

STAFF RESPONSES TO IMPLEMENTING ENVIRONMENTALLY SUSTAINABLE
CHANGE AT FEDERAL FISH HATCHERIES IN BC

By

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We accept this thesis as conforming
To the required standard

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Abstract

Anecdotal information indicates a resistance to change from federal fish hatchery staff regarding environmentally sustainable infrastructure renewal and hatchery operations. Qualitative research was conducted to investigate this phenomenon, using face-to-face interviews with nine hatchery staff across British Columbia. The interviews were audiotaped and transcribed verbatim, and participants' responses remained confidential, due to the relatively small hatchery community. Responses were grouped under two headings, *Barriers to Change* and *Embracing Change*, and four distinct themes emerged: Governance, Benefits, Education and Research, and Culture and Personal Beliefs. Barriers to change related to governance emerged as the dominant theme during interviews. This research examines the culture of hatcheries and their perceived governance structure, identifies barriers to implementing change, and makes recommendations to foster effective governance. Characterizing hatchery staff responses to change is a significant step in moving towards environmentally sustainable infrastructure renewal and environmentally sustainable program operations.

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Chapter One: Introduction

Salmon hatcheries first appeared in British Columbia during the 1880s to enhance the commercial fishery resource (Houston, 1975). Many years later, in 1977, the Department of Fisheries and Oceans (DFO, also referred to as the Department, or Fisheries and Oceans Canada) undertook a new, aggressive plan to design, construct, and operate fish hatcheries throughout British Columbia. The work was done through the Salmonid Enhancement Program (SEP), whose goal was to restore salmon stocks to their historical levels (Fisheries and Oceans Canada, 2008).

During the 1970s and subsequent years, hatcheries were built with some of the latest technology. Engineers and biologists from the Department traveled to Washington State and as far as Japan to learn about leading edge techniques in design and operations.¹ Men and women were hired to manage and operate these new hatcheries, many of whom had worked their way up in the Department through the pre-SEP era. They embodied a *culture* that can best be described as hard working and knowledgeable, with a practical hands-on approach and dedication to the fisheries resource (Houston, 1975). Robbins & Langton (2001) discuss the concept of organizational culture, which includes admirable traits such as loyalty, perseverance, and a good work ethic. However, they also state that this culture can include arrogance, a sense of entitlement, and a solid reluctance to take risk.

Culture provides stability to an organization and gives employees a clear understanding of “the way things are done around here.” Unfortunately, culture can also be a major barrier to change, as it was at IBM Canada for many years. (Robbins & Langton, 2001, p. 379)

It is not uncommon at hatcheries to have staff who have worked within the hatchery culture for 20 to 30 years mentoring young people who follow in their footsteps.

Today most hatcheries are approximately 30 years old or more. Although maintenance, repairs, and modifications to the hatchery infrastructure were implemented over the years, for the most part, improvements to the buildings have been status quo towards the original design. There was no official emphasis on environmental sustainability, and *green* technology as an ideology was not well known. Hatchery program operations were fairly consistent in their routine during this same time period.

Currently, the Department of Fisheries and Oceans is in the process of developing infrastructure renewal initiatives that may result in program operation changes for its fish hatcheries in British Columbia. In line with government-wide initiatives, DFO upper managers (management level staff responsible for overall program direction, who are geographically separate from hatcheries in that they work at Pacific Regional Headquarters [RHQ] in Vancouver) support moving towards an environmentally sustainable model when it comes to these operational facilities. The emphasis of the model is on greater efficiency and cost savings in the operation of fish hatcheries (Fisheries and Oceans Canada, 2006a).

Despite favouring an environmentally sustainable model for hatchery operations, DFO upper managers and others involved with implementing infrastructure renewal believe there to be some hesitation (or barrier) by hatchery operational staff towards transitioning to this new model. Engineers, biologists, and upper managers have anecdotal information and personal ideas that may explain this tension/reluctance. However, there is no formal documentation on this topic; thus, a knowledge gap exists that inhibits progressive change.

The term *barriers to change* is discussed extensively by McKenzie-Mohr and Smith (1999), who use environmental psychology in designing programs to promote sustainable behaviour in communities. These barriers can prohibit behavioural change in any type of organization regardless of the culture. However, there are effective tools for fostering change in organizations (National Institute for Health and Clinical Excellence, 2007; Terazono, 1999; Doppelt, 2003). Gaining insight into the organizational culture and behaviours provides a foundation for breaking down these barriers (Robbins & Langton, 2001), especially with the younger generation who are more likely to alter their behaviour when faced with changing environmental conditions (Grimm & Smith, 1991).

My research identifies and discusses hatchery staff responses to environmentally sustainable change with regard to general hatchery infrastructure renewal and hatchery operations. My research lists a number of environmentally sustainable options specifically related to water and energy, and identifies hatchery staff responses to these options and reasons for their responses. In addition, I identify factors that hatchery staff have found most helpful and least helpful in fostering change. Recommendations are made about measures upper management might take to break down barriers to implementing progressive, environmentally sustainable change. The research used qualitative methodology and centres around interviewing staff at federal fish hatcheries throughout British Columbia.

Significance of the Research

The significance of this research is in the identification of barriers to environmentally sustainable change in hatcheries, the identification of the reasons change is or is not embraced, and an examination of the reasons for them. Until now, understanding this resistance to, or

acceptance of, change has been a knowledge gap for upper management that this thesis aims to fill.

Characterizing hatchery staff responses to change is a significant step in moving towards environmentally sustainable infrastructure renewal and environmentally sustainable program operations, which emphasize efficiency and cost reduction. This, in turn, will impact positively on the environment, social awareness, and the economy of the Department, and thus, the taxpayer at large. Barriers to change in other sectors of the Department may also exist, and some upper managers outside of SEP may be interested in the results of my thesis. It is hoped that other government branches, non-governmental organizations, and community groups will be able to substantiate the findings of this thesis through further research and apply some of the results and ideas found here to their journey towards an environmentally sustainable model.

Chapter Two: Research Methodology

Approach

My research focuses on understanding hatchery staff's responses to environmentally sustainable change "in their natural settings, to attempt to make sense of, or interpret, phenomena in terms of the meaning people bring to them" (Denzin & Lincoln, 2005, p. 3). Therefore, a qualitative approach to research fits with my goal to "develop understanding."

Creswell (2007) describes five approaches to qualitative inquiry, but suggests there is much overlap between the approaches, which lends flexibility and adaptability. The approach I most closely align my work with is the *phenomenological study*, which describes the meaning for several individuals of their perspectives on the world or their lived experiences of a concept or a phenomenon (Creswell, 2007; Kvale, 1996). The phenomenon I explored is hatchery staff responses to, or experiences with, environmentally sustainable change at their facility. Kvale and

Brinkmann (2009) contend, “If you want to know how people understand their world and their lives why not talk to them?” (p. xvii). This is the reason I decided to use the interview as a method for data collection.

Another approach to qualitative research is *grounded theory*. Although the intent of grounded theory research is to move beyond description to create theories (Charmaz, 2006; Creswell, 2007), phenomenological studies may benefit from the use of some of the basic procedures and methods described in grounded theory (Strauss & Corbin, 1998). Hence, I have also used Charmaz (2006) for qualitative analysis, finding her process of data analysis a practical guide for describing phenomena.

Analysis involved transcribing the interviews verbatim. Major themes and subtopics were formulated and the most explanatory quotations were used to illustrate themes (Dey, 1993; Strauss & Corbin, 1998). The data were then examined for regularities, variations, and singularities (Hesse-Biber & Leavy, 2008). Dey (1993) and Charmaz (2006) suggest that the basis of qualitative analysis (collecting data, describing, coding, memo writing, connecting, and account) is more than a single sequential process. Rather, it is “iterative and is better represented by a spiral than a straight line” (Dey, 1993, p. 53). This visual analogy was helpful in producing an account of the interviews, as I conducted a number of iterations during the coding, memo writing, and connecting stages. I found it most helpful to produce a printout of a large spreadsheet, 1.7 metres by 1.8 metres, listing in columns all the coding and memos of all nine interviews (not included as an Appendix, due to confidentiality issues). This enabled me to make physical connections and develop subthemes, which I listed in a table where I further grouped subthemes under more general theme headings (see Appendix A: Table of Themes). The general

theme headings enabled me to further organize information and generate an understanding of this phenomenon of responses to change.

