TOWARDS ECOSYSTEM-BASED MANAGEMENT IN CANADA'S NORTHEAST PACIFIC OCEAN: RESEARCH SUPPORT FOR AN EMERGING COLLABORATIVE SCIENCE INITIATIVE

by

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We accept this thesis as conforming
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ABSTRACT

TOWARDS ECOSYSTEM-BASED MANAGEMENT IN CANADA'S NORTHEAST PACIFIC OCEAN: RESEARCH SUPPORT FOR AN EMERGING COLLABORATIVE SCIENCE INITIATIVE

A new BC organization – the *Pacific Marine Analysis and Research Association* (PacMARA), was formed in 2003 to undertake and facilitate research and analysis initiatives that would inform and support an ecosystem-based approach to marine planning, marine conservation and marine resource use in BC. In this paper, an analysis of the literature around governance, collaboration, complexity, the role of science in society, and new thinking about resource management was undertaken to show that collaborations such as PacMARA might actually be better at asking and answering the questions needed to inform an ecosystem-based management approach. A new evaluative framework for science and research collaborations was also developed for this thesis and some illustrations of how it can be used are discussed here, looking at four similar organizations in Canada and the USA. The thesis concludes with recommendations for future work on refining the evaluative framework for use by others.

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"…collaborative research is the synergy or "critical mass" when different knowledge systems communicate, after decades of silence or conflict, that leads to quantum jumps in knowledge. The juxtaposition of "Heiltsuk intuition" with ecosystem science is no accident."

Nigel Haggan, et al
UBC Fisheries Centre, 2004

"We believe that science, the generation of better knowledge and the wide dissemination of knowledge and information are themselves key processes in the emergence of stronger civil societies and hence of democracy. These are essential foundations for the more equitable and sustainable management of natural resources."

Jeff Sayer and Bruce Campbell
The Science of Sustainable Development, 2004

CHAPTER 1 - INTRODUCTION

In 2004, The National Post carried a story about a high school in Cochrane, Alberta that has had no permanent water or sewer services since it opened in 1999. Three graduating classes of students have gone through high school in a building that has never been hooked up to water or sewer systems. This results in a multitude of problems, not the least of which, is that water must be trucked to the school on a regular basis, and when this water runs out, students are bused up to eight kilometres to other schools for bathroom breaks.

The reason for this topsy-turvy situation is a political dispute that has been going on since 1998 between the town of Cochrane, the municipal district, the school board and the developer, over who is responsible for the work and the costs required to deal with this problem. The players in this scenario also disagree over who is accountable for letting it go on this long, and the resulting escalation of strong feelings means these groups have simply not been able to work together to resolve this problem. “Everytime we get everyone together, we get the same discussions about whose fault it is, who’s responsible for what. I’m so tired of hearing that crap” (Dohy, 2004). Minimum standards of health and safety cannot even be met in this relatively simple situation because disputes about information have turned into a blame-game, with kids at the losing end.

Complex issues like this one, involving disputed information and multiple conflicting perspectives are actually very common scenarios. We have seen them often enough in coastal British Columbia with our long history of land-based resource use conflict in BC’s coastal temperate rainforest. These have included such well-known

disputes as ‘the war in the woods’ in Clayoquot Sound, the battle over the Carmanah and Wahlbran Valleys, the arrests of Haida Elders protesting logging on Moresby Island and most recently, the conflict in the Central Coast’s Great Bear Rainforest. Our BC coastal forests have been areas of high conflict because their globally significant ecological values have been pitched against their local economic, social and cultural values. Governments have struggled, mostly unsuccessfully, to deal with these challenges in light of diminishing assets and overcommitments. As well, the growing 'emergence' of First Nations entitlements on the BC coast and in the offshore has become a central part of these discussions.

As we have reduced logging pressure by protecting various coastal watersheds in these and other areas, pressure to economically diversify into the marine environment is growing in response. Because of this loss of some traditional forest income opportunities and because we also have globally significant marine and coastal values, we are beginning to see some of the same resource use conflict in BC's marine and coastal environments. This is, of course, exacerbated by the already existing pressure from "traditional" marine activities, many of which are now themselves approaching supply/demand crises.

Rural BC has seen a decade of decline across many economic indicators so there is an urgency to create wealth in these areas of the province, particularly in Northwest BC (BC Progress Board, 2002). Unfortunately, the need to expedite economic development and community stability in BC’s Central Coast, North Coast and Haida Gwaii/Queen Charlotte Islands means that diversification into the marine environment is moving faster than our ability to plan in an integrated way to first protect and restore valuable marine

habitats and resources. Major new industries such as offshore oil and gas are being proposed for BC. An expansion of finfish and shellfish aquaculture both geographically and through an increasing number of species appears promising for creation of year-round employment. The cruise ship industry, now with stops in northwest BC en route to Alaska, continues to grow. Global economic drivers mean proposed terrestrial infrastructure development, in the form of pipelines and railways could soon blanket the region, and many coastal communities are also now trying to respond to the need for increased industrial port capacity. (Vancouver ports are overcrowded so other BC facilities are needed to accommodate container ships and commodities heading to and from Asian markets.)

Forest management in BC is relatively straightforward with few players and a long management and planning history. For the most part, we are still in a pre-treaty environment in the coastal forest. This means the Province of BC is the primary landowner and lessor allocating forest tenure to a few major forest companies with some minor tenure opportunities for First Nations and communities. In contrast, marine management in BC is even more of an incredibly complex, multi-layered and difficult arena in which to operate. It is a more challenging place to achieve either marine conservation or marine economic development goals. Some of the challenges are around governance, including:

- The multiplicity of diverse jurisdictions, users, issues and different long-term visions for the BC Coast. This includes, among many possible examples, the fishing industry: from small scale to industrial to recreational to First Nations food, social and ceremonial use and

also to aquaculture, all involving many different species, and responding to many different markets. BC also has a variety of unique coastal areas, including the remote, isolated, sparsely populated, pristine farther north, to the urban, heavily industrialized south. In some places subsistence food gathering by First Nations and other locals supports economically disadvantaged communities, but in other areas this is no longer possible due to pollution, species decline and loss of access. And, while the Federal Government is the dominant resource management agency in this complicated environment it has yet to develop or practice integrated management even within its own agencies let alone between it and other levels of government, that responds appropriately to the challenges faced in managing the BC coast's human and geographic diversity,

- A variety of evolving and sometimes uncertain property rights in different areas including open access, common and private property; making our traditional sense of the ocean as a common property resource largely no longer true, necessitating a parallel evolution in marine and coastal management we have mostly yet to see,
- Many outstanding aboriginal title and treaty claims meaning long timelines before certainty can be achieved in the marine environment for either conservation or development. This includes legal challenges from governments about possible precedent setting aboriginal claims to marine resources and areas, and finally

- Certain pre-treaty economic or protocol agreements that First Nations may negotiate one on one with government or industry, which may also exacerbate conflict, uncertainty and impacts to marine habitats and resources in the absence of an overall marine use plan for the coast.

There are also management and policy challenges such as the:

- Absence of an overall marine planning regime, and no process for integration and harmonization of land and marine use planning,
- Lack of coordination among a myriad of agencies and organizations working on both marine conservation and economic development, which has lead to a piecemeal and redundant approach and also results in competition for scarce resources,
- Lack of a coherent plan to collaboratively develop a knowledge framework for integrated marine ecosystem-based management on the Pacific Coast,
- Significant gaps in both information and analyses needed to effectively plan and make decisions within an ecosystem-based framework, and also,
- Lack of public awareness and engagement around marine issues and concerns reflecting our terrestrial bias. People love the water and many play around its edges but most don't see the complete marine

> environment and its issues and needs, the way we have with terrestrial situations.

Although we do not yet have a war on the water to parallel the war in the woods, conflict is growing. We have already seen the occasional protest because of increasing concern over things like: offshore oil and gas, open net cage aquaculture, underwater pipelines, offshore wind farms and marine protected areas. This discontent can only grow, and particularly in the Northwest BC marine area with its relatively pristine and mostly still to-be-allocated coast and waters.

What can we do now to preempt escalating conflict, avoid repeating the experiences of the past and instead profit from the painful lessons already learned in the BC coastal forest about resource-based disputes? In the example of the Great Bear Rainforest, solutions involved acknowledging the complexity of the situation and recognizing the need for more innovative solutions than anyone could have previously imagined. The traditional approach to solving problems had resulted in a zero-sum game, in which no resolution was possible, because someone always had to lose (Coady, 1999). Linda Coady, a Forest Company Executive for McMillan Bloedel during this period described the change of approach this way:

> …we created a social model that we used to help us understand forest issues and options in BC. That model held that the application of traditional linear authority simply doesn't work when it comes to forest issues and policy in this province. It doesn't work because relationships among the various interests involved are so complex and interdependent that no one can really be in charge. Instead, the situation behaves much more like an economic marketplace (or an

> ecosystem), in which outcomes are the product of constant interaction among various forces. Now I want to be clear that the concept I am talking about here is not "win-win," nor is it a "stakeholder consensus" model. The dynamic I am describing is both more complex and more variable...but whether or not you agree with it, the important thing is that it inspired us to want to move away from the old simplistic, adversarial relationships into new relationships that would allow us to deal with complexity. (Coady 1999, p 23)

As shown here, dealing with complexity in managing BC's coastal rainforest is multiplied in managing BC's marine environment. So, if innovative solutions were needed to resolve forest conflict, the marine environment might need even more innovation. This can only be created through "constant interaction among various forces" (Coady 1999, p 23). Another word for this is collaboration.

Many organizations, groups and individuals in BC are interested in trying to achieve either conservation or economic development gains, however these two concepts are still seen by many as ideologically irreconcilable, and for the most part the proponents on either side don't yet always talk to each other in a constructive way. Often, this is because of disputes about information and science. One of the critical innovations from BC's experience in terrestrial land-use planning processes was around information being commonly held and agreed to. So it would seem that this also must be a cornerstone for the even more complex realm of marine management, where competing jurisdictions, and lack of knowledge prevail.

As noted in recent reports, significant marine information gaps exist in BC (Royal Society of Canada, 2004; Zwanenburg 2003). There are also issues impacting progress

such as the difficulties with data access and ownership, lack of data coordination, and minimal work being done on synthesis and analysis to produce better information from the data we already have. All these things are limiting factors in achieving a coordinated ecosystem-based approach to managing BC's marine environment.

Some members of the BC marine knowledge community met a number of times since 2003 to discuss this issue, and out of those discussions eventually formed a new non-government organization called the Pacific Marine Analysis and Research Association (PacMARA). The purpose of the organization was to bring the marine science and research community together, in an area of common ground, which is the general acknowledgement of the need for high-quality information and analysis for decision-making.

PacMARA members believe that a joint (multi-sector) science and research approach can create or facilitate development of syntheses to answer the critical ecological questions that are not currently being addressed, overcome limitations of individual organizations and also contribute to the building of social capital to help mitigate conflict. The organization believes that this new initiative will help lead to better management outcomes for both ecosystems and communities, thus moving us closer towards sustainability in BC's marine environment.

Coastal BC does need economic revitalization, but an integrated ecosystem-based approach to using marine resources in a sustainable way over the long term is also needed to protect our rich biological heritage and coastal culture. Canada's Oceans Act affirms Canada's position that "conservation, based on an ecosystem approach, is of fundamental

importance to maintaining biological diversity and productivity in the marine environment" (Oceans Act, 1996, preamble).

