginal communities from the region on Species at Risk issues, including the use of Aboriginal Traditional Knowledge. This committee is comprised of representatives from Environment Canada, Parks Canada Agency, Canadian Food Inspection Agency, Indian and Northern Affairs Canada and Fisheries and Oceans Canada, all of whom have responsibilities related to SARA, the use of Aboriginal traditional knowledge and Aboriginal consultation. An interdepartmental collaborative approach permits a 'one-stop' approach to common issues and needs across departments such as Species at Risk education, Aboriginal concerns about sharing ATK, identification of regional sources of ATK and streamlined approaches to Species at Risk research. It also clearly demonstrates willingness for government departments to work together on some issues. Further, all efforts are made to provide participant communities with the tools so they are empowered to effectively participate in Species at Risk decision-making. Given that provinces and territories also bear part of the responsibilities for species at risk, such structures should also include these decision-makers in their deliberations.
- Empowerment of Communities – The Interdepartmental Committee has been instrumental in developing relationships and trust among government department staff and the technical people associated with Mi'kmaq, Maliseet, Innu, Labrador Inuit and Labrador Métis communities and organizations and in providing educational and networking opportunities for Aboriginal communities. This committee, often through pooled funding, has hosted several workshops for Aboriginal communities on SARA, Aboriginal traditional knowledge, the American Eel and in March 2009, on the possibility of establishing an Atlantic Aboriginal Species of Concern Committee. At the March workshop, the Aboriginal communities present, having the desire for continued involvement from government partners, began to establish a Terms of Reference for the committee: "We form a united voice for the species and ecosystems of our region through the use of Aboriginal Traditional Knowledge and Western Science. Additionally, we promote and facilitate knowledge exchange within and among communities and governments to empower Aboriginal communities and organizations

to make informed decisions about the natural world". Aboriginal participants were fully engaged in the planning and functioning of all workshops after the initial workshop hosted by the interdepartmental committee.

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