Reducing Bias

Interview-based data collection may introduce bias to the data being collected. One way to reduce bias is through triangulation strategies. Most interview-based research refers to Denzin's (1978) discussion of four types of triangulation: data, investigator, theory, and methodology (Perlesz & Lindsay, 2003). A data source triangulation method—the use of a variety of data sources—fit well with my research question. To begin with, anecdotal information from discussions with upper management, including engineers and biologists, provided initial information on hatchery staff responses to environmentally sustainable change at hatchery facilities. I then conducted pilot interviews with two DFO upper managers who have worked in hatcheries for many years in various job positions. This was done to validate and compare views with those still working at the hatchery level. Following the pilot interviews, a discussion took place with each of the two participants to critique the interview with the intent to improve the interview questions, if needed. Based on comments from the pilot and a meeting with advisors, I determined that no modifications were necessary. To complete the triangulation strategy, the primary data source was the hatchery staff interview participants, who are the key players in supporting or resisting program change.

In order to ensure trustworthiness of interviews between the interviewer and participant, it is imperative that there is a good rapport (Kvale, 1996). As I was the sole interviewer, I considered my past work relationships with each participant to evaluate whether I was at sufficient arm's length to establish a sense of trust. Because DFO is a fairly small community, I have known all the participants for many years, and at times, have worked with some of them.

The relationships are cordial. As such I believe each participant understood they could be open and honest during the interview, because they knew I had no direct link in infrastructure or operational decisions related to hatcheries or staff. Nonetheless, judging whether or not someone is honest or giving full disclosure is very difficult. The nature of the interaction did, however, lend to the belief of openness and honesty, because the interview was not time-limited, the interview was semistructured and, as much as possible, the participant guided the discussion. I was seen as being *one of them* and part of their culture, in spite of my office at Pacific Regional Headquarters. This relationship to the participants helped me to understand what participants were communicating better than someone who was not one of them. They were also assured confidentiality.

The selection of interview participants reflected the wide spectrum of job duties and responsibilities at a hatchery, which lent to a triangulation strategy where the research object differs but the methodology remains the same (Denzin, 1978). It is worthy to note that using triangulation does not always lead to a confirmation of data (Mathison, 1988); however, according to Perlesz and Lindsay (2003), divergent findings could lead to new ideas and further exploration that could also benefit the research.

Finally, in order to minimize research bias, I applied strategies to monitor and evaluate researcher preconceptions, subjectivity, and perspective from a list in McMillan and Schumacher (1984). A peer debriefer was used to facilitate the logical analysis and interpretation of interview data and to test for bias and inaccurate inference. In addition, a journal was maintained to record decisions related to research. Further, I engaged in ongoing meetings with my research advisors and thesis supervisor to discuss such things as ethical considerations.

In summary, qualitative research methodology, triangulation techniques, and bias reduction strategies were used to ensure data validity and strengthen the conclusions drawn from the research.

Limitations of the Research

Although a broad range of experiences and opinions were expressed during the nine interviews, I cannot claim them to be representative of the views of all hatchery staff in British Columbia. Nor can my research be used for comparative analysis among demographics such as regions, genders, or ethnicities. Along these lines, a suggestion for future research would be to investigate whether themes are consistent between various demographics.

Another limitation of my research was imposed by the relatively small size of the hatchery community and the challenge to maintain confidentiality. Participants often shared information that could not be included in my analysis, over concern it might identify the participant.

Finally, a key assumption is that each interview is unique and self-contained. Although consistency and similarity of interview responses can be seen as a form of confirmation, it can also be unhelpful to the richer understanding of a phenomenon. Finding consistencies and similarities in interview responses could also suggest the effect of the culture where all interview participants think the same way because they all have formed a unity around a particular worldview. As nearly as I can ascertain, the interview questions and selection of participants produced a rich assemblage of views to reflect perceptions of change at fish hatcheries across British Columbia (BC).

Research Question

My research question is: What are federal fish hatchery staff responses to changes from upper management towards environmentally sustainable (green) program options and infrastructure renewal? During interviews, the term *environmentally sustainable* was used interchangeably with other common terms such as sustainable development, green options, and eco-friendly options. My reason for this was twofold; (a) the focus of my research was to determine responses to change, without getting caught up in varying definitions of terms that, in my opinion, might complicate the interview and (b) I allowed hatchery staff to define what they meant by these terms during the interview. Their definitions are presented in the Results section.

Research subquestions.

1. What options would staff embrace? Why?
2. What options would staff resist? Why?
3. Is there a connection between the responses to change and the various infrastructure renewal proposals and program operational changes?

Research objectives.

1. To identify and examine responses from hatchery staff to change towards environmentally sustainable infrastructure renewal and changes in program operations
2. To describe within the context of the Department's sustainable development strategy (Fisheries and Oceans Canada, 2006a) the detail of green infrastructure renewal and green program operations as it applies to fish hatcheries
3. To use the principle of interviews to determine the thoughts, concerns, advice, and opinions of hatchery staff towards change in their work environment

4. To analyse the data gathered from interviews in order to develop themes and correlations between responses to change and proposed environmentally sustainable options, and discuss the results
5. To develop strategies for hatchery staff and upper managers to embrace change based on the results

Interviews

Davies (n.d.) states that qualitative research most often includes interviews and emphasizes the skill required for this methodology. Based on his explanation of types of interviews, I chose a semi-structured interview to allow for detailed coverage of the topic, which raised issues and revealed information not previously considered. However, as Kvale and Brinkmann (2009) point out, “The research interview is not a conversation between equal partners because the researcher controls and defines the situation . . . and critically follows up to the answers to the questions” (p. 3). Informal conversations pose difficulties in analysing the data and may also cause ethical issues in formal research (Davies, n.d.). Therefore, I developed eight discussion points that I used as an interview guide to ensure consistency among interviews and to ensure that my broader research questions were addressed (see Appendix B: Interview Guide). In developing the interview discussion points, I followed a method by Moustakas (as cited in Creswell, 2007), where participants were first asked two broad and general questions about their response to environmentally sustainable change. This set a focus on the participant’s experience and the context that has influenced their experiences. Following the two general questions, several more specific questions were asked to build on the data (Moustakas, as cited in Creswell, 2007).

The two pilot interviews were conducted at Regional Headquarters in a private meeting room at the choice of each interview participant. Participant interviews were conducted at hatchery facilities throughout BC, although the option was given to meet in an alternative setting. A phone interview was also an option if a face-to-face meeting was unlikely; however, this was never the case. Hatchery locations and staff names are kept anonymous in all my research documentation and confidentiality during the interview was emphasized. In addition, all interview participants are referred to in the male gender in my research and there is no mention of ethnicity or age in order to ensure confidentiality.

A purposeful sample of interview participants was selected for rich data construction rather than population representativeness (Charmaz, 2006). Prospective interview participants were specifically chosen if they had worked for the Department for many years and if I felt they would be able to contribute to the research question. Interview participants had worked an average of 29 years with the Department. Choices were peer-reviewed by my advisors to confirm sampling decisions.

I initially contacted interview participants via email to briefly describe my research and request an interview with them. Attached to the email was a letter of recruitment (see Appendix C: Letter of Recruitment) and a consent form (see Appendix D: Consent form). Out of 10 recruitment emails sent out, nine attracted responses. All nine respondents agreed to participate. I followed up the email with a phone call to arrange an interview appointment and to answer any questions or concerns.

Interviews were scheduled for approximately one hour. Seven of the interviews lasted between 40 and 50 minutes, and two interviews lasted approximately 30 minutes. All interviews were audiorecorded and notes were not written during the conversation.

The Ethical Conduct for Research Involving Humans was strictly adhered to, as well as Royal Roads University Policy. The Department of Fisheries and Oceans did not require an ethical review. However, upper managerial approval to interview staff was required, given the interview was outside the scope of hatchery staff's normal duties (DFO Director of Human Resources, personal communication, June 25, 2009). Permission was granted to conduct the interviews.

Sample Size

Both Creswell (2007) and Kvale (1996) suggest 5 to 25 interviews as an appropriate sample size. Charmaz (2006) claims 20 to 30 would be a desired sample size in order to achieve rich data, but agrees a smaller sample size of face-to-face interviews that are audiotaped and transcribed verbatim could achieve the same results. In considering these recommendations, I also met with researchers and professors who recommended five to seven as an appropriate sample size based on their experience. I chose nine hatchery staff to be interviewed (including two former hatchery staff for the pilot interviews). I personally conducted all of the interviews. Audiotaping was my approach, and I personally transcribed all interviews, which produced 170 single-spaced pages. I included the two pilot interviews in the analysis, because there was no change in the methodology (interview schedule) between the two pilot conversations and the subsequent seven.