This thesis project is being done as research support for PacMARA in order to try to answer two questions to help inform its further development. The first is: *Is there evidence that collaborative enterprises may be a more effective model for assuring the appropriate ecological questions are asked and answered to inform resource related decision-making and planning?* To answer this question, the theoretical literature around governance, collaboration, complexity, the role of science in society, and new thinking about resource management will be examined.

The second question is: *How might collaborative, transorganizational science and research initiatives be evaluated to help them improve their delivery of effective results?* To answer this question, a review of existing evaluation frameworks will be done, and a new evaluative framework with potential critical elements of success for science collaborations will be proposed. This framework will also be examined here briefly in practice, using illustrations from four other collaborative science organizations.

First, however, the following chapter will describe and discuss the action research methodology used in this thesis project.

CHAPTER 2 - RESEARCH METHODOLOGY

"In action research we are attempting to develop deeper understandings and more useful and more powerful theory about the matters we are researching, in order to produce new knowledge which can inform improved action or practice."

Yoland Wadsworth, 1998

Action Research Described

In this section, I will describe the research methodology used in this project and discuss the rationale for using it here.

This thesis uses *action research methodology*, that is to say, its a kind of research methodology conducted close to action, by participants, players in the action, and is designed to inform and influence action. This is in contrast to a more policy neutral view of research as mere observer. Using action research, research and action are both achieved in a cyclical process, in which a pressing world issue is identified, research planned and carried out, possible solutions found and implemented, or reflected on to inform further research and action. This, ultimately addresses the original issue or concern, or is then again used to ask further questions. (Dick, n.d.; Parks & Panelli, 2001; Wadsworth, 1998) "Put simply, action research is 'learning by doing' – a group of people identify a problem, do something to resolve it, see how successful their efforts were, and if not satisfied, try again." (O'Brien, 1998, p 2) However, it is indeed a research approach, not just a general kind of problem solving, as its methodology is scientific in at least the broad sense, involving systematic, empirical research informed by theory (O'Brien, 1998, Reason 1994). In fact, some say it is more influenced by its methodological theory than other forms of scientific study, which lead it to be described

as an “orientation to inquiry” rather than a methodology (Reason & McArdle, n.d., p 2). Swepson sees it as more of a vision than a method (Swepson, 1998). It has at its core the idea that social science and policy questions should be researched in a collaborative way, using an adaptive process, which will then inform understanding as well as solve a real-world problem. It is used in real life situations, and with researcher and participants as partners in the research rather than subjects under study (Dick, 2004; O'Brien, 1998). Through action research a real-life situation may be studied, changed and improved (Wadsworth, 1998). Using this vision as its basis, the action research methodology developed for a project becomes what is suited to a specific time and place, fit for function. In this regard, the cyclical action research process can actually be seen as an aspect of the theory rather than a prescriptive methodology to be used in exactly the same way in every research project.

Action research has most of its long history of use in educational and organizational settings. (Charles, 1997; Parks & Panelli, 2001; Reason & McArdle, n.d.) Indeed, many of the action research reference materials are in the educational literature. There is a now also growing recognition that natural resource management issues, with their complex contextual mix of natural and social science and their need for collaboratively negotiated solutions are better studied through an action research approach, which is, again, why it seemed appropriate for this research project (Norman Dale, personal communication September 15, 2004; Parkes & Panelli, 2001)

Action Research in Practice

Action research or participatory action research, as it is also sometimes called, is more about working with people to achieve change than it is about specific research

methods and procedures (Pain & Francis, 2003). The researcher is guided by the research, instead of a research framework (Pain & Francis, 2003). The detailed methodology used in an action research project is the right one if it meets the goals of action research theory – to both add to understanding and to help accomplish change in the situation under study. The methodology itself is really a spectrum of approaches depending on the people, organizations and situation being researched (Parks & Panelli, 2001). It is not concerned as much with generalizing or replicating learnings but with improving a specific condition in a particular time and place (Dick, 2004; Charles, 1998).

It is also not restricted by having to produce replicable results, as are traditional, pure scientific studies with their need for highly controlled, specific, experimental methodologies. Unfortunately, research in the messy world of people and politics does not easily fit within normal science research methodologies. In this reality, there are no abstract truths or distinct, unmovable controlled and uncontrolled variables.

The value of action research is its applicability to a real world situation, with all its complexity and human drama. Indeed, positivism, the ideology underlying the traditional scientific approach stresses, at its most extreme, objective, value free truth, one where facts are strongly separated from values, and truth is what one can taste, touch, see or smell. This traditional scientific method also sees researchers as passive collectors and interpreters of data (O'Brien, 1998). In contrast, action research is characterized by belief in a "socially constructed, subjectively based reality – one that is influenced by culture and history" (O'Brien, 1998, p 9). It sees the researcher as co-participant and participants as co-researchers, which helps in understanding "meaning and significance" (Williams, 1998, Qualitative Research, para 4). Action research is a specific scientific

methodology that reflects emerging ideas about the validity of a research approach where facts and values are acknowledged, and the integration of participation, research and action are legitimate constituents of the problem being researched. It also involves a researcher who takes on responsibilities for change as well as research (Dick, n.d.; Parkes & Panelli, 2001).

Action Research and this Project

The main reason why action research was considered an appropriate methodology for this particular study is that the focus of this thesis project is indeed about solving a real problem for a real organization. PacMARA is an emerging organization attempting to identify a successful path forward to deliver on its collaborative research and analysis goals, within a very complex web of other organizations and issues in the BC marine arena. Choice of a research method was an important consideration in this project and action research was found to be both appropriate and in fact, one methodology that might actually provide the information PacMARA was looking for.

Action research methodology was also chosen for this thesis as its approach and assumptions about the potential effectiveness of collective endeavors parallel PacMARA's beliefs and assumptions. In fact the methodology itself expresses the same reality – with constructs such as: co-learning, collaborative, complexity, adaptive, cyclical and systems-based. It suits a set of assumptions that PacMARA members and this researcher also purport, including the recognition of the need for collaborative, integrated analyses and research to better inform decision-making.

It is also potentially the right type of research methodology to help PacMARA members develop more internal solidity that can be enhanced through action research's

participatory characteristics. This building of social capital: "a combination of the elements of mutual trust, reciprocity, group belongingness, the collective sense of a shared future and collective action." (Roberts, 2004, p 20) amongst PacMARA's members, who belong to a specific knowledge community in BC's marine sector, is an important aspect of the research for the organization as "trusting relationships are a key to fostering long term partnerships and alliances" (Boutilier & Svendsen, 2002, p 10).

Links Between Science and Action Research

Interestingly, the growth of action research as a scientific research methodology parallels the evolution of scientific inquiry from normal to post-normal, reflecting in both spheres the complex state of affairs of the 21st century.

> "Participatory action research is a term that brings together a set of assumptions underlying 'new paradigm' science, and in contrast to those of traditional or 'old paradigm' science. These new assumptions underline the importance of social and collective processes in reaching conclusions about 'what is the case' and what the implications are for change which is deemed useful by those whose problematic situation led to the research in the first place" (Wadsworth, 1998 What participatory action research is - and is not! section).

Many see traditional scientific inquiry as insufficient to address the complexity of some of the issues that need scientific input, including global climate change and marine resource management (Allen, Tainter & Pires, 2001; Funtowicz & Ravetz, 1990; Parks & Panelli, 2001). Similarly, many types of traditional scientific research methodologies no longer appear sufficient to address the complex issues under study, – such as those in this thesis. Paradigm shifts in science parallel paradigm shifts in research methodology

as both spheres acknowledge complexity, uncertainty and the need for more collaboration in order to ask and answer the questions needed to inform decision-making.

Traditional research methodologies in both natural and social sciences have as an underlying assumption: objective experts discovering ultimate truths. That is not necessarily the assumption underlying this thesis project or PacMARA's existence, further confirming the need to consider discarding certain research methodologies for this particular project. Indeed, there appears to be a natural fit between the scientific research methodology called action research, the assumptions underlying this particular thesis topic and the idea of a real collaborative science initiative in BC. More on the theoretical context in which PacMARA has emerged and on the evolving role of science can be found in the next chapter of this paper.

How this Thesis was Carried Out

This thesis project was originally proposed at a PacMARA workshop in Skidegate, BC in November 2003. Steering Committee participants agreed that the author should conduct research into theory and practice of collaborative science as her MA thesis topic in the MEM program at Royal Roads University in Victoria. An initial presentation on the proposed research was given to the PacMARA Steering Committee at a subsequent meeting in April 2004 in Vancouver. Some feedback into problem definition and thesis project design was received at this workshop and in the following few weeks by email. A formal thesis proposal was circulated by email to all 10 members of the steering committee and substantive feedback was received from most of them.

Interview questions for members of the organizations under study were then developed in order to answer these thesis questions. Proposed interview questions were circulated to Steering Committee members and feedback was received from some. Intermittent emails and phone calls about thesis progress, and informal communications to members took place over the course of the thesis research period. Formal updates were given at PacMARA Steering Committee meetings. A presentation on completed research and analysis done to date was given at the first PacMARA AGM in June 2005.

The results of this thesis project will be submitted formally to the now PacMARA Board of Directors and used to inform the further development of the organization. This is the nature of action research. As well as being one of the participants in the organization, the role of this researcher has also been to continue to facilitate the ongoing activities of the group (action element) and to provide input and information for further development (research element). This thesis is both a cycle in itself with its complete act and review components, and is also part of the larger cycle of PacMARA's progress in which it can be seen as an action element.

This thesis will also be submitted to Fisheries and Oceans Canada to fulfill the requirements of a partial funding contribution, which involves providing the agency with recommendations about collaborative science in the Pacific North Coast Integrated Management Area (PNCIMA).

One external presentation on some of the results of this research was already made to the Ocean Management Research Network (OMRN) conference in Ottawa in October 2005, and another will be made at the Society for Conservation Biology Conference in San Jose, California in June 2006. The author also intends to publish in an

appropriate organizational or natural resource journal on one specific aspect of this research, which was the creation of a new evaluative framework for transorganizational science collaborations.

Literature Review and Analysis Component

A significant amount of literature was examined for this project. It is an aspect of the methodology that the literature review phase continued throughout the study period rather than being done at the beginning, as: "the relevant literature is defined by the data you collect and your interpretation of it. This means that you begin collecting data first, then go to the literature to challenge your findings" (Dick, n.d. So why doesn't everyone use it? section). The author found that many of the references originally chosen, subsequently seemed irrelevant, and so were discarded. For example, because PacMARA has an organizational focus on producing products, the outputs of the organizations being studied seemed initially to be important reference material for this study; however they were not found to be relevant or citable references for this particular study once the author began this project. Instead, after some interview conversations about potential models for better science information creation and synthesis, this researcher found the literature on societal conceptual shifts in governance and resource management, as well as papers on science theory and the role of science in policy much more relevant to the questions under study.

Also, this researcher found nearly complete gaps in the evaluation literature both about trans-organizational models like PacMARA, and in the area of science collaborations specifically. This then meant that most of the reference materials about collaborations in this study were about planning and management, not specifically

science and research collaborations. These literature gaps speak to the relative newness and innovation of what PacMARA is trying to accomplish, as well as account for some outside interest in the results of this thesis research to better inform the field.

The author also intentionally looked for literature that would perhaps disconfirm the original thesis questions in order to provide balance, including reviewing some references on how increased participatory involvement has not always proven to be beneficial to resource management, and also about how ecosystem-based management science is elitist

Interview Component

Interviews were conducted September to December 2004 with representatives of four organizations (See Appendix 2): Fishermen and Scientists Research Society (four interviews), Centre for Marine Biodiversity (two interviews), North Pacific Research Board (five interviews) and the BC Coast Information Team (eleven interviews). In total, 29 interviews, each of one to two hours in length were conducted. Seven questions were asked of each case study interviewee (See Appendix 1).

The interviews were qualitative, descriptive, exploratory, conversational and sometimes narrative. Some of the interviewees in this thesis also provided suggestions to the researcher about other relevant literature, again in line with the act, review, act cycle of this methodology.

During the beginning of the thesis research process, four proposed theme areas of critical elements of science collaborations were developed by the researcher and were used to frame and then extract possible interview questions. This led to the creation of some possible criterion for evaluation, which were then further developed and are

described in a subsequent chapter. It became clear during the period of research that it would also be useful as a way to assess success in general and may be useful for others. This became even more evident after reviewing the range of other evaluation options and finding nothing that was specifically useful in its entirety.

It should also be noted here that the researcher initially planned to more fully analyze the interview information in this study than has actually been done here. Instead, the development of the evaluative framework became the focus for the second half of this thesis with the interview information serving only to illustrate its use through examples.

Methodological Limitations

As a research methodology – action research has its own constraints and limitations. Some of its detractors believe it is too vague and does not follow a rigorous enough scientific process, as well as being too subjective. Some also feel this methodology makes it too easy to introduce researcher bias as the researcher is a participant in the study. As discussed previously, some see action research as more of a vision than a method (Swepson, 1998). Indeed, this thesis project did not follow a prescribed or formal action research process. The author used general information from the action research methodology literature to develop a research project that seemed appropriate to this particular project. This study does reflect the general action research cycle of: act, review, act, review (Dick, n.d.). The thesis itself is one component of this cycle (act) and its success will be measured, in part, by whether it adds useful information to help PacMARA's development (review). Its recommendations may then be carried out (act) and used to inform the literature around action research and collaborations (review). Even with its limitations, this researcher strongly believes this

general methodology is the correct one for this project – mainly because of its comparable underlying assumptions to the PacMARA initiative, and because this methodology is a useful one for trying to get to the heart of the complex, linked questions, issues and context under study in this particular thesis. It should be added also, that no concern was expressed about methodological issues from any actor in this project.

The next section of this thesis examines in detail the possible theoretical justification for collaborative science and research.

CHAPTER 3 – THEORY AND ANALYSIS

Introduction

This thesis was commissioned to assist the Pacific Marine Analysis and Research Association (PacMARA) towards achieving its goal of producing better ecologically based information for decision-making in BC. PacMARA was created because a number of individual marine researchers, planners and analysts believed that marine sustainability could not be achieved in BC without a more collaborative scientific approach; and that no forum currently existed in which to work collaboratively. Nigel Haggan of the UBC Fisheries Centre put it this way: "No other BC organization was prepared to take the broad-based perspective necessary for marine biodiversity conservation that PacMARA was; no other group was even thinking this way" (Nigel Haggan, personal communication, October 22, 2004).

In order to begin to look at whether collaborative enterprises might be better at informing decision-making and planning, we must look at some of the relevant resource management literature and theory. The social context for this first thesis question being considered here incorporates a number of changing trends and new ideas in resource policy and management.

These include: continued research and experience globally with participatory and collaborative approaches; the changing role of government; and increased interest and commitment to integrated ecosystem-based approaches. Other important emerging ideas in this field include: societal conceptual shifts towards newer ways of thinking about resource management including concepts like complexity, resilience and adaptive

management; the growing use of local and traditional knowledge; and finally, the evolving nature of science and its role in decision-making.

This section of the thesis will situate and discuss PacMARA's emergence as a collaborative science initiative in BC through an exploration of the broader evolving social context, as well as some of these theoretical developments in resource management.

Collaboration - New Approaches and New Thinking

Participatory and consultative approaches in resource management are now quite commonly used in planning, decision-making, and more recently in science and research in Canada and other places (Dovetail Consulting Inc., 2004; Fisheries and Oceans Canada, 2004; Savan, Gore & Morgan, 2004). In fact, they are now seen in some areas as standard procedure (Jasanoff, 2003). This researcher has herself participated in participatory and consultative forums involving various resource issues in BC for at least twenty years. Collaboration in resource management is a more significant type of citizen involvement than these other kinds, and exists at one end of a continuum of practice. As described by Sherry Arnstein (Arnstein's Ladder) collaboration is sited on a much higher rung, part of the field she calls *citizen power*, as opposed to the ones called *tokenism* or *non-participation* (as cited in Dorcey, 2001, p 252). It is an inter-organizational partnership between two or more groups that is being increasingly chosen to advance goals that cannot be achieved by individual agencies, organizations or sectors (Roberts, 2004; Smith, McLaren & Wright, 2004). "It 'happens in the space' between traditional organizations and macro systems like society or government or community" (Roberts, 2004, pg 6). Ann Dale describes collaborative, integrated resource management

approaches as the only way to achieve sustainability because they deal with the prevailing "solitudes, silos and stovepipes" (Dale, 2001, p. 8) that have lead to our existing fragmented, rigid and ineffective institutions. PacMARA arose to respond to the need for this kind of collaboration, however, specifically at the technical level, to help move us towards sustainability goals. Technical collaboration can be seen as a governance strategy for the organization and dissemination of scientific knowledge. Before we can address the appropriateness of this strategy, we will look at the notion of governance in general and collaborative governance in particular.

Collaboration and Governance

Governance itself is broader than government. It is simply a description of a social function of shared responsibility and cooperation in decision-making, which can be applied to any administrative, management or political realm (Dale, 2001, Grzbowski & Owen, 2001; Savan et al, 2004). It is defined as "the interactions among structures, processes and traditions that determine how power is exercised, how decisions are taken, and how citizens or other stakeholders have their say." (Graham, Amos & Plumptre, 2003, p. ii). Governance issues arise at all levels of society, from global to local, and are increasingly seen as something critical that must be addressed in order to achieve sustainability. United Nations Secretary General Kofi Annan has stated that: "good governance is perhaps the single most important factor in eradicating poverty and promoting development" (as cited in Graham et al, 2003, p. 1).

These inter-organizational partnerships also need internal governance structures to support mutual goal setting, and an external institutional arena that supports governance in practice, hence the term collaborative governance (Ginger Group Collaborative, 2004).

Interest in collaborative governance has become more widespread with civil society's increased desire for a more significant role in government decision-making. In reviews of recent literature about governance, McCarthy found the "focus was a new appreciation for loosely structured governance entities that spontaneously emerge or self-organize" (McCarthy, 2003, p 4).

Development of collaborative governance theory and recent increase in examples of it in practice are an acknowledgement that government alone cannot understand or deal with all of society's issues and problems. It is also recognition of the complexity of issue management in the 21st century as collaborative governance is about sharing power. BC institutions such as the *West Coast of Vancouver Island Aquatic Management Board* are piloting new co-management governance systems with the Federal Government, for integrated management of aquatic ecosystems. There are many other examples, making it appear that collaborative governance organizations, including PacMARA, may be part of a growing trend.

Interest in collaboration as a governance strategy is also growing because some players are seeing its practical benefits. These include financial cost sharing and improved knowledge and social benefits; such as increased trust between participants which may perhaps lead to the ability to deal more effectively with conflict over resources. In 2003, collaborative research between Fisheries and Oceans Canada (DFO) and the Canadian fishing industry was valued at $27 million and consisted of 180 individual collaborative projects (Fisheries and Oceans, 2004). DFO values these partnerships and in general, expects various types of joint ventures with industry and others to continue to increase (Fisheries and Oceans Canada, 2004). The Executive

Director of the Fishermen and Scientists Research Society (FSRS), which is involved in one of these DFO-fishing industry partnerships, sees benefits in the creation of a "common language that may lead to greater understanding and stewardship of resources" (Patty King, personal communication October 12, 2004).

This pursuit of collaborative governance is one indication that there may be some societal justification for the existence of initiatives like PacMARA (Dorcey, 2001). It appears there also may be increasing interest in collaborative approaches both because of their practical benefits and because they reflect evolving thinking about the need for more complex governance models to address complex issues and achieve sustainability

Managing a Complex World

Another motivation for collaboration stems from the complexity of resource management issues. This section will look at some issues in complexity theory and their implications for management. It will conclude with a description of ecosystem-based management as a model that can perhaps be used to better manage a complex world, and in which collaboration is a fundamental precept.

Wicked Problems

The complexity of resource management and the subject area in which collaborative resource management has appeared is nicely described through Rittel and Webber's notion of *wicked problems* (Rittell & Webber, 1973). The contention made by Rittel and Webber, among others, is that some environmental problems are wicked problems, in contrast with tame problems, which may not be minor but are more routine and "can be tackled with more confidence" (Buckingham Shum, 1997, p 5). Wicked

problems are defined through a list of essential properties. Simon Buckingham Shum says wicked problems are ones that:

- Cannot be easily defined so that all stakeholders agree on the problem to solve,
- Require complex judgements about the level of abstraction at which to define the problem,
- Have no clear stopping rules,
- Have better or worse solutions, not right and wrong ones,
- Have no objective measure of success,
- Require iteration-every trial counts,
- Have no given alternative solutions – these must be discovered,
- Often have strong, moral, political or professional dimensions.

(Buckingham Shum, 1997, page 5)

Wicked problems abound in the real world. One example, which can be found close to home, is the ongoing issue of whether or not to lift the offshore oil and gas moratorium. (This is actually a Federal moratorium on tanker traffic off the BC Coast which has been in place since 1972, but which therefore, effectively, also limits any development of the BC offshore that would necessitate oil tanker traffic). Arguably, all of the above properties are exhibited in this example. Driving the conflict are two competing and fundamentally opposed perspectives on the future of northwest coastal BC. One of these is a vision for a mixed-use economy, with plenty of industrial activity to provide a significant tax revenue base and create well-paying, long-term employment in rural coastal communities. This, broadly speaking, is the view of the Provincial Government and of the BC Chamber of Commerce who represent much of the BC business community. Many other British Columbians also share this vision.

The contrasting vision, promoted by many ENGO's, First Nations and others in remote coastal BC as well as urban areas, is for a conservation economy focused on preserving natural capital and attracting economic activities with lighter footprints, like

tourism, shellfish mariculture and renewable energy. Crucial to this vision is the protection of existing First Nations' and other small-scale economies. In this scenario, the two sides have very different perspectives about the future of the northwest BC coast, and accordingly, they frame the issue of making a decision on whether or not to lift the moratorium on offshore oil and gas as utterly different kinds of problems. Because of this, what solutions might be proposed and what success might mean is not clear at all. This has led to an irresolvable outcome for decision-making about both development and conservation, and is evidence of a wicked problem. This competing vision issue is described well by the first property in the above list.