Strauss and Corbin (1998) claim that sample size is sufficiently large when saturation is reached. They define saturation as that point when no new information emerges from the data, and they list a few issues to consider. One issue is that saturation isn't necessarily reached when it appears there is no new information. This could be especially true in a smaller sample size. The second issue is that new information will most likely be found if sampling continues, but the

new information will not necessarily add anything significant to the research. A final issue is that time and money play a factor in deciding what is reasonable for a sample size and a researcher must be realistic when balancing all of these issues. Based on the above considerations, I judged that nine interviews would be sufficient and my advisors agreed with the decision.

I referred to Charmaz (2006) to engage in coding and memo writing immediately after the first interview, which is the path I followed. By the third interview I could detect clear themes emerging. After the seventh and eighth interviews I began to notice a consistency and similarity in the participants' responses, which continued during the ninth interview. Although I could not confirm I had reached saturation, the overlapping themes between participants suggested my sample size was adequate.

Chapter Three: Results

This section begins with a discussion of staff definitions of sustainable development. Next, under the heading *Embracing Change or Barriers To Change*, I will talk about what evoked participants to embrace change and what caused them to resist change at hatcheries. This lengthy discussion will be organized under subheadings. Finally, I will present participants' responses to specific questions regarding water and energy environmental issues at hatcheries.

Staff Definitions

The term *sustainable development* is a broad concept that became a topic of popular discussion in the 1980s (Pezzy, 1992). Although there are several definitions of sustainable development, the one that seems most commonly used today is found in the Brundtland Commission Report (1987) and indeed is the definition most used in Canadian environmental law (Benidickson, 2009). Subsequently, the Department of Fisheries and Oceans has adopted the same definition, which states, "Sustainable development is development that meets the needs of

present generations without compromising the ability of future generations to meet their own needs” (Fisheries and Oceans Canada, 2006a, p. 8).

Despite the Department’s official definition of sustainable development, I thought it was important to get an idea of how each interview participant interpreted the concept, as well as other terms that are commonly interchanged with it, such as eco-friendly options and green choices. This understanding would act as a reference point for individual responses. As such, the first interview discussion point stated: The Department plans to implement a sustainable development strategy and is currently working on details. Already we’ve been hearing a lot about green or eco-friendly initiatives. What I’d like to know is when you hear these terms, environmental sustainability options, eco-friendly, sustainable development, or green options, what does that mean to you, or how would you define those terms?

Most participants described positive outcomes when defining sustainable development. Saving energy was the most common description of sustainable development from these participants. Equated with this was saving money which was most often mentioned within the same sentence as saving energy. Energy usually meant electrical energy, but the next most common type of energy was fuel energy. These participants expected to save energy, thereby saving money, when engaging in eco-friendly options at hatcheries—an indication of their focus.

One participant expressed his definition in negative terms, saying sustainable development would entail extra cost and extra money, which would disrupt the normal way of doing business. His comment was, “[My] initial knee jerk reaction [is] ‘here comes another one of these things that is just going to make my life difficult and I’m not going to necessarily see something that is advantageous for me and the operation . . .’”²

Implicit in most definitions offered by participants was the idea of water conservation with regard to incubating and rearing salmon. Participants most often spoke about energy and money savings because of a recent installation or pending installation of new high-efficiency, high-volume water pumps in their facilities. These high-efficiency water pumps use electrical power either from the BC Hydro grid or from diesel generators used at remote hatchery sites where there is a need to produce independent power. High-efficiency water pumps use significantly less water than the older technology pumps, resulting in less energy use, and therefore, a significant money savings. The topic of water conservation and high-efficiency water pumps will be discussed in a later section.

Other, less frequently used phrases included in definitions by participants were “being friendly to the environment as much as possible,” “the least detrimental impact during hatchery operations,” “having a smaller footprint,” “anything that is safe for fish,” and “recycling as much as possible.” These phrases, although not complete and not formal definitions, are consistent with what Meadows (1998) refers to as *indicators*. These indicators are described as partial reflections of reality, both subjective and objective, based on a person’s values—thus, how they define their world and the concepts within. Meadows (1998) contends that indicators are important for developing a solid base for decision making around sustainable development issues. These indicators are likely important for DFO upper managers in making decisions around the implementation of sustainable changes at hatcheries.

Two other indicators that participants mentioned frequently during the interviews were “controlling hatchery pollution through regulations” and “upgrading hatchery facilities with new eco-friendly technology.” Examples they gave included not transporting fish carcasses to the landfill, but instead, placing them back in the river to mimic nutrient replacement in nature; not

using controversial chemicals such as malachite green³ (prior to when it was legally banned) to treat fish disease; and bringing 30+-year-old hatcheries in line with 21st century sustainable technology. Together, these partial definitions and examples give context to the way participants respond to environmentally sustainable change. What enables participants to embrace change or resist change will determine how effective recommendations will be in moving toward environmentally sustainable hatcheries. The next section will look at reasons for participants to embrace or resist change.

Embracing Change or Barriers To Change

Change has a considerable psychological impact on the human mind. To the fearful it is threatening because it means that things may get worse. To the hopeful it is encouraging because things may get better. To the confident it is inspiring because the challenge exists to make things better.

~ King Whitney Jr. (1967)⁴

The next topic of discussion during the interview revolved around four questions: What do you see as the major concern or barrier to change with regard to incorporating environmentally sustainable options at this hatchery? What options would work? What options wouldn't work? Why? Responses were categorized in four themes under each heading of *Embrace Change* and *Barriers to Change* (see Figure 1). My approach in this section is to discuss the findings under each theme, unless otherwise stated.

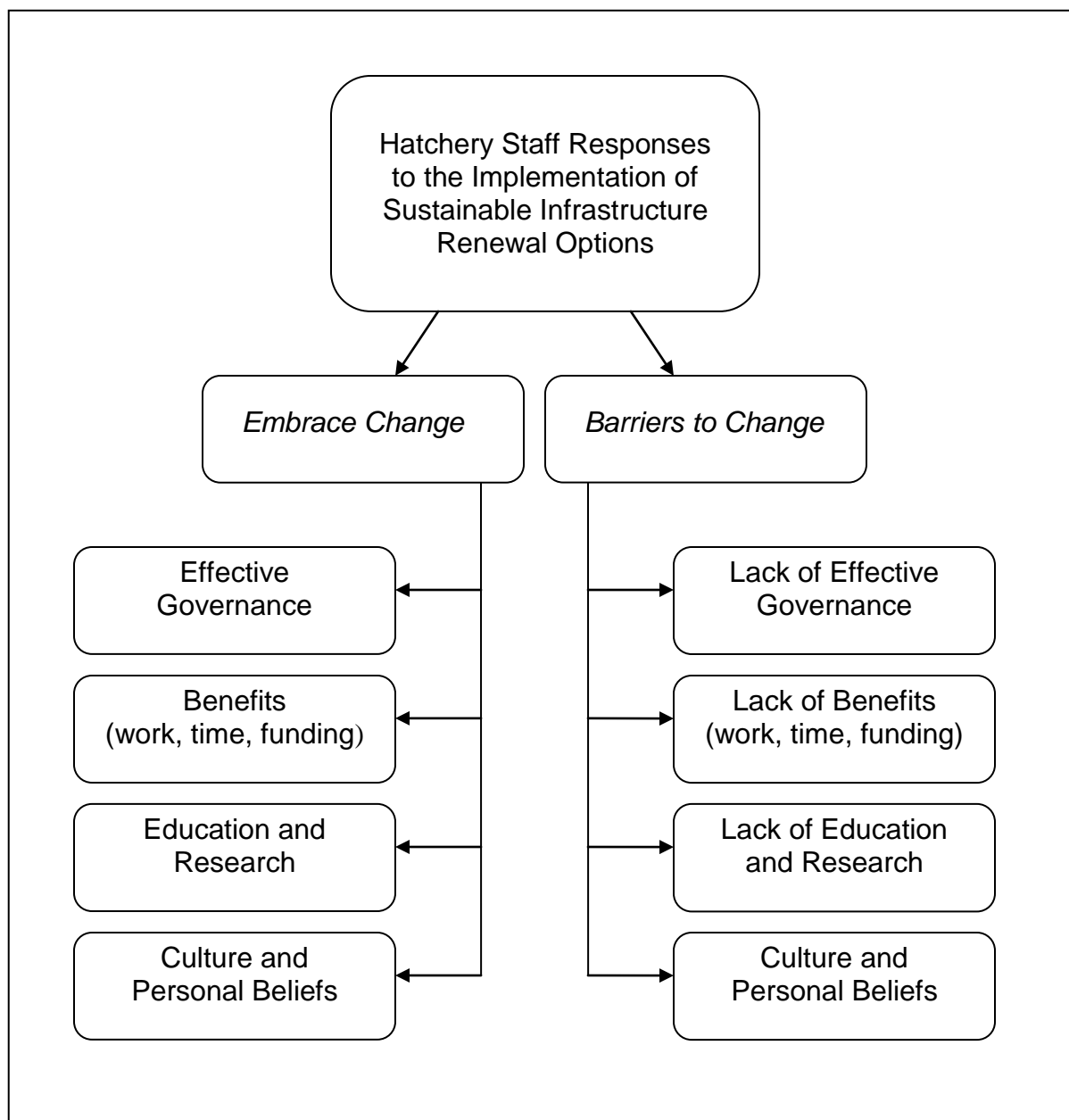


Figure 1. Chart showing themes of embracing change and themes of barriers to change.