In this scenario, some British Columbians see the moratorium decision as a relatively straightforward political or public policy problem – 'we have enough information, government just needs to make a decision about the moratorium'. Others only too readily agree that it is not an informational issue. That is because they see it as a matter of principle, as a moral issue; and just as financial gain from a crime is no excuse for committing a crime, no factual information that might be presented to them has any bearing whatsoever on the question of whether BC's marine and coastal ecosystems should be violated in this way. Others opposed to both of these see it mainly as a problem of not having enough information to make a precautionary decision at this time, and believe we should simply postpone making it for 20 years or so. We might distinguish still another group that believes opponents to development would change their minds and support lifting the moratorium if they only had more and better information about how safe the industry is. Finally, yet another group would say that there is enough information already, and that information is conclusively telling us not to lift the

moratorium, ever. Needless to say, many of the individuals within all of these opinion groups don't recognize the other, different perspectives on this issue, and think their assumptions are the same as everyone else's. (Conklin, 2003)

Perhaps a collaborative approach to problem solving has more of a chance at overcoming the complexity inherent in a wicked problem such as this. Consultative and other participatory methods may work for more routine or tame problems, but cannot bridge the huge barriers shown in this example, and can sometimes even exacerbate the problem as these approaches underestimate the significance of conflicting world views. This is indeed true in this instance, as shown in the release of the recent Roland Priddle report. The independent panel in the report could not make a conclusive recommendation to the Federal Government about lifting the moratorium, even after reviewing 3,700 submissions. The Panel concluded that the views presented: "do not provide a ready basis for any kind of public policy compromise at this time in regard to keeping or lifting the moratorium." (Priddle 2004, p iii) Approaches like public hearings, reports and formal consultation with stakeholders may be able to address tame problems but cannot deal with the conflicts in an issue as complex as the BC offshore oil and gas moratorium. These approaches cannot deal with the fundamental problems in this issue, which are invisible conflicts over differences in worldviews (Chociolko, 1995). The example presented here also represents only one aspect of the complexity surrounding the debate about offshore oil and gas issues in BC, making this and other similar wicked problems "truly complex" and "complex all the way down" (as cited in Ludwig, 2001, p 799; as cited in Ludwig, Mangel & Haddad, 2001, pg 482). Decision making and governance in resource management is evolving from centralized command and control to multiparty

participatory approaches because, among other things, society no longer accepts those traditional approaches as they begin to realize how difficult it is to ever resolve these kinds of wicked problems without a more collaborative problem-solving approach (Conklin, 2003; Shannon, 2002).

Complexity and Resilience-More Reasons For Collaboration

Another way to look at wicked problems is that they are problems with an extraordinarily high degree of complexity. In this section I will address the concept of complexity as well as the related idea of resilience, and discuss how they too suggest a possible appropriate role for collaborative research.

So what exactly is complexity? Atlantic Canada fisheries scientist Anthony Charles proposes one definition that is quite informal but begins to describe the idea: a complex system is " one comprised of many components, with many interactions among those components." (Charles, 2001, p 222) The thought here is that the problem can't simply be broken down into a series of less complex problems that can then be managed (Faucheux & Froger, 1995). One of the leading thinkers in complexity science – theoretical biologist Robert Rosen - calls it "the property of a real world system that is manifest in the inability of any one formalism being adequate to capture all its properties" (as cited in Mikulecky, 3.2, para 4). Complex problems are ones that cannot be resolved through any single technical solution, recipe or formula. Complexity theory also suggests that there should be as much variety in governance, management and regulation as there is in the system being governed, managed and regulated (Berkes, 2004; Ostrom, 1998). This is because agencies or other actors, operating in traditional ways, and in isolation, cannot respond to wicked problems and deal with the uncertainty that exists in a complex

system. The desire for certainty and predictability which traditional structures across all the realms of governance, business and science have been taught to expect and work within are no longer sufficient. Participation and consultation in an era of complexity must evolve to instead become collaboration towards like goals.

BC's marine management arena involves a complex mix of users, issues, jurisdictions and long-term visions. Decisions must be made taking into account many disciplines, including the ecological, social, cultural, economic and community. Collaborative approaches may be better mechanisms to manage and govern this kind of complexity, because of their potential for increased linkages between ecological, social and other systems to help to improve their resilience. Resilience is the ability of a social-ecological system to respond to and recover from disturbance or change (Walker, Holling, Carpenter & Kinzig, 2004).

It reflects the understanding that social and ecological systems are linked and that present management regimes are outdated (Finlayson & McCay, 1998). Resilience theory suggests that existing mechanistic, linear, command-and-control, centralized governance structures are no longer sufficient to manage towards a sustainable future and will put resilience at risk, since, among their other limitations, they are not set up to recognize these linkages. (Clark & Doubleday 2003; Holling & Meffe 1996; Walker et al, 2004). Resilience theory has itself given rise to the idea of collaborative approaches and other innovations in resource management. Collaborative ventures are a type of governance system that may recognize and adapt more easily to uncertainty and to changing circumstances. Collaboration also means an expanded peer community with more linkages to other knowledge groups and disciplines. Wicked problems, complexity

and resilience are phenomena that, it seems, cannot be adequately dealt with through the traditional resource management models we are currently using that focus on managing isolated elements instead of whole systems. Various management models could perhaps be found to better address wicked problems and deal with complexity and resilience. One of the newer theories and perhaps one component of a suite of management approaches that reflects some of the above described emerging concepts is known as "Ecosystem-Based Management".

Ecosystem-based Management (EBM)

In general, Ecosystem-Based Management means managing systems rather than just managing individual elements within systems. As well, it “requires the integration of sociocultural, economic and biological dimensions of ecological systems “ (Lee, nd, p 10) If done thoughtfully, it incorporates the concepts discussed in previous sections above, as well as addressing issues of risk and uncertainty, the use of appropriate scales, adaptive management, and the precautionary principle. (Finlayson, et al, 1998) The integrative nature of EBM also suggests that it must be designed collaboratively.

Government agencies in Canada are now trying to develop EBM approaches in order to deliver on their legislated responsibilities for ocean management under both Canada’s Oceans Act and the National Marine Conservation Areas Act (Jamieson et al. 2001; Oceans Act, 1996); however, wicked problems and complex systems do not respect administrative and political boundaries. Some would say that the application of EBM principles, objectives and indicators must be done collaboratively with both experts and stakeholders, in order to properly reflect the principles of EBM (Coast Information Team, 2001; Cardinal & Day, 1998; Lee, n.d.).

The Pacific Marine Analysis and Research Association was created to undertake collaborative research and analysis that will inform and support an ecosystem-based approach to marine planning, marine conservation and marine resource use in British Columbia. PacMARA members believe that collaboration amongst a multi-sector, multidisciplinary group of knowledge holders will help build a more defensible and broadly-based consensus around EBM questions and answers than if agencies attempt to do it alone (Holling & Meffe, 1996). Hopefully, this will also then result in better information being provided for decision-making and planning.

Criticism of the concept of ecosystem-based management does exist, with some seeing it as a way for scientific experts to "maintain hegemony, because only experts will be able to determine how complex ecosystems function, and devise standards and criteria for meeting the goal of sustainability" (as cited in Cortner, 2000, p 27). In short, however, this criticism is really directed at a less than ideal model of EBM. If done collaboratively, incorporating multiple disciplines and using local and traditional sources of knowledge, EBM will involve a larger peer-community and a more fully expanded definition of expert, invalidating this particular criticism (Cardinall and Day, 1998; Coast Information Team, 2001; Funtowicz & Ravetz, 1993; Lee, 1993; Parks & Panelli, 2001; Zanetell & Knuth, 2002). There is a genuine concern here, however the concern may be perhaps more rightly directed at agencies or organizations that are currently attempting to construct ecosystem-based management approaches in isolation of the broader community. It must also be stated that another criticism of this approach is that "EBM" still a largely unproven and untested theory which has yet to prove an effective response to the underlying imperatives.

The Role of Science

"…the rise in importance of the history and sociology of science as academic disciplines has led to a more complex characterization and debate about the nature of science."

Steel, et al. 2004

In this section I will look at the demands and challenges faced by the natural sciences in the modern era as well as some of the issues involved in incorporating science information into decision-making. This section will also describe some of the new thinking about science that suggests a role for collaboration.

Science Under the Microscope

The criticism of the role of experts in EBM is an example of how natural science, with its claim to independence and objectivity is lately being looked at more closely. The purpose of science and its proper role in resource management has come under examination in the past few decades as many feel it has "come to assume great moral authority in politics and society" (LeRoy & Cooper, n.d., Policy section). With assumed authority comes legitimacy questions, and science has not escaped these. Understanding existing views about the role of science in public policy will add a further dimension to understanding the place of collaborative science organizations.

So what is the role of science and scientific discourse in policy making, and how does this relate to the idea of collaborative science? The demand for scientific results to inform decision-making has increased because of growing evidence of human impacts globally, including increased population pressure, industrialization, new technologies like

genetic engineering, and our role in climate change (Jasanoff, 2003; Lee, 1993; Lubchenco, 1997). The world's population continues to climb exponentially and exploitation of natural resources grows apace. We now have all the technology we need to fish every last fish out of the sea. This increasing evidence of human power over nature has fuelled a public demand for more science based environmental policy at all levels of government (Steel et al, 2004). Increased scientific knowledge is at the heart of these problems, and so we now see the need for science to solve them. Interestingly, this demand for scientific solutions has happened despite the increasing popular concern about the legitimacy of science.

Demand has also increased with newer analytical tools like GIS and modeling, as well as greater global communication abilities (USGS Science, 2002). Members of society now have both a greater concern and a greater ability to be involved in science and research at some level. PacMARA has arisen in the midst of this modern arena where science is both demanded and challenged. The organization wants to use the increased ability for analysis, synthesis and communication of information to better address the critical questions being demanded of science. At the same time, questions about the legitimacy of science challenge all scientific initiatives, including collaborative science. PacMARA is indeed living close to contradiction.

Traditionally, the role of science in policy development and planning has been to improve decision-making by providing information that will create a better understanding of the problems and implications of various policy options. Science also has a role in monitoring and evaluating the chosen results and consequences (Lubchenko, 1997; Wagner, 2001). In the past, science has usually been thought to play a very neutral non-

political role, leaving decision-making to others (Hoberg, 2004). In fact, Wagner states that science is indispensable as "the only reliable source of illumination into a process that otherwise becomes merely a shadowy game of power politics" (Wagner, 2001, final paragraph). However, even if its traditional role is being questioned, that is not to say it has no role to play. There is a need for rigorous scientific information to support and inform both political and policy decisions at all levels.

Nevertheless, scientific inputs to decision-making don't always answer all the questions right, or answer all the right questions. Scientists are not necessarily asking the questions politicians or the public want them to ask and they don't always have the answers people are looking for. As well, new research often brings to light new questions (Jasanoff, 2003). Science has also sometimes failed to resolve issues that people think it should, such as in the example of conflicting scientific information about the degree of human responsibility for our changing climate. These days, science does not seem to be playing the same role in illuminating policy and political decisions as it did in the past (Hoberg, 2004). Actually, we ask a lot of science, and it suffers from our conflicting demands. We go to scientists asking for information but when that information comes back and doesn't fit with our other needs, we sometimes choose not to listen to it.

In an increasingly complex policy and management environment, scientific information seems to be only one of many factors in resource related decisions. One reason why the role of science in decision-making is not completely clear-cut is that decisions made using science and research are really ultimately negotiated and resolved in the realm of society's values, ethics and ideology. Certainly in the context of this

research the relationships between science and policy, facts and values, are very important. As well, some would argue that science is socially constructed (Allen et al, 2001; Weeks & Packard, 1997) and therefore not objective and not able to "deliver truth that is non-arguable" (Cortner, 2000, p 23). This is another area of context through which to look at how science is delivered.

Science and Resource Decision-Making

Another issue complicating the role of science is that the traditional scientific model ("rational-analytical") is different than the model used in planning processes and in society in general ("bargaining-conflict containment") (as cited in Cortner, 2000, p 26). This means that, as it is presently being used, science is sometimes completely ineffective in making a popular case for itself as a critical input to important policy questions. As an example, one of the issues faced by the BC Coast Information Team (CIT), was that one of the planning tables for which research was being produced did not feel that the CIT products were absolutely necessary to the decisions they were trying to make; to the extent that rather than delay planning because of late deliverables, the table members discussed voting on whether or not to simply continue without using the CIT products at all. No convincing rationale had been presented in advance by the CIT to the planning table members that persuaded them that the information being produced was crucial to the decisions they were being asked to make. While the Coast Information Team was an innovative collaborative science organization, it did not completely get beyond the 'rational-analytical' idea that producing better information would always result in better decision-making.

Finally, one more problem in the realm of science and decision-making is that information may sometimes be used to mask unpopular policy decisions. This can happen through a lack of clarity and boundaries around the role of science, as well as by a lack of understanding that science is itself, touched by values (Hoberg, 2004; Shannon, Meidinger, Clark, 1996). One specific example of this problem comes from the forest sector in the 1990's, during the heat of the conflict over the endangered spotted owl. During this period, the Clinton Administration established an interagency science committee called the Forest Ecosystem Management Assessment Team (FEMAT). FEMAT proposed new rules requiring more ecologically focused management on US Forest Lands to provide protection for the spotted owl and its habitat and a version of these rules was passed by the U.S. Congress in 1993. Hoberg argues, however, that these recommendations were, in fact, not scientifically justified, and this was instead an example of government avoiding a difficult, value-laden political decision by instead pointing to the recommendations of their scientific committee (Hoberg, 2004).

So how then do these issues about the credibility, legitimacy and role of science apply to PacMARA and other collaborative science endeavours? PacMARA was created because its members believe that doing science collaboratively will produce better information for decision-making. As we have seen, science, in its present form, does not seem to be completely meeting our 21st century needs. These issues and examples presented seem to suggest that traditional scientific approaches may no longer be sufficient for the cause. Could other scientific approaches, including well-designed collaborative ones, perhaps offer us another better option?

New Thinking About Knowledge

While there is still a vital role for traditional positivist science in answering bounded questions, it appears we need to define a new process for generating and using information that reflects the complexity of the issues that exist in marine management in particular, as well as, perhaps in other spheres. This is where collaborative science and research may offer us a helpful alternative.

This debate about science emerges alongside the societal shifts in thinking that we have already examined, such as complexity, uncertainty and risk, and the need to integrate ecological and sociological disciplines in order to manage and recover from change. Funtowicz and Ravetz see the need for a more complex "post-normal" science that reflects "the assumptions of unpredictability, incomplete control and a plurality of legitimate perspectives" (Funtowicz & Ravetz, 1993, p 739) While *normal science* is generally about typical, routine applications of known techniques, *post-normal science* acknowledges that our environmental problems are ones where 'typically facts are uncertain, values in dispute, stakes high, and decisions urgent." (Funtowicz and Ravetz, 1993, p 744). Many of our problems are not routine problems anymore. A new approach to science is needed when issues are less about facts and more about philosophy, ethics and conflicting societal values (Allen et al, 2001; Ludwig 2001; Funtowicz & Ravetz, 1993). Post-normal science, as Funtowicz and Ravetz describe it, is a shift in thinking about science to an acknowledgement of wicked problems and complex issue management. It recognizes, among other things, that environmental, social and ethical issues can no longer be considered externalities to science and research (Funtowicz & Ravetz, 1993). It acknowledges that where previously all facts were hard and values were soft, very often now values are hard and facts are soft (de Graaf, Musters &

terKeurs, 1995; Funtowicz & Ravetz, 1993;). Post-normal science is also fundamentally, collaborative in nature.

In his seminal paper, Alvin Weinberg calls this complicated science situation *trans-science* (Weinberg, 1972). One interpretation of his original concept says that trans-scientific problems are ones that "can be posed to science, but cannot be solved by science alone" (Paterson, 2003, abstract, p 1). These are decisions that are informed by science, from which possibilities and issues are identified, and from which, a dialogue and ultimately a negotiation about a vision for a sustainable future occurs (Carr, 2004; Kay, Regier, Boyle & Francis, 1999; Hoberg, 2004, McCarthy, 2003,). Science collaborations may be a better alternative for generating scientific information, if they involve socio-economic and other disciplines and so acknowledging that facts and values are linked and science is only one input to decision-making. Much the same as how EBM may be a better management model for managing a complex ecological system, multi-sector, multidisciplinary science collaborations may be a better model for generating and communicating scientific information within a complex social system.

Finally, however, we must also consider one final important point. We are still really only making an assumption that better information will ultimately lead not just to better decision-making but also to better outcomes. Most would agree that achieving true sustainability in BC's marine environment will take broader societal understanding and commitment than just improvement in the area of science and information. From better science to better decision-making to sustainability actually covers a spectrum of choices that leads to another important question: in what way should science (facts) and

decision-making (values) be integrated to achieve better decisions in the form of sustainability outcomes?

From Science to Sustainability?

PacMARA arose from the belief that better scientific information would lead to better decision-making, which would then ultimately lead to sustainability in the marine environment. However, as this discussion here has shown, linking better information to better decisions can be challenging enough in the messy world of human beings, let alone ensuring that better decisions will lead to sustainability. PacMARA is a science-based organization operating completely separate from decision-making. This was done deliberately in order to keep facts separate from values to preserve the integrity of both. As a non-advocacy NGO, PacMARA's role is simply to collaboratively produce or facilitate development of information and make it accessible for planning and decision-making. At the same time, however, PacMARA was created because its members believed strongly that better decisions made through use of better information would necessarily result in sustainability in BC's marine environment. But as we have already seen, from the perspective of government or the public, far from being the only input, science may not even be the most important input to planning. Scientific input is part of the dialogue, which is however, also informed by issues of "equity, liberty, democracy, justice and community" (as cited in Cortner, 2000, p 25). In fact, some see science as just another form of political argument (Cortner, 2000) and would argue that science has to get its point across in a debate much the same as other sectors, like the economic and the social. In fact, the realm of science itself could actually be considered a kind of negotiation. Scientists lobby for funding, they interact with their peers, they agree or

disagree over results of their research. Even if a scientist is entirely devoted to discovering the truth, the context around scientific inquiry is still filled with possibilities for negotiation (Chociolko, 1995). So if PacMARA produces better outputs in the form of better information are they also assured of ultimately producing better outcomes? This question leads us to consider more closely the concept of integration as another important aspect of the science and decision-making discussion. Because of the range of complicated issues around the role of science in policy making, there is a longstanding debate about whether science should be more independent of decision-making, or more closely integrated with it.

As we have already said, PacMARA has set itself up to operate completely separate from decision-making, however, the organizations examined as part of this thesis show wide variation in rationale, policy and application on this point because of their own unique circumstances. The literature also reveals disparity on this point. Funtowicz and Ravetz et al. call for a post-normal science with a closer involvement of scientists with bureaucrats and decision-makers (Funtowicz & Ravetz, 1994; Steel et al, 2004). Sayer and Campbell would agree, and state: "researchers need to become actors in the systems they are working with; they cannot remain outside the system as totally objective observers." (Sayer & Campbell, 2004, p 42). Many advocate a complete breakdown of the present system that they say, incorrectly separates research from management. They believe that research and management should be completely integrated and research design become a shared or joint learning experience for scientists, decision-makers and stakeholders; only in this way can we have better decision-making outcomes (Berkes, 2004; Fall, Daust & Morgan 2001; Sayer & Campbell 2004; Shannon

et al 1996; Shindler, 2001; Steel et al, 2004) Others simply see the need for integration as inevitable, because science and values are tightly linked (Bradshaw & Bekoff, 2001; Hunt & Shackley, 1999). Some believe the Atlantic Canada northern cod crisis was caused, in part, because of the isolation of scientists from policy makers (as cited in Finlayson & McCay, 1998). This is because, if the scientists, managers and resource users in this situation operated with different knowledge and under different assumptions in an incredibly complex linked ecological, social and economic system, how can scientists in one agency, operating in isolation, expect to produce useful and accurate information to guide managers and policy makers?

On the other hand, some say, there is a danger of political interference here so we should have absolute separation. Using this same example of the northern cod crisis, some advocate for the complete separation of science organizations from management, citing examples of political interference with scientific advice, interference that included, as an example, DFO's dismissal of scientific advice from a local Atlantic Canada fishing sector organization, advice that was later corroborated by DFO. (Hutchings, Walters & Haedrich, 1997; Sissenwine & Mace, 2001) Here some research just happened to be produced by the 'wrong' group so some important information was thrown out instead of being considered and perhaps resulting in a different outcome. This issue is also often seen in BC as well, with science and research produced by Government, ENGO's First Nations and industry all being discounted as biased from time to time. No one source of information is considered credible, so not all of the available information is being used in decision-making, which may ultimately have an impact on sustainability. Some

researchers present the specific solution of independent science teams or institutions as a remedy to this problem (Hutchings et al, 1997).

PacMARA was created to take advantage of the broad consensus available through a large trans-organizational collaboration to legitimize and support creation and synthesis of information from a variety of sources and disciplines, but it is still set up with clear boundaries between itself as an independent science body, and planners and decision-makers. The organization has not tested its assumption that a completely separated science organization may in fact be less successful than one that is more closely integrated; although the principles PacMARA operates under might suggest closer relationships rather than not; joint science rather than independent science.

It has also not been made clear yet that even if PacMARA helps to produce better information that this will ultimately lead to better sustainability outcomes. The next section of this thesis will look at some ways to evaluate success or failure of collaborative science organizations and perhaps shed more light on this issue.

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CHAPTER 4 - EVALUATING COLLABORATIVE SCIENCE

> "Generally, it is agreed to be the trusting relationships among people that facilitate collective action and access to resources."
>
> Jane Jacobs, The Death and Life of Great American Cities (1961)

Introduction

This section of the thesis will look at some possible ways of assessing collaborative science in practice, in response to the thesis question: *How might collaborative, transorganizational science and research initiatives be evaluated to help them improve their delivery of effective results?*

The Pacific Marine Analysis and Research Association is a new organization and a new innovation in BC; whose mission is to produce products and facilitate the development of collaborative marine ecosystem-based research and analysis initiatives. PacMARA arose spontaneously, from the grassroots, not in response to any government decision or recommendation from a planning process, and therefore, without any external operating system to guide it; or any framework or criteria by which to evaluate its successes or failures and improve it.

Because of this, the organization decided research assistance through this thesis project might provide some important information to help PacMARA progress from being simply a good idea to operating as a successful, functioning venture. PacMARA was not searching for a specific organizational model to duplicate, but the group agreed that looking at lessons learned through experience, in a range of other organizations, might provide important information about best practices and criteria for how to evaluate

PacMARA's internal processes at this early stage in its history, perhaps helping the group avoid problems already experienced by others.

PacMARA also had another need, which was to be able to assess its progress and success through a more externally focused results-based evaluation. This is important in order to gauge its progress as well as respond to questions from partners, decision-makers, funders and its own constituency, about, for example, legitimacy, credibility, value, and how, contextually, the initiative fits in with what else is already going on (Conley & Moote, 2003, Possingham, 2001).

Finally, Conley and Moote propose yet another reason for evaluation of collaborative initiatives, which is to help "refine and institutionalize a movement which has developed largely at the grassroots level" (Conley & Moote, 2003). This third reason is indeed also relevant here as the research questions and the initiatives being discussed are all towards making normative what is currently an exception in approaches to marine science and research. Evaluation against broader goals is important for building a case history of successful experiences in the natural resource community with collaborative science and research endeavours.