Lack of effective governance.

The topic of regulations was most often cited as a barrier within governance. Top down initiatives from Ottawa, such as the National Environmental Compliance Audit Program⁵ (NECAP) was one example given. In the words of a participant,

the big frustration for the people at the hatchery level is DFO initiates [NECAP] unilaterally without really involving the people who are going to have to be most affected to do most of the work and then all of a sudden you're into this system that has a whole bunch of legally binding obligations and time frames with no money to come along with it to actually assess any of the issues that are identified but still a whole lot of obligations that you have to do by a certain date.

He goes on to say that this preliminary experience will probably set a negative tone for hatchery staff.

Another comment about the NECAP initiative was that, although the intent of it was good, that is, to make sure everyone was following proper procedure with environmental issues, the outcome tended to be hypercritical, picky, primarily concerned with paperwork, and extremely bureaucratic. In addition, there was a perception that parts of NECAP duplicated other regulations, such as the Workplace Hazardous Material Information System (WHMIS). Duplication in general was seen as unreasonable, impractical, a waste of time and money, and counterproductive to environmental sustainability.

One participant, frustrated and angry about regulations that, in his opinion, lacked common sense, summed up his thoughts this way:

We spent a fortune on friggin' signs that nobody will ever read, you know, and it gets to the point that, ah, it's administration. They're most concerned about the documentation and the paperwork than they are about the product or what's happening to it. . . . They come here and check on the documentation, right? They [consultants and other non-hatchery government staff] don't know the first thing about the unit and what it does, but why do we have to have everything tagged and labelled, for instance, a fridge, a regular

fridge in the lunchroom? What the hell's that all about? . . . There are so many things going on that really should be changed, but they're worried about our fridge and that it might not have a tag on it.

In spite of the participant being frustrated, one might argue that the participant's comment could be interpreted as indicating a lack of understanding on the participant's part, regarding the intent of the regulation or program.

Discussions about regulations often led to the topic of administration, both as a body of people and as a process. Barriers to effective change that were identified were a lack of flexibility in administration, for example, to move money from one allocation to another, such as salary dollars and operation and maintenance dollars; becoming overwhelmed with excessive paperwork, such that the focus seemed to be taken away from actually doing meaningful work in the field; and a convoluted process for introducing new ideas or requests. "The whole Department has been overtaken by administration" was how one participant expressed his view of a seemingly over-controlling administration.

Although upper management, that is, management not located at a hatchery site, was regarded highly and with a great deal of respect, nonetheless, it was also a topic of frustration during the interviews. The impression of a top-down management style, together with a command and control attitude, fuelled a great deal of frustration. "Boom! Do it now" was how one participant described it. Further to this, some participants said they would be sceptical of any top-down environmental initiatives, if they were perceived merely as a fad or fulfilling political correctness. Mandatory attendance at a lecture on environmental issues was one such example, where there didn't appear to be much substance beyond the lecture itself, "You go to a meeting and a fellow . . . gives a nice talk. It's all good, but, like I say, he explains it's good for the

environment, for the economy, and we all save on energy, but, you know, ten minutes later, who really cares, right?”

Participants agreed that they look toward upper management for leadership and buy-in of sustainable development, but one participant said he often felt that staff were one step ahead of managers on environmental issues. Participants wanted a meaningful sustainability strategy and wanted clarity on who would be heading this up and who would be helping hatcheries. “As a federal agency we should be showing leadership and sometimes we don’t. We should be leading the charge . . . leading by example—that’s what sets the stage for other people.” These were comments made with a great deal of conviction. Another comment was that hatcheries should be a showplace of eco-friendliness, with such things as roof gardens and other innovations. Staff argued that hatcheries were considered by the public as the “shining light” of the Department in a time when, in his view, the media portrayed the Department as not managing the fisheries resource very well.

Some participants described occasions when they perceived a lack of direction or confusing messages from upper management. While the particular details cannot be discussed for risk of breaching confidentiality, in these cases the sincerity of managers about sustainable development issues or hatchery staff ideas was questioned. Attempts by upper management to interact with staff were sometimes seen as disingenuous. Feelings of bitterness, abandonment, and frustration were described. At the same time, participants recognized the stresses associated with upper management positions in terms of trying to balance budgets and dealing with a multitude of staff requests or issues at hatcheries. They felt that upper management didn’t have the time or energy to interact with hatchery staff, in part, due to pressures of fulfilling priorities set by executive management.

A situation that gave rise to feelings of confusion for one hatchery staff member occurred when hatcheries were made subject to the same investigation as fish farms, regarding a particular incident. This participant didn't understand the connection between fish farms and hatcheries, because he viewed hatcheries as a public service to enhance and protect fish, whereas fish farms were viewed primarily as private enterprises concerned with making profits.

Staff changes within upper management at Pacific Regional Headquarters were observed by some participants as resulting in inconsistent leadership. "No one is there for the long term" was one complaint. One example was given of an interim manager was seen as causing more bureaucracy, because he was not up to speed with past decision-making rationales. This led to a duplication of meetings to the point where the participant described feeling as if he was in a "torture chamber" because of adversarial type questions being "hammered" at him. Once the questioning was over and the interim manager was satisfied with the answers, the participant was left feeling abandoned. This feeling was contrary to the participant's overall perception and respect for upper management.

Effective governance.

"If someone would sit down and talk to me about it, who knew and could explain it, and rationalize the whole thing, I wouldn't be opposed to that." This statement from a participant sums up a great deal of the interview discussion on embracing change and what it would take to achieve it on environmental issues. Participants indicated they wanted to be included in discussions on environmental change from the ground up; they wanted to be asked for ideas and asked for help. They also wanted to be asked for their commitment, which would somehow validate their importance. If participants gave a commitment, they would in turn expect a pledge of honesty and support from upper management. As one participant said, "[We want] a

willingness for someone at RHQ to help, to give ideas, and to walk through the process with us.” They also wanted to know, if initiatives were experimental, would participants be guinea pigs, what was the rationale, and were there hard-core examples of success? The answers to these questions didn’t seem to matter as much as the personal engagement that would be required. Moreover, some participants didn’t mind having more work downloaded on them in regard to a new environmentally friendly initiative, as long as they were given the authority and some autonomy in making decisions. Engagement and transparency were seen as important components of effective governance.

Participants also gave positive examples of working together with upper management. One example involved brainstorming with upper management to solve problems that resulted in operational efficiencies and environmentally friendly solutions. This ensured automatic buy-in by hatchery staff. Similarly, when consultants were contracted by DFO for specific initiatives, and where participants were included in face-to-face discussions about needs, concerns, and solutions, then buy-in was also generally assured. Another example described a situation where consultants were hired by a non-DFO client to develop a solution to mitigate a water issue that caused a problem for hatchery fish at a particular facility. The consultants’ recommendation was extremely expensive and seemed to waste a lot of energy. Nonetheless, it met the mitigation requirements for fish, and the non-DFO client was willing to pay. Hatchery staff, unhappy with the solution, were encouraged by management to offer an alternative solution based on staff’s expertise at the specific hatchery site. Their solution proved to be a fraction of the cost and used a fraction of the energy. The consultant and the hatchery staff collaborated to refine the solution. The result meant a less complicated hatchery operation, simpler maintenance, and a benefit to the

environment. Needless to say, both sides embraced the change because of the collaborative effort and, for the hatchery staff, a sense of autonomy to generate in-house solutions.