So, PacMARA and other science collaborations have three overall purposes for evaluation. These are:

1. A need to evaluate internal process successes and failures towards improvement of the organization,

2. A need to evaluate progress and results, particularly for external scrutiny, and

3. A need to evaluate success more broadly in response to the emerging conceptual societal vision about the need for collaboration in general.

However, evaluation both for internal and external purposes can only take place if a suitable framework and criteria exist to be evaluated against. Can PacMARA locate an appropriate evaluative framework that clearly identifies critical elements of success criteria for collaborative transorganizational science and research initiatives?

In the next section this researcher will examine some existing evaluative frameworks to see if they might be suitable for use here, and then discuss why these were eventually discarded. A new framework will then be proposed which was created specifically in this study and for use in evaluating transorganizational science collaborations. The usefulness of this new framework will be reviewed using some selected examples from four other similar organizations.

Evaluative Frameworks

So how does one discuss and evaluate the elements of success for transorganizational science collaborations like PacMARA? Only one literature source was found, indeed published during the same period this thesis was underway, that specifically looked at evaluating transorganizational partnerships (Roberts, 2004). And no sources were found of frameworks specifically for assessing transorganizational science collaborations. There are, however, many examples in the literature of evaluative criteria for participatory planning processes, as this area has a much richer research history. So, would one or more of these planning related frameworks also work for assessing a transorganizational science collaboration? In this section three examples of existing evaluative criteria will be reviewed; two are for planning - of which one is for evaluating planning outcomes and one for evaluating process - and the third is for use in transorganizational collaborations. This section will look at the appropriateness of each

of these three frameworks for evaluating transorganizational science collaborations such as PacMARA. It should be noted, that there, of course, might also be other frameworks that could have been reviewed for this discussion, but the researcher found these three to be very broadly representative of what exists.

The first two frameworks discussed here were developed specifically for evaluating planning processes. Thomas Beirele evaluated public participation in environmental planning in the Great Lakes region of the USA. To do so, he created a framework involving six social goals and used the Great Lakes study as a pilot project to find out how useful this approach was. Beirele laid out a social framework for evaluating environmental outcomes as he believes environmental decision-making must be viewed through a broader social lens, since the results of planning processes will impact more than those directly involved in a specific planning initiative. The six social goals Beirele developed as the bases of his evaluation are:

- Educating and informing the public
- Incorporating public values into decision-making
- Improving the substantive quality of decisions
- Increasing trust in institutions
- Reducing conflict, and
- Achieving cost-effectiveness

(Beirele, 1999)

He then broke these down further into context and process attributes from which interview questions in his study were then extracted.

Closer to home, Dovetail Consulting, in BC, described a Process Structure Framework in a recent evaluation of the design and implementation of various collaborative multistakeholder initiatives in Canada, the USA and Australia. They explain how it can be used to "evaluate, design and implement a collaborative

initiative...to make sure a process is meaningful and will lead to lasting outcomes" (Dovetail, 2004, p. 7). In their evaluation, they used this framework to analyze the success or failure of each of the planning processes reviewed. Like Beirele's, this framework was specifically developed for use in assessing planning initiatives, however, the difference here is that this one is specifically about evaluating process rather than outcomes. The Dovetail framework includes six principles, which are each then also further broken down in more detail:

- Common purpose and definition of problem and commitment to collaborate
- Inclusive and effective representation of interested parties
- Effective process management
- Effective process design
- Structured and integrative decision-making framework
- Equal access to information.

(Dovetail, 2004).

The third evaluative framework considered here was not developed for evaluating planning but as a "Tool to Determine Transorganizational System (TS) Effectiveness" (Roberts, 2004, p 56). Its focus is on evaluating the effectiveness of this specific organizational model in practice, as the author's professional expertise is in building successful collaborative partnerships. It is also slightly different from Beirele and Dovetail, as it is not really a tool towards implementation of some results, but more for use by organizations that have been in existence for some time and are in the process of evaluating their efforts through internally focused strategic planning. The Tool has six phases and each phase then contains a further extensive list of questions for consideration:

1. Determining the need for a TS and exploring the problem set
2. Motivation to collaborate
3. Member identification and selection
4. Collaborative planning

5. Building an organization
6. Evaluation

(Roberts, 2004)

The three examples considered here do generally reflect the broad spectrum of existing evaluation mechanisms - from evaluation of outcomes, process and organizational effectiveness, to internal and external goal evaluation. (Conley & Moote, 2003) There are four significant reasons, however, why the researcher decided these frameworks were not completely sufficient for the purposes of this study.

1. Criteria relevant only to planning process models

This first issue speaks to the overriding conceptual difficulty with using either the Beirele or Dovetail frameworks in their entirety; in that they were both designed for use in the sphere of negotiation between diverse and possibly conflicting interests - i.e.: a multistakeholder planning process; not a collaborative endeavour. PacMARA and the other organizations in this study are transorganizational collaborations, not stakeholders in a planning process. This is a different kind of organizational entity. As discussed in a previous section, collaboration is more like a partnership or joint venture between parties with a common goal, than an arena for negotiation and compromise; although of course, this does take place, to some extent, as it does when any group of people get together to do something. However, some of the evaluative criteria in the Beirele and Dovetail lists are there because they relate very specifically to areas often at issue in successful multistakeholder planning processes, such as: conflict, willingness to collaborate or not, varying degrees of trust in institutions, and difficulties accessing data. As desirable as principles to remedy these issues are, for our purposes, they are not appropriate

evaluative criteria. These particular evaluative elements are critical for successful planning processes but for PacMARA, these would be more than just evaluative criteria; as they are part of a reason for being. Yes, through PacMARA's efforts the group hopes to, among other things, reduce conflict, increase motivation to collaborate and increase equal access to data in the general marine community. However, these are not arguable or negotiable amongst PacMARA's membership. In fact, these principles would be more at home in the mission statement or vision of a collaborative science organization such as PacMARA, as they are principles fundamental to its existence. Therefore, although some of these are desirable criteria in general, some of the elements in these two lists do not constitute appropriate evaluative criteria because they represent a different kind of initiative than what they were created for.

2. Very general criteria

The researcher felt that some of the elements in the above lists are simply good practice for any general organizational activity; including: representation, effective process management and process design. In fact, most general principles of good process apply to many types of participatory work, and as a result, many of these are naturally reflected here. The fact that they must be included as planning process evaluative criteria also reflects the very basic difficulties inherent in multistakeholder negotiation scenarios; however, some of these are so basic they are just not very useful for the purposes at hand.

3. Irrelevant criteria

Some of these elements are not related to PacMARA's very specific, bounded goals. These include ones like: educating and informing the public or achieving cost-effectiveness, so these criteria are easily excluded.

4. Important criteria absent

Because PacMARA and other science collaborations have a specific mandate, they also have specific issues that need to be considered in evaluating success. One of these in particular is not described in any of these frameworks, which is: is good work being produced? PacMARA intends to produce synthesis and analysis products, which will themselves need to be evaluated. There are no criteria in the other lists that reflect this particular need. Secondly, PacMARA wants to evaluate results as well as process, and this combination of process and outcome evaluation is not reflected perfectly in any of the three frameworks above. It is these gaps, actually, that really, finally serve to exclude the use of any of these frameworks in their entirety.

It must also be noted, however, that although these frameworks do not work as a whole for these specific purposes, there are some relevant and useful items in each of these lists. These can be found repeated to some degree within the newly created framework as described in the next section, including, as examples: determining the need for the organization, improving the substantive quality of decisions, and agreement on common purpose and definition of problem.

Finally, it is important to consider that there also may be other useful framework examples out there that could have been reviewed, but that the researcher did not use,

such as the well known "10 Guiding Principles of Consensus Processes" from Canada's National Round Table on the Environment and the Economy (Cormick, Dale, Edmond, Sigurdson & Stuart, 1996), or perhaps even the Institute on Governance's "Principles for Good Governance in the 21st Century" (Graham et al, 2003). So, the researcher concluded that although there were also at least some useful elements in these as well, none of the ones closely examined or briefly referenced here were exactly right and worked in their entirety for the purposes of this project. Some of the pieces work, but as a whole they don't work for the particular needs of a transorganizational science collaboration or to address the research question under study.

In this regard, the researcher decided that a new framework appropriate to the task was needed. This is a good example of how the cyclical methodology of action research works and why it was the appropriate choice for this study; the initial thesis research led to an assessment that there was no useful framework in existence so an action was taken to create one, which will now then, further inform the research.

A New Evaluative Framework for science collaborations

The framework proposed here has four overall criteria; which are then each broken down into more detailed explanatory elements. Early in the thesis process, this researcher created this list of theme areas and descriptive elements in an attempt to generate an outline from which interview questions could be extracted. It became clear during the course of this research that these themes were actually more significant than first thought and were in fact, appropriate criteria for a new evaluative framework for evaluating transorganizational science and research collaborations. This new evaluative framework is now formally being proposed here.

The four criteria are:

1. **Valid reason for being**
2. **Produces good work**
3. **Clear relationship to decision making**
4. **Truly collaborative in approach**

In the previous chapter, we explored the theoretical justification for transorganizational science collaborations. We will now look at some existing, place-based collaborations through the lens of this framework. While the first interview question looked at theory, this second one here is looking at practice. In the following section, each of the above criteria will be discussed briefly in relation to one or more of the organizations examined in this research to illustrate how this evaluative criteria could be used in the future for formal evaluation purposes.

The thesis will conclude with some final discussion and recommendations, including posing some other essential questions that might to be addressed in future research.

Illustrating the Framework

Valid Reason for Being

This criterion is important for evaluating a transorganizational science collaboration because this particular governance model is still considered innovative and to some extent must justify its existence epistemologically. In simple terms, this criterion asks the question "why"? It can be defined by a number of intuitive elements:

Reflects current reality/ reflects pasts lessons learned/supported by emerging theory/endeavour suits place and time/has epistemic

credibility/seen as legitimate and potentially useful/broadly supported/would be missed if gone/relevant.

These elements can also then be further grouped into two themes. The first one is closely connected to the theoretical justification for this type of initiative as discussed at length in the previous chapter (reflects past lessons learned, supported by emerging theory, has epistemic credibility). The second theme, containing the balance of the elements, relates to contextual factors in the external environment where the initiative is underway. This is still why - but in practice.

The four groups examined here came into existence because of either some formal external mandate or recommendation (Fishermen and Scientists Research Society, North Pacific Research Board, BC Coast Information Team); or, because of a commonly perceived need or belief, from which a grassroots initiative then took shape (Centre for Marine Biodiversity). Their 'reason for being' is unique in each case but can begin to be validated or reconfirmed using the elements here.

For example, the Fishermen and Scientists Research Society (FSRS) arose out of a recommendation made in 1989 from the Hache Task Force hearings into groundfish management in the Scotia Fundy region of Nova Scotia, to support more collaborative initiatives between the DFO and the fishing industry (Zwanenburg, King & Fanning, 2000; King, Elsworth & Baker, 1994). The recommendation about collaborative science by the Task Force reflects past lessons learned through the Atlantic Canada cod crisis about the need for better relationships between fishermen and scientists in order to make sure critical information makes it into fisheries management decisions. Similarly, in interviews with members of the FSRS, interviewees identified, among other points, that

the level of commitment in personal time from both DFO and fishermen to this project was invaluable and impossible to calculate, and that the fishing industry had become very comfortable with the FSRS as the hub for this information focused dialogue. "Participation of fishermen has led to talking in a common language" (Patty King, personal communication, October 13, 2004). The FSRS is seen to be relevant and broadly supported in its community. The organization has managed to build a bridge between the fishing industry and the Federal fisheries agency through production of information now considered invaluable for decision-making. The FSRS accomplished this because they were seen to be credible and useful, and have become more credible and useful because of the work they continue to do.

In contrast, the Coast Information Team was considered by most interviewees to be contentious and its reason for being was not so easily affirmed. While many talked about how important this initiative was for BC and towards future sustainability, some described that it was born into a highly politicized, chaotic environment, tainting from the beginning its legitimacy and credibility. Others described a lack of integration between this initiative and what science initiatives BC government agencies were already doing, with in fact, the same agencies, from time to time, also endorsing competing products and projects. Some said that the CIT's purpose was in fact unclear, and sometimes appeared completely different to various participants, indeed also driven by some sector groups. One interviewee said it in fact failed in its fundamental reason for being, which was to produce independent science. It must be noted, however, interestingly, that none of the concerns with the CIT related to this criterion were around its theoretical justification, but instead were entirely about the external environment in which it operated.

Produces good work

This criterion is necessary for evaluating a transorganizational science collaboration because the focus of the effort is around either producing products, or facilitating their production. This criterion is also one of the ones not found in other evaluative frameworks mentioned in this review.

It is defined here through the following elements:

> *Asks and answers the right questions/produces useful, desired, perhaps better products/work is peer reviewed /incorporates knowledge from many sources/work becomes a model for others/supports like initiatives/fills an existing gap/work is technically sound*

As an example of how this criterion might be used, we could look at the BC Coast Information Team (CIT). The CIT came about through the implementation of the 2001 Central Coast Land and Resource Management Plan Framework Agreement. Its purpose was to provide independent information and analysis towards ecosystem-based management for Northwest BC's strategic land use planning processes. In the interviews with CIT members for this thesis, there was tremendous disagreement between interviewees about the usefulness, quality and value of the work that was produced by the CIT. Although in the broadest assessment, the scope of work was hailed as critical, groundbreaking, and a model for others to improve upon in the future; the products themselves were described by various interviewees as: not capable of being implemented from a policy perspective, ineffectively peer reviewed, late - meaning they were not

always used, disconnected from local information and science, not well integrated or contextualized, at the wrong scale, addressing the wrong questions, and sometimes even technically unsound. This criterion originally seemed to this researcher to be the most straightforward, but in fact it is probably the most complex one in the framework and the one that will need the most refinement to be ultimately helpful for evaluation purposes. In an area of science and research like ecosystem-based management, much of the work is still very unbounded and cutting-edge, with relatively few experts to either produce or peer review it. What good work means, in this new context, requires more exploration.

In contrast, all FSRS interviewees spoke easily about specific projects that were considered well done by this group, in particular, lobster assessments; however, it might be argued that this was primarily basic data collection and analysis which could be considered much more routine, and perhaps easier to label good or poor work than more complex, expansive ecosystem-based management projects.

Clear Relationship to Decision-Making

This criterion is significant because it is the one that links the production of information to the management system where it would be used. Without this link, creating better information has no purpose. Good work would be work done in a vacuum. This criterion can be described using the following elements.

> *Linked or having a clear relationship to planning, management and or decision-making structures/non-advocacy nature understood by all/clear communication of results/knowledge of policy arena and*

issues/research is made available and accessible/understood mandate and-or authority

As an example, The North Pacific Research Board (NPRB) was created in 1997 through an act of the US Congress to make recommendations about science funding needs to the US Secretary of Commerce. It is an independent, stand-alone organization but has close linkages to the North Pacific Fishery Management Council (NPFMC), the fisheries management body for The Gulf of Alaska, the Bering Sea and the Aleutian Islands. The NPFMC was established under the 1976 US Magnuson-Stevens Fishery Conservation and Management Act to oversee management of fisheries in these areas. In interviews about the NPRB most interviewees were hopeful and confident that the right structures were in place for their research results to be used to inform fishing plans and habitat related decisions of the NPFMC. The Executive Director of the NPRB described an initial measure of success for this, which involved seeing NPRB products compiled and put forward as part of the collection of research reports used to develop fisheries management plans through regular NPFMC meetings. Examples were described of where this had actually happened to date for specific pieces of research. This relationship is an example of one model of how the linkage of science and decision-making could look in practice. (This is in contrast to the CIT model, where their products were primarily produced at the request of the planning bodies). Here there is no formal linkage between the two organizations but a type of relationship to decision making still does exist, as NPRB research is accessible and made readily available to be taken up for use in management and decision-making. Some interviewees did also note, however, that there

has been some discussion from time to time about establishing some more direct formal linkage between the two groups.

Collaborative in Approach

This criterion is important because it is about the organization itself and how its internal operations help or hinder it in meeting its organizational mandates. Will it survive and thrive? Will its own members support it as it does its work? Is there good internal process to deal with problems that will inevitably arise? This criterion can be defined through the following elements:

> *Internal organizational stability/ terms of reference in place/ shared vision and goals/has operating procedures and policies that reflect the collaborative model/funding stable/credit given for work done by member organizations/autonomy of member organizations/conflict of interest addressed*

For example, the Centre for Marine Biodiversity (CMB) was established in 2000 to focus on enhancing scientific information towards protection of marine biodiversity in the Northwest Atlantic. The CMB has a formal structure that includes a number of levels of memberships, including charter members, individual members, students and supporting associated organizations. They also have a formal Advisory Board with Terms of Reference. The CMB has a volunteer Executive Director and Assistant Executive Director, along with a part time administrative assistant. It receives some basic operating funding support from Fisheries and Oceans Canada. CMB is unique amongst the four outside organizations examined here as it arose from the grassroots (as PacMARA has

also done). Interviews with the CMB noted issues around capacity in some specific areas like fundraising. Because this organization arose from the grassroots it has always tried to impose a minimal burden on board members, and has a self-described very laissez faire approach to internal structures, outside of some minimum checks and balances. The CMB benefits from the small volunteer staff team who do most of the work out of their own personal interest in seeing what they started here succeed. One interviewee said that it was really up to people who were involved to identify work they wanted to do, and find a way to do it, as long as it was within the mandate of the CMB. One concern was expressed that they were so unstructured that they would perhaps not be ready internally, to ramp up, if a big funding opportunity happened to fall in their lap. This is an important issue for such organizations to consider, as the research and discussions needed to achieve ecosystem-based management are multi-year in nature and do not lend themselves to short timelines or organizations that aren't stable.

One more criterion

During the process of this thesis, this researcher also identified one more criterion that should be added to this framework in its next iteration. This one is called "*Embraces Joint Learning"*. This criterion is about the need to make sure collaborative ecosystem-based science and analysis is communicated, explained and understood externally at all stages of the effort to build a supportive constituency for this new governance model; so it begins to be built into the system as a best management practice. This criterion is actually more than just an evaluative element, it is currently a missing link between

science and sustainability and this idea is also discussed in more detail in the concluding section of this thesis.

While it may be argued that external communications is not necessarily part of the mandate of a science and research organization; this researcher believes that it is a critical aspect of a broader approach to sustainability, which needs to be understood and supported by the larger public. Who is better placed or has more responsibility to do this than the people who already support it and are involved in it? This new criteria still needs to be further defined but some descriptive elements might include, for example:

communicates project results externally/publishes in
the peer reviewed literature/actively supports like initiatives;
builds links between researchers and decision-makers, etc

As we have discussed previously in this chapter, evaluating transorganizational collaborative science organizations has not yet been done in any significant or systematic way and, indeed we have only illustrated here how this new evaluative framework might be used to do this. A further step is now needed to fully develop and rigorously apply this framework. This includes breaking the descriptive elements into actual questions to allow it to be really tested. The framework should then also be formally peer reviewed.

In the next chapter, this thesis research project finishes with some conclusions and recommendations based on the research conducted here.

CHAPTER 5 - CONCLUSIONS AND RECOMMENDATIONS

Collaboration, not just Collaborative Science

A collaborative marine science and research initiative like PacMARA is indeed a step forward from where we have been up to this point in time in BC. This research has shown that there is some solid theoretical justification for it. In fact, after completing this research project, it seems amazing to this author that we are only starting to do it now, as the alternatives are definitely inferior. How we do science is very important in a planning and management environment of wicked problems and increasing complexity. Having a way to evaluate new efforts like transorganizational collaborative science is also critical so they indeed help instead of hinder efforts. However, we must also remember that achieving marine ecosystem-based management and ultimately sustainability, is not just about better information, and if we think that – we are headed for trouble; as we have shown here how science can often be tinged by politics and that ultimately sustainability is about societal choices, with science being only one input to decision-making.

There is also one more important element to be considered here, which is the link between information and results. The process towards sustainability might be seen as a kind of pyramid with three levels, where success has to be achieved beginning first with a strong base of good process and information (inputs of all kinds), then incorporating that into decision making as we move up the pyramid (outputs), to finally achieving sustainability (outcomes) at the pinnacle. The development of commonly held and understood information is a legitimate and workable goal. However while a theoretical rationale alone may justify implementation and activity, and evaluating success on the

ground is needed to ensure better information gets incorporated into decision-making and planning, we are not yet still necessarily assured of sustainability outcomes.

While this thesis has shown some evidence and examples that suggest collaborative science and research models are better than what currently exists and that their value can be assessed and improved through proper evaluation, the link between inputs and results, or to put in more specific words for our purposes, between collaboration and sustainability, has not yet actually been fully made. To some extent, this question is hard to answer based strictly on the research presented here, as these governance models are so new that there is simply no proof out there yet, although, as some interviewees stated, they believe the right structures are in place for this to happen. As well, ecosystem-based management itself is still considered untested and unproven so perhaps even asking this particular thesis question was premature at this time.

However, I would argue that a missing piece here that might help us create the bridge between science and sustainability is a tighter linkage between actors throughout the whole process, to better bind inputs to outcomes. This is actually a key principle of well-designed ecosystem-based management, it's called: "building the model together".

Collaborative science and research is really only a miniscule advance, certainly not the solution to our sustainability problems. However, it is an important advance; supported by theory and becoming more widely used in other jurisdictions. It is also potentially provable in practice and this thesis has advanced that evaluative process by proposing a framework that now needs to be refined and then employed. I would indeed argue that by this time in our history, collaborative science and research should indeed be considered a best management practice, rather than an innovation still up for discussion.

Collaborative science organizations are the ones best placed to help lead this discussion, since they are the ones already thinking about integrated systems and long term outcomes. If decision makers and stakeholders don't support the process or results, or perhaps don't understand it; whether research is done through collaborative partnerships or by agencies alone, it still won't be useful or helpful or might be completely ignored. This is why we need a joint learning approach where we build the model for sustainability together, from inputs to outcomes.

However, in terms of what is really needed to achieve sustainability in the marine environment, collaborative science is still only a baby step. We don't just need collaborative science; we need collaboration. Only true collaboration can bridge the gulf between diverse interests and worldviews and overcome wicked problems that prevent us from moving forward successfully with either conservation or sustainable economic development.

And So, Closer to Home

So where does this leave us here in BC in particular, as we strive towards marine ecosystem-based management in Canada's Northeast Pacific? In the introduction to this thesis, we described how we do not yet have a war on the water in BC and perhaps building common ground around information, might help anticipate and head off future conflict. However, often crisis is a driver for action, so without a large-scale biological crisis or at least certainly no broad public awareness of any looming crisis in the Northeast Pacific Ocean, is there still a chance for this pre-emptive, rational, common-sense approach to advance? I would argue that there is. We have shown that collaborative approaches to science have a theoretical basis and are also becoming more

commonly used in practice. Results are still somewhat mixed and uncertain, but, after all, most of these organizations are still new. Supporting transorganizational collaborative research and analysis is certainly as defensible in BC as it is in these other places. In fact, in our particular unique place and time, one organization, the Pacific Marine Analysis and Research Association has already spontaneously emerged to meet a broadly perceived need, this without even knowing that it had a pretty solid case for its existence and approach based both in theory and practice.