Often participants claimed that “hatchery staff tend to be environmentally orientated individuals,” because the very nature of hatchery work is all about saving and enhancing fish. Another participant continued this theme by saying, “We’ve changed our processes in the way we do things to become a little more eco-friendly and a lot of that started before the Government took on the idea of being more eco [friendly]” He concluded that, with a little more encouragement, they would put a lot more effort towards environmentally sustainable change. The next section elaborates on factors that encourage or discourage change.

Benefits.

The themes of benefits centred around the issue of funding for environmentally friendly initiatives at hatcheries. Participants perceived benefits as a program, approach, or technical solution that made work at hatcheries easier or more efficient. Benefits were also seen as a process that caused a savings in the budget, so that money could be spent on “extras,” which would ultimately benefit fish. One participant summed up this section quite frankly when he said, “Well, I think it always comes down to the almighty dollar. Who’s going to pay for it?”

The topic of funding and budgets evoked a fervent discussion by each participant. Lack of funding encompassed a significant barrier to change at hatcheries when compulsory environmental initiatives were not accompanied with extra capital money or increased operational budgets. Also, in cases where extra funding was supplied, hatchery staff were sceptical that the new initiatives would result in long-term maintenance and operational costs that would not be covered with the one time start-up funding. Scepticism was further fuelled by participants’ view that they were in an era of diminishing budgets. Often the mention of

delivering extra funding was seen as empty promises. One comment was, “Most of my colleagues were more than willing to jump in and embrace change. I mean, we’re into sustainable development and I think everyone buys into [the term] environmentally friendly, as a concept. But they’ll always worry that there’s never enough money. There’s lots of promises.”

On the other hand, an example of a benefit cited was a top-down initiative from Ottawa called the Economic Action Plan, where funds were provided for capital improvements at hatcheries. Although final approval for projects came from Ottawa, there was an opportunity for input from hatchery staff on project ideas. Most of the projects were environmentally friendly in that they involved replacing old equipment with new technologies, which resulted in energy and cost savings (mostly related to water conservation). Although the Economic Action Plan was generally considered a positive “shot in the arm” during a time when budgets were being cut, his point that it was long overdue was clear. The participant also expressed his frustration in not having the proper funding to initiate change that would benefit both the environment and hatchery operations. It was recognized that the Economic Action Plan was a two-year program and would not ensure consistent future funding. Another participant commented that he used to make requests for eco-friendly upgrades such as double-pane windows for hatchery buildings, and variable speed water pumps that would automatically save several thousand dollars on the energy bill, but there was never any funding available for it. He said, “It used to drive me nuts.” “I just didn’t ask anymore,” was another response that signified losing hope. Another request was made for several thousand dollars to decommission a large obsolete piece of equipment that used a lot of electric power. According to this participant, it was kept running for many years before it was finally considered a priority for decommissioning. The resulting annual savings on electrical bills were almost the same amount of money as the one-time decommissioning cost.

This sense of giving up hope was further emphasized when participants talked about accomplishing energy savings. At first staff were delighted how the way they were able to contribute to helping the environment. The money saved was an incentive for them, because it meant they could do more with the same budget. However, their enthusiasm eventually weakened when they realized that the savings would be “scooped away to the regional pot” by upper management, and the hatchery would see no benefit other than a verbal “good job.” This action sometimes led to hatcheries keeping quiet (as long as possible) about any efficiencies and cost savings in order to maintain their current budget for the next year. They felt penalized for their accomplishments. In the words of one shocked participant who had just been informed that the budget savings was being taken from him, “So I shut up pretty quick about any efficiencies, right?” Hence, a communication barrier was created, as well as feelings of distrust, which could further contribute to an *us and them* culture.

Participants empathized with the budgetary pressures placed on upper management to save money. They didn't necessarily believe that all money saved by individual hatcheries should be kept at the hatchery, as indicated in this scenario:

Let's say I saved \$20,000 on energy. I don't want to see my budget the following fiscal year reduced by 20 grand. Maybe the Department would like to give me 20 grand less, but if you want me to really buy in to it, then reduce my budget by 10 grand, and now I've got 10 grand to spend on other things, and then I'm buying into the program. I'm spending less on energy and I can take the savings and do something new with it.

Other participants voiced similar views about incentives, which were perceived as benefits that seemed to focus mainly on improving conditions related to the hatchery in general, rather than on individual rewards. For example, spending a portion of the saved budget on

improving health and safety, building a new public viewing area, or hiring part-time staff when needed for extra work projects were some of the ideas. Other suggestions included such things as receiving a half-day off work or a party, when eco-friendly goals are met. Still others claimed that more effective incentives to assure buy-in would be the workload remaining the same or becoming easier, or having no change in their lifestyle at work, that is, not having to give anything up. In one case, the participant wanted to see no disruption in work or negative impact on operations before embracing a project with an environmentally friendly label on it. Conversely, some participants seemed pleased to embrace change, even though it meant a little more work. The benefit to them was to see visible progress in helping the environment. They would also work a little harder if they could measure an improvement in fish health, or if the initiative had anything to do with water supply and water conservation—the lifeblood of a hatchery.

Finally, the perception that an environmental initiative was too menial or wouldn't make a difference provided a barrier to change. One participant described a recycling program at a hatchery that was successful until staff were asked to monitor types of recyclable items to determine what was used the most and where improvements could be made in reducing waste. The added task of monitoring came with resistance, even though it was forced on them. In the end the monitoring task failed because “it was not a big enough piece of the puzzle for people to buy in.” The recycling program remained, but staff were not as enthused about it as in the beginning.

Education and research (or lack thereof).

It is what we think we know already that often prevents us from learning.

~ Claude Bernard 1813–1879

Participants discussed the theme of Education and Research both as a barrier to change and as something that led them to embrace change. Both views will be discussed in this section.

As Bernard stated over a century ago, attitude can be a barrier to change if one thinks one knows everything, and as one participant said, “education is the key” to helping people change. Another participant put it this way, “I work here because I was always concerned about the environment, even as a little kid, so I read a lot. I think the more literate you are, the more education you’ve had, the more open-minded you are.” Resistance to change seems partially rooted in the fear of the unknown, and a lack of education and understanding about the proposed changes and how they will directly impact upon hatchery staff and their day-to-day operations.

Participants seemed willing to embrace new environmentally friendly initiatives if research or audits proved there would be a benefit. Sometimes the barrier would be a perception that not enough research was conducted. The fear would be wondering what the long-term effects to fish health might be when there was only short-term research available. There was a fear that making a commitment to embrace change might cause regret, if it didn’t meet their expectations and they were unable to get out of the commitment. The concerns included lack of improved fish health, increased workload, and lack of increased funding to continue the new commitment. There was also a fear of not fully understanding the implications of the change and “regretting a decision because you can’t turn back once you’ve committed.” One participant stated that “there is a cost to doing research right.” Research was seen as a long-term study, at least three to five years, with continued monitoring afterwards to confirm the benefits of the eco-initiative, but “money is not available for that” was the conclusion. It was further suggested that perhaps one or two hatcheries could be used as a pilot to adopt new techniques supported by existing research, rather than imposing a unilateral change. Participants seemed to realize that

discussions through conferences and workshops were needed to talk about new ways of doing things at hatcheries, because the environment was changing. The findings of pilot studies and research of new technologies could also be presented and discussed at these forums.

Audits conducted to determine where hatcheries could save on energy were usually welcomed, because the work was done by others for the hatchery and often costs to incorporate energy saving initiatives were covered by other programs. One complaint from participants, however, was that hatchery staff didn't always understand the audit data or the data were seen as vague or incomplete. For example, one participant stated that he wanted to know more details from an audit, such as whether it was better to turn lights on and off 10 times versus leaving them on for an hour. They wanted to see the data that showed it was beneficial to use new energy-efficient light bulbs even if these mercury-filled bulbs are put in the landfill afterwards; was it really better to use plastic bags versus the reusable bags or was this just a fad; and finally, was it better to use new biofuels in all situations, or were there other options to consider? One participant summed up the energy audit this way:

They sent us a consultant who gets a hold of the Hydro records and produces a chart, and they do a statistical analysis on it. What they've done is taken a bench mark period and they compare your use over different intervals against that bench mark, and what I've found was one year we're way high and another year way low, and I don't even know why I was high or low. It's just like one year I say "Yippee, I'm low, but I don't know what we did different" . . . The consultant doesn't know. He's just taken our old flow of demand. If we had an actual energy audit, learned where our big factors were, then we could start making some adjustments and start making some savings . . . just for the

general good, and if we had some specific goals and some incentives, then it's more likely we'd stick with it.

One last example on education and research had to do with mentoring. A suggestion was made to have younger staff shadow senior staff who were considered experts in their field and who were anticipating retirement in the near future. Although, in one instance, this was considered a good idea, in the end a consulting company was hired by upper management to interview the senior staff person in order to compile a knowledge capture manual that would be available to everyone. In the end, the book was put on a shelf, never looked at. According to the participant, the endeavor was considered a success by upper management, although the participant did not consider this true mentoring, because it was not a hands-on approach nor did he consider the consultants qualified to write the manual.

Another comment from a participant that spoke of the loss of a hands-on mentoring approach was "We don't have job exchanges anymore," where staff received input from other hatcheries on biological and engineering issues. Job exchanges also allowed workers to help out in other sectors, if required, especially in remote communities where it was difficult to access temporary staff from other sources. One reason given for the disappearance of job exchanges was cost and time, but another reason was that staff were willing to take part in job exchanges when they were young, with fewer family responsibilities, and at a time when they were interested in career advancement. They seemed to get complacent as the years progressed, according to the participant. This introduces the topic of the senior generation versus the newer generation, which will be discussed in the next section.

Organizational culture and personal beliefs.

If you want to make enemies, try to change something.

~ Woodrow Wilson (1856–1924)

Organizational culture and personal beliefs were common topics of discussion amongst most participants. Although participants were not asked to provide a definition of *organizational culture*, their comments implied a definition consistent with that of Robbins and Langton (2001, p. 381), who state it is “a system of shared meaning and common perception held by members of an organization, which distinguishes it from other organizations . . . and gives employees a clear understanding of *the way things are done around here*.” Doppelt (2003) adds the idea that organizational culture is a system of community. These ideas were supported clearly during one interview, while talking about egg production at hatcheries. The conversation centred around the way the environment in Georgia Strait might be changing and the fact that some scientists were starting to think hatcheries were loading too many fish in the Strait. The participant’s comment to this scenario was, “”Don’t reduce my egg targets, no siree, because that’s not what we do.” Behind this view was the fear of budget cuts, as expressed by the participant, “I guess the fear from the hatchery’s perspective is if I’m doing 30% less fish, I’m expected to come up with a surplus in my budgets that’s going to get grabbed, and I may never see that again. I’ve been around long enough to know that that’s what happens. You lose it and it’s a bitch to get it back. There’s that fear.” This fear was also related to a fear of loss of jobs, if production were to be cut.

Interview participants were employed as hatchery staff for an average of 29 years. This group represented the senior generation by some of the participants’ own definitions. Although many of the participants considered themselves environmentally aware or environmentalists by

nature, many of them also agreed that the younger generation would carry on the torch of the environmental movement that had been started. There was indication from some that the senior generation of hatchery staff could only go so far in terms of embracing change because they were resistant to change in general; it was felt by some that a cultural shift was needed. The perception of some participants was that, generally, the senior generation were more set in their ways, to the point that “you just couldn’t teach old dogs new tricks.” Other views indicated that a small number of the senior generation just simply didn’t care. It was unclear whether there was divisiveness among younger and senior staff that might be a source of tension and represent a barrier to change.

Participants expressed a hope in the younger generation who had grown up with environmental issues and were, therefore, more open to change. These young people were described as “more energetic, more educated, more exciting, more dynamic, more everything . . . they also bring new ideas . . . they are like fresh air.” One concern, though, was these young people needed mentoring by the senior generation with regard to practical experiences.

Not surprisingly, the personal approach was seen as most helpful in facilitating change at hatcheries. When a technician, engineer, or biologist from RHQ was assigned to a facility, as was often the case in the past, it signified to the participants clear leadership and that the senior employee would take responsibility for issues. Face-to-face, on-site discussion was important to staff, because they often saw quick action with new ideas as a result.

The opportunity for education from outside DFO was also seen as very helpful in that it “gave greater awareness and knowledge of what could be done, the importance of doing it and assistance in how to get involved or how to get on board.” Outside contacts with provincial

government groups and private groups were viewed as good information sources when common experiences were shared.

Water and Energy Environmental Issues

Water is the lifeblood of a hatchery, because it is this resource that fish depend on. Energy translates into the cost required to access the water resource and to operate each hatchery facility. Part of the interview focused on participants' views on water and energy issues and options for environmental sustainability, centred around the following topics: use of grey water; use of recirculating water for fish incubation or fish rearing; and use of solar, wind, geothermal, or private hydro power. These topics were discussed during the interview because they are options being used at some hatcheries, but not all hatcheries, or they are options being considered generally.

Grey water.

Grey water was considered to be anything that went down a wash basin or floor drain, not including water used for fish incubation and rearing. The general consensus on this topic was that there wasn't enough grey water produced at hatcheries to create an environmental benefit through secondary use. Participants thought the use of grey water would be limited to watering lawns and washing down equipment and structures. One comment was, "Let the lawns go brown," meaning it's not worth the effort. The cost to modify plumbing in order to separate sewage from grey water plus the cost to treat potentially contaminated grey water were the barriers cited for this option. One comment that seemed to sum up participants' views on grey water was, "We have lots of water, we have good water, and I don't think it's going anywhere." The view of having a perpetual and abundant supply of water is carried on in the next topic on water recirculation.

Water recirculation for fish incubation and rearing.

Generally, the idea of recirculating water for fish incubation was embraced, because incubation requires a relatively small amount of water and fairly simple installation compared to water required to rear fish. Some facilities already recirculate water for incubation, and the word has spread through workshops and personal conversations that recirculating water for incubation results in energy savings, cost savings, convenience, and bigger, healthier fish. Participants agreed that embracing this change was made easy when someone came to the hatchery and explained the benefits (e.g., to the hatchery budget, to staff workload, to fish health, to the environment), and that the process was dependable, that it was a tested process, and that the option was not imposed by upper management. Interestingly, the issue of fish disease was cited both as a barrier to change in one instance and as a reason to embrace change in another instance. At one facility a fish culture problem was solved through recirculating incubation water, thereby ensuring acceptance. At another facility bacteria developed after recirculation was introduced, so regret in deciding to recirculate caused a barrier in continuing with the recirculation procedure. After much research it was discovered the bacteria were caused by dead alevins and fish egg shells, which collected in the plumbing system. Improved cleaning techniques resolved the problem, and eventually staff resumed their acceptance of recirculation.

Recirculating water for fish rearing purposes was generally not embraced, because it involved a large volume of water, was regarded as complicated to implement and maintain, and would not result in significant cost savings where a gravity supply system existed. Participants seemed willing to consider recirculation for rearing purposes only if there was a sudden loss or shortage in water supply. There was one exception that had to do with partnerships. In some instances, partnerships exist between the Department and nongovernmental agencies that supply

water to a small number of hatcheries. One participant expressed his hesitation of entering any type of partnership in the future because of an experience where he felt “held hostage” by events that he thought were not in the Department’s control. He, therefore, saw this partnership and future partnerships as a barrier, even if it enabled hatcheries to take advantage of recirculated water.

It seemed the main barrier to recirculating water for rearing purposes was a view that the water resource was unlimited. Further, if the water supply system was gravity fed (no power consumption), then there was no possibility to save on energy costs. After commenting on the abundance of water in a river that flowed passed his hatchery, a participant made this comment:

I stand at the intake and watch that river go by weekly and just think what a precious resource it is; and our pumped water is really good . . . we’re blessed that way. I’m not a big fan of recirculation for two reasons: one, I don’t know that much about it and secondly, I’ve heard of some problem of disease and other things that have happened at other facilities. The majority of our water is gravity fed so there is no power consumption.

This was a common view, that there was no need to recirculate, because there was lots of water. No participant claimed that recirculation was warranted based on conservation and the benefit to the environment alone. The benefit had to involve a cost savings or work efficiency related to the hatchery; this comment was the expectation: “You’d have to convince me first if it would be effective, and then it was going to save us money, and then it was going to be good for the environment”; otherwise, it was not a priority.

Alternate power sources: geothermal, solar, wind, and private hydro.