PacMARA grew from the grassroots to fill an unmet need for collaborative research and analysis that was identified in 2003 by marine scientists and planners. While the results of this thesis research have shown that PacMARA can now more confidently base its existence and activities on some firm theoretical grounds, there are two questions that have not been fully addressed in this study that still remain up for further discussion. 1) Is PacMARA the appropriate model for a successful collaborative marine science organization in BC, and if not, how should it be adjusted to better achieve its objectives? and, 2) Will the existence of PacMARA specifically (not just collaborative science in general), help us towards ecosystem-based, sustainability outcomes for the BC Coast?

In regards to the first question, there are a number of different models of collaborative science organizations in various jurisdictions, and some have been described briefly here. All of these were established uniquely attached to a specific place and time. We have seen that, in theory, collaborative science can be considered a better approach for addressing complex environments and as the only collaborative marine science organization in existence in BC, PacMARA now needs to formally evaluate itself, preferably by an external body, through the framework provided here, as a way to try to

address this question and so be able to speak with finality about its validity as part of the solution towards sustainability in Canada's Northeast Pacific Ocean.

Regarding the second question: this, of course, remains to be seen. None of the information reviewed through literature or interviews provided definitive answers on this point. Sustainability has a long horizon and speaks to intergenerational thinking. The time frame of our organizations and studies is always remarkably shorter in comparison. The only things we can say with assurance are that we cannot save ourselves by looking backwards for solutions to existing and future problems; and that therefore new models of governance for knowledge need to be very thoughtfully considered and actively supported as part of the solution to addressing the increasingly challenging resource related questions in our complex world.

Recommendations for Further Work on the Evaluative Framework

- Add and fully describe one more criteria - "*Embraces Joint Learning*" for addition to the evaluative framework.

- Further refine the framework by using the descriptive elements to draw out a series of questions suitable for a more formal evaluation.

- Investigate how the criteria might be weighted (are all these criteria and their various elements equal?)

- Formally peer review the next version of the proposed evaluative framework through its submission as part of an article in an appropriate organizational or resource management journal.

Recommendations for Fisheries and Oceans Canada

- Develop a National policy framework around collaborative governance that includes the areas of collaborative ecosystem-based science, research and analysis.

- Drawing on the results of this research, formally position collaborative science, research and analysis as a Best Management Practice in upcoming LOMA and MPA planning processes in the Northeast Pacific, and provide appropriate support for it.

- Actively support existing collaborative science initiatives, such as PacMARA, that can assist with pressing policy challenges, including lack of capacity in government,

the need for coordination of marine research initiatives and actors, and the need to fill various marine information gaps.

Recommendations for PacMARA

- Formally evaluate the organization using this new evaluative framework for science collaborations.

- Continue to act as a hub for connection and facilitation of marine expertise in BC as this remains an unfilled niche, and recognizes that successful "outcomes are the product of constant interaction among various forces" (Coady, 1999).

- Continue to ask integrated questions to get integrated answers (Cortner, 2000), and focus on questions that span the longest possible time scales. These are the areas not being addressed and the ones most needed for long-term sustainability.

- Focus effort on communicating results of projects to the broader public, as well as decision-makers and managers to build a broader constituency for ecosystem-based science and research.

- Consider more closely how best PacMARA should be linked to decision-making to reflect a joint learning (joint science) approach, which is in principle, more truly collaborative than an independent science approach.

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Appendix 1 – Interview Questions

Question One: Would you say that to date, the NPRB/FSRS/CMB/CIT has been successful at meeting its original mission (see below for list)? If yes, see next question. If no, why not?

Question Two: What do you see as the critical elements of your success (What are the primary assets that led to this success).

Question Three: Overall, are the science/research analysis products created by NPRB/FSRS/CIT/CMB credibly filling an information gap needed for an ecosystem-based approach to decision-making/management/planning? If yes, please give me one or two examples that show how the organization's assets made this possible, if no, why not?

Question Four: Is/Was the NPRB/FSRS/CMB/CIT successful at getting its research included in decision making/management/planning? If yes, why and how? Please give me one or two specific examples highlighting the organization's assets that made this possible. If no, please explain why not.

Question Five: Has the work done by NPRB/FSRS/CMB/CIT resulted in better decisions being made – (has it had a positive influence on decision making/management/planning), and highlight the organization's assets that made this possible? If yes, please give me one or two specific examples. If no, please explain why not.

Question Six: Does the institutional/administrative/organizational structure of the NPRB/FSRS/CMB/CIT effectively support the collaboration necessary for the organization in meeting its mandate? If yes, please describe how and why. If no, please explain why not.

Question Seven: If you could do it all over again, what would you do differently?

Appendix 2 - List of Interviewees

Name	Relationship to Case Study Organization	How Interviewed	Interviewed in/from
FSRS (www.fsrs.ns.ca)			
Patty King	Executive Director	In person	Halifax, NS
Ross Claytor,	Science Panel	In person	Halifax, NS
Jim Jamieson,	External User, DFO staff	By phone	Halifax, NS
CMB (www.marinebiodiversity.ca)			
Ellen Kenchington, DFO	Executive Director	In person	Halifax, NS
Leo Muise, Province of Nova Scotia	Board Chair	In person	Halifax, NS
NPRB (www.nprb.org)			
Tylan Schrock	Board Chair	In person	Anchorage, AK
Clarence Pautzke	Executive Director	In person	Anchorage, AK
Rich Marasco	Science Panel		Washington, DC
Heather McCarty	Advisory Panel	By phone	Juneau, AK
Dave Witherell	External user – Fisheries Mgmt Council	By phone	Anchorage, AK
Dick Beamish	Science Panel member from Canada	By phone	Nanaimo, BC
CIT (www.citbc.org)			
Patrick Armstrong	Management Committee	By phone	Nanaimo, BC
Scott Slocombe	Peer review	By phone	Guelph, BC
Kevin Kriese	External user - BC Government	By phone	Smithers, BC
Jody Holmes	Management Committee	By phone	Smithers, BC
Dan Cardinall	EBM handbook working group	In person	Victoria, BC
David Johns	Management Committee – Co-Chair	In person	Victoria, BC
Melissa Hadley	Secretariat – Cortex Consultants	In person	Victoria, BC
Eamon O'Donahue	External user – BC Government	By phone	Smithers, BC
Keith Moore	External user – Haida Gwaii	By phone	Queen Charlotte City, BC
Robert Prescott Allen	Executive Director	By phone	Victoria, BC
Lindsay Jones	External user – CCLRMP Implementation team	By phone	Nanaimo, BC

Appendix 3 - History of PacMARA

A WWF-Canada workshop held in Prince Rupert in March 2003 brought together most of the organizations doing marine science and or planning for the Northwest BC marine region. The initial purpose of the workshop was to discuss how to build momentum towards conservation-based marine planning in the region. There was general agreement amongst this large group of scientists, researchers and analysts that an important component of this problem related to information.

Workshop attendees were from:

- Fisheries and Oceans Canada (representatives from both Science and Oceans Divisions)
- UBC Fisheries Centre Back to the Future Team
- Province of BC (Regional and Provincial representatives)
- Nature Conservancy of Canada
- Gitga'at Nation
- Canadian Parks and Wilderness Society
- Kitasoo Nation
- Parks Canada (representatives from the Gwaii Haanas office and Vancouver Support Services office)
- Living Oceans Society
- Tsimshian Stewardship Committee
- WWF-Canada (Atlantic and Pacific representatives)
- Turning Point First Nations Initiative (Alliance of Coastal First Nations)

At the workshop, science and information was quickly identified as an area of common ground and common concern where people and organizations could perhaps work together in a more coordinated way. We agreed that even with different organizational mandates, approaches and activities, we had similar needs for information and analyses, and had experienced similar problems with data access and coordination. The area of ideological common ground agreed to by everyone in the room was the *importance of conservation of marine biodiversity*; and participants generally agreed that

lack of coordination around information was one constraint facing ecosystem-based marine management in BC.

The major result of this two-day workshop was basic agreement among participants on beginning to work toward the development of a collaborative science and research non-governmental organization (NGO), modeled very broadly on the existing BC Coast Information Team. This new organization would produce information and analyses products needed to inform and support an ecosystem-based approach in marine and coastal planning processes. PacMARA members were very clear that this new non-government organization must not play an advocacy role in marine planning and decision-making. The purpose of the organization would be to produce and support peer-reviewed ecological information and analyses to meet the needs of governments, industry, First Nations and coastal communities. PacMARA would not carry out experimental science projects, or conduct field-based research. Its niche would primarily be to produce syntheses of existing information and research, as these are, in some ways, the bridge between science and policy. (Jeff Ardron, personal communication 2004) However, using the broadest definition of science: "pursuit of knowledge about how the world works, a pursuit with an established process for inquiry, logic and validation" (Danby, Hik, Slocombe & Williams 2003, p 193); PacMARA is a science organization.

A follow-up workshop was held in Skidegate in November 2003 and the vision was reconfirmed, more organizations became involved and details were discussed on how to move forward. Some funding was raised then and there to cover the expenses involved with next steps on this initiative, including conference calls and another workshop. The author also agreed to provide research support for the initiative in the form of an MA

thesis in the Royal Roads University Masters of Environment and Management Program (MEM).

One further workshop was held in Vancouver in April 2004, and in January 2005 PacMARA became incorporated under the BC Societies Act.

Appendix 4 - PacMARA Constitution (2003)

FORM 2

SOCIETY ACT

CONSTITUTION

1. The name of the society is the **Pacific Marine Analysis and Research Association (PacMARA)**

2. The purposes of the society are:

- To undertake research and analysis initiatives that will inform and support an ecosystem-based approach to marine planning, marine conservation and marine resource use in British Columbia.

- To produce products that highlight, promote and communicate the results of PacMARA's research and analysis.

- To facilitate the development of cooperative and collaborative research and analysis initiatives between First Nations, provincial and federal governments, non-government organizations, academics, and community and commercial interests.

- To provide science-based services that use PacMARA's research and analysis to support marine planning, conservation and resource use in B.C.

Appendix 5 - Proposed Evaluative Framework

Criterion	Elements:
1. Valid Reason for Being	Reflects current reality/reflects pasts lessons learned/supported by emerging theory/endeavour suits place and time/has epistemic credibility/seen as legitimate and potentially useful/broadly supported/would be missed if gone/relevance
2. Produces Good Work	Asks and answers the right questions/produces useful, desired, perhaps better products/work is peer reviewed /incorporates knowledge from many sources/work becomes a model for others/supports like initiatives/fills an existing gap/work is technically sound
3. Clear Relationship to Decision-Making	Linked or having clear relationship to planning, management and or decision-making structures/non-advocacy nature understood by all/clear communication of results/knowledge of policy arena and issues/research is made available and accessible/ understood mandate and-or authority
4. Collaborative in Approach	Internal organizational stability/ terms of reference in place/ shared vision and goals/has operating procedures and policies that reflect the collaborative model/funding stable/credit given for work done by member organizations/autonomy of member organizations/conflict of interest addressed
NEW ! **5. Embraces Joint Learning**	Communicates project results externally/publishes in the peer reviewed literature/actively supports like initiatives/builds links between researchers and decision-makers, etc