Participants were generally interested in any alternate power source, as long as it didn't affect fish health and had a short payback period. One concern was whether staff could understand the new, complex technology required to operate and maintain these new initiatives. This had a senior generation–new generation theme to it, as well. Another concern was expressed for remote locations where technical support may not be readily available should a problem arise; hence, remote locations would require more technically skilled staff than urban locations. With respect to wind power, a participant questioned whether such a project would result in an unhealthy amount of vibration and noise. Most agreed that as long as the new power initiative was practical and cost effective then it would be worthwhile, and they would embrace it “because the power and fuel bills are so large.”

Private hydro power was the most popular topic with regard to alternate power sources. Private hydro power refers to non-BC Hydro power, but not necessarily a private company producing hydro power at a facility. One participant expressed his views on private companies producing power at hatcheries this way: “Once you bring the private sector into it, they're in it to make money and they'll cut corners. If you want to see something go sideways environmentally, just privatize it and watch what happens.” Nonetheless, most participants were passionate about the possibility of incorporating on-site hydro power at their facilities because they believed infrastructure requirements existed to facilitate this option. Federal regulations were commonly identified by participants as a barrier to such an option.

Chapter Four: Discussion

I begin this section by discussing some of the difficulties with the concept of sustainable development, not only at the hatchery level but at the academic level, as well, and show how the

difficulties can affect progressive change. Next, I consider the theme of governance, which was central in my research findings, and provide a critique of significant DFO documents pertaining to sustainable development strategies. I show there is a solid rationale for both hatchery staff and upper management to operate hatcheries in an environmentally sustainable manner, even in the absence of formal direction. Third, I list issues that complicate environmentally sustainable decisions and review some of the major systemic difficulties that exist in bureaucracy in general, which can be linked to barriers to change. Fourth, I discuss the concept of what some interview participants referred to as “leading the charge” or being the “shining light.” The preceding four topics also address the theme of education and research where one participant stated “education is the key to change.” Understanding the challenges of definitions, understanding the Department’s foundational documents on sustainable development, and understanding difficulties in bureaucracy are important educational topics that can help provide key insights in fostering change.

The Challenge of Definitions

Interview participants expressed a variety of views in defining the concept of sustainable development, containing both negative and positive outlooks and influencing their willingness to embrace or resist change. Literature supports this phenomenon. For example, the Brundtland Commission Report’s (1987) definition for sustainable development, adopted by DFO (2006a, p. 8) is, “development that meets the needs of present generations without compromising the ability of future generations to meet their own needs.” Dale (2001) argues that the term is a paradox, in that development cannot occur without some cost to future generations. An opposing view of sustainable development is one such as Luke’s (2005), where he states, “The real political agenda of sustainable development is obscured for clear reasons that serve important ideological

and political purposes” (p. 236). He argues that players at the table of sustainable development are highly self-serving, pursuing their own personal financial interests. He further contends that the concept of sustainable development is an oxymoron and is the Brundtland Commission Report’s (1987) catchphrase of intellectual emptiness. Dale (2001) adds a more workable position, by which she encourages us to reconcile the tensions that paradoxes bring, rather than pretending they don’t exist, in order to seek solutions for a sustainable society.

For some interview participants, living within these tensions seemed to be understood in the context of sustainable development of hatchery infrastructure and hatchery operation renewal options. For example, because they often viewed themselves as environmentalists, participants indicated they were frustrated that hatchery operations consumed a great amount of fossil fuel, circumstances that were out of their control. The use of vehicles for various work functions was also seen as a large fuel drain, but as a requirement for successful operations, especially in remote locations. Reducing energy, thereby reducing operating costs, was a focus for most participants and an initiative easily embraced—perhaps their way of dealing with the tensions of the paradox, although a question not specifically asked during the interview.

Embracing Change: The Existing Foundation

To address these tensions in some degree, the Department has provided tools to support hatchery staff, such as green procurement choices (Government of Canada, 2007a; Government of Canada, 2007b). Plus, there are a number of significant federal government documents that influence DFO’s sustainable development actions. Some documents have a soft approach; they list suggestions on how to move towards reducing a carbon footprint and encourage departments to incorporate change. Other documents carry more authority by providing directives aimed at implementing green initiatives. Finally, there are documents that legislate change (e.g., Federal

Sustainable Development Act). There is also follow-up on progress, which takes the form of audits, evaluations, and progress reports. Following is a discussion of some of these documents.

The document that appears to be the most comprehensive and detailed strategy within the Department is *Our Water, Our Future: Sustainable Development Strategy [SDS], Fisheries and Oceans Canada 2007–2009* (Fisheries and Oceans Canada [DFO], 2006a). The Minister of Fisheries and Oceans at the time of this report was the Honorable Loyola Hearn, who introduced the strategy by stating that “Canada’s new government is fully committed to integrating sustainable and responsible development principles.” (DFO, 2006a, p. 4).

A foundation is set at the outset of the SDS for addressing hatchery infrastructure and operations renewal with eco-friendly options, in that an additional goal was added to the three existing principles of integrating sustainable development. This new goal is *environmentally sustainable operations and management*. It raises awareness of managing impacts of day-to-day departmental operations on the environment. With this comes a commitment to identify clearer connections between initiatives (activities), outcomes, and goals.

As a goal, environmentally sustainable operations and management has several proposed outcomes, which include further details of activities, performance indicators, and target dates.

These outcomes are:

- DFO will use a strategic environmental assessment (SEA) approach in its policies, plans, and programs.
- Environmental compliance and concerns will be understood by DFO staff as part of their daily work routine.
- Climate change impacts will be better understood within departmental business.
- Frameworks for action will be developed to direct DFO’s environmental management.

- Vehicle gas emissions and maintenance costs will be reduced by proper vehicle deployment.

Not all solutions, tools, or documents on sustainable development are as simple or straightforward as they seem, and interview participants sometimes became skeptical when an eco-friendly option became the buzz word of the day. For example, biofuel, which was mentioned by one participant, is an ever-increasingly popular alternative to traditional fossil fuel for decreasing the use of nonrenewable resources. However, some biofuel crops use up to 17 litres of water to produce one litre of biofuel. (Wu, Mintz, Wang, & Arora, 2009). This could jeopardize water supply for fish and humans in some areas and harm ecosystems—a Catch-22 scenario. Further, an interview participant claimed that a closer study of the use of biofuels at his hatchery facility indicated there would be no benefit to the hatchery or the environment. His opinion was the hatchery did not consume enough biofuel to make its use worthwhile, because it would require using more non-renewable resources to maintain the biofuel option compared to continuing the use of diesel fuel.

Tools for calculating carbon footprints, a concept used by some interview participants, is another example of an oversimplified procedure, if interpreted and implemented improperly, as discussed by McManus and Haughton (2006). They point out that the concept of ecological or carbon footprints as developed by Wackernagel and Rees (1996) is meant as an educational tool, rather than a policy-making tool. McManus and Haughton list ten concerns of ecological footprint theory. Two of these are (a) the lack of recognizing flow of benefits in calculating a carbon footprint and (b) lack of a stronger consideration of water in calculations of land impacted in terms of marine environment food production and the consumption of fish. These two concerns prove to be especially significant for the Department of Fisheries and Oceans when

trying to reconcile the tension between a reduction of a carbon footprint, on the one hand, and the environmental services that the Department provides, on the other. As new technology progresses and infrastructure support increases, perhaps these tensions will be alleviated.

Audits and regulations were not always looked on favourably by interview participants, because they were seen as barriers to meaningful change. On the other hand, there were interview participants who found audits and regulations helpful, because they were perceived as logical and useful. Although this command and control style of management is seen largely as ineffective, Simpson, Jaccard, and Rivers (2008) suggest there is a place for command and control management in the form of regulations and incentives. These inducements force a desired behaviour, where a *tragedy of the commons* (Hardin, 1968) scenario may take place otherwise. A comment from an interview participant, who viewed regulations as a way to embrace change, was that sometimes forced behaviour eventually led to habitual behaviour, and he saw the benefit of it.

Nonetheless, environmental compliance became an important government-wide priority with the creation of the Commissioner of Environment and Sustainable Development (Office of the Auditor General of Canada, 2008). An audit for the years 2000 to 2003 reported noncompliance with applicable federal environmental laws and regulations across the Department nationwide as a major finding (Fisheries and Oceans Canada, 2004). Reasons stated in the report were a lack of accountability, an unclear line of responsibility between management and staff, and a lack of commitment, awareness, and guidance. Future corrective measures were proposed as a result.

An evaluation was conducted on the DFO Sustainable Development Strategies 2001–2003 (Fisheries and Oceans Canada, 2006b). The evaluation identified limitations in its scope.

One limitation was the lack of a significant-sized survey of DFO staff to determine their level of understanding and knowledge of sustainable development or the degree to which sustainable development has become a part of routine activities at the Department. Further, the evaluation did not assess achievement of long-term impacts of sustainable development—a concern also raised by interview participants. One final evaluation worth noting was that, although the sustainable development strategy was highlighted as an important part of DFO's activities, there were no assigned financial resources for the 2001–2003 strategies. This highlights a concern voiced by most interview participants when discussing barriers to eco-friendly change.

Nonetheless, the above tools and documents provide a foundation for sustainable development initiatives, and demonstrate a process that is continually evolving (Gunderson & Holling, 2002). Understanding these underlying strategies, tools, and documents could be a valuable step forward for hatchery staff and, if incorporated into a learning session, could play a part in addressing staff's desire for continued personal education and research, thereby fostering change.

Bureaucracy: A Barrier To Change

Bureaucracy was another passionate topic with interview participants in the context of barriers to change. Peters (2001) describes this barrier to change as a weapon available to the civil service. The weapon is based on permanence.

Politicians come and go; the bureaucracy remains. This not only represents several long-term strategies to administrators who are not pleased with the current political master, but it also presents those political masters with some quite difficult problems of controlling their civil servants. (Peters, 2001, p. 249)

Thus, the permanence-of-government scenario could lead bureaucrats to provide what some refer to as window dressing, rather than productive results (Smid, Bernaert, & Derksen, 2003). Window dressing manifests itself in the form of lagging results in implementation, shielding negative outcomes, and stressing the positive side in the form of positive storytelling. Smid et al. (2003) suggest bureaucrats act this way for a number of reasons; a lack of trust in the program or its goals, a fear of losing reputation or control, a lack of political loyalty, or past negative program experiences. Although the emphasis here is on the actions of bureaucrats, similar symptoms, that is, lack of trust or negative experiences, seemed to exist at the hatchery level of the civil service, resulting in barriers to change.

Nonetheless, strategies and other reports from the Department seem to demonstrate a genuine willingness by some to move towards environmentally sustainable options or at the very least it provides a legitimate foundation with which all levels of staff can move forward with eco-friendly initiatives without having to justify their actions.

Embracing Change Through Revolutionary Thinking

Some interview participants introduced the idea of “leading the charge,” “leading by example,” and “being a shining light,” while describing the change they envisioned. Dale (2001) builds on these thoughts by saying that in order to succeed with this vision there needs to be revolutionary change in governance, a paradigm shift, which includes balancing the three sustainable development imperatives: social, environmental, and economic. “Governments are so fragmented and lacking in holistic systems-analysis capabilities that the task of responding to sustainable development imperatives seems overwhelming” (Dale, 2001. p. 113). Present divisive approaches will not result in successful solutions. As observed by S.B. Hill, in *Absolute Values and the Search for the Peace of Mankind*, “If I stand back and look as objectively as I can

at the earth, what I see are populations made up predominantly of stressed, malfunctioning humans against a backdrop of predominantly stressed, malfunctioning ecosystems” (cited by Dale, 2001, p. 161). In the end, a holistic and inclusive framework seems to be the only hope of reaching common ground between a diversity of opinions and ideas. Participants alluded to this when they said they wanted to be included in discussions and decisions where people were open-minded, rather than exhibiting an adversarial approach.

Dale (2001) also points out that the public service processes of administration were originally created to exploit and export natural resources and not, for the most part, to sustain them. Exploitation had a familiar sound in one interview participant’s statement, where he described seeing the limitless amount of water flowing past the hatchery intake, thereby reinforcing his view that, although the water resource was valued, the perception was that due to abundance there wasn’t a need to recirculate or conserve water at the present time.

A new reconciliation framework for responsible decision making, further described by Dale (2001), is recommended, where the best and most innovative solutions emerge from the interaction between public policy decision makers (i.e., upper management staff), interdisciplinary research (i.e., education and information sharing), and stakeholder participation (i.e., operational staff). This interaction will require common ground, which will increase a sense of partnership and decrease isolation. Interview participants underlined this idea by collaborating with consultants to solve a problem at a hatchery, using innovative and environmentally sustainable principles. Other participants expressed a willingness to embrace more change if they were encouraged to do so and Hamel (1996) supports this by saying that staff need to be engaged in the strategic-making process by giving them accountability for engendering change and some control of their future. A reconciliation framework is a model that could provide the desired

encouragement and engagement. Others agree with the reconciliation framework and refer to it as a radical approach both to governance and in the way individuals (i.e., hatchery staff) conduct their lives in modes of production, consumption, decision making via collaboration from opposing points of view, and new technologies (Kastenhofer & Rammel, 2005; Benyus, 1997).

It seems a contradiction could exist within hatcheries and upper management where intelligent and sincere and well-meaning people, with regard to policy change affecting the environment, are nonetheless ineffective because “the lowest common denominator prevails in decision making, in the face of information to the contrary” (Dale, 2001. p. 97). One reason for this, Dale suggests, is widespread restrictive forces working against the implementation of sustainable development. These are referred to as solitudes, silos, and stovepipes. Solitudes are barriers that separate us by language, geography, and gender. Silos are barriers inside governments, between government levels, and between academic disciplines within universities. Stovepipes are barriers between research organizations and governments, between the research organizations and the private sector, and between each of the above groups and nongovernmental organizations. Dale concludes by saying a new reconciliation framework for responsible decision making is not possible unless solitudes, silos, and stovepipes are addressed.

Chapter Five: Conclusions and Recommendations

This qualitative research has looked at hatchery staff responses to environmentally sustainable change with regard to infrastructure renewal and hatchery operations. Confidential, face-to-face interviews were conducted with staff at federal hatcheries in British Columbia. Despite the expectation that responses from staff would be of a more technical nature, the findings indicate that resisting or embracing change has more to do with hatchery culture,

motivation, and strong leadership. This indicates a path forward in enabling hatchery staff to embrace change.

The primary driver for hatchery operations identified by staff was budget and costs. Environmentally sustainable changes with the potential to reduce operational costs will likely be embraced, but changes that come at an additional cost or increased workload to the hatchery will be resisted.

Recommendation: Continue to look for ways to harness the economic system to provide incentives such as reduced costs and more efficient workloads that improve environmental quality. Encourage technological innovations that are key factors in moving toward a sustainable path (see Appendix E: Suggested Reading, for a list of recommended resource books).

Based on the resource-passionate culture of hatchery staff, environmentally sustainable changes that also benefit the resource (fish) are most likely to be embraced.

Recommendation: Upper managers should prioritize making these types of changes first in order to get buy-in and build trust. Then subsequent changes, which may not have such a direct resource benefit, are more likely to be embraced, especially if goals are clear and measurable.

Hatchery staff are hard working, conscientious, and proud. They want to feel a sense of respect and be given some autonomy. They want input at the decision-making level and would be more likely to embrace change.

Recommendation: Upper management should partner with hatchery staff to formulate ideas and develop environmentally sustainable solutions. A collaborative framework would

reduce the perception of isolation and increase cooperation in order for innovative ideas to emerge.

The existing, strong hatchery culture requires cultural awareness and sensitivity from upper managers. The personal touch will foster willingness and motivation to embrace change at the operational level and leadership will build *contagious* (Gladwell, 2002) conviction about environmentally sustainable changes that will resonate with the resource-passionate attitude of hatchery staff.

Recommendation: Committed flexible leadership with a sensitivity to hatchery culture will motivate change. Offering guiding principles, as well as suggesting ideas that act as impulses, will engage staff..

The hatchery culture may be in a state of transition, as the senior generation becomes replaced by new, younger energy and attitudes. Upper managers need to be sensitive to, and possibly can take advantage of, this progressive shift in attitude.

Recommendation: Search out new staff, involve them with new ideas and skills, and place them where they are visible and influential. The majority of time should be spent with the vast majority of people who are open minded.

Of the technical interview discussion points relating to water and energy, water recirculation for incubation stood out as a change most likely to be embraced, as did alternative energy sources, so long as the energy change translated into cost savings and would not increase existing workloads. Water recirculation for rearing was not seen as necessary by many hatchery staff, as water was seen as an abundant resource or recirculation, uneconomical to initiate.

Recommendation: Upper management should initially focus on water and energy issues, which are likely to be embraced by staff. Then, begin to introduce new environmentally

sustainable options through education and face-to-face discussions. Be consistent in highlighting how the new options will benefit everyone.

A fitting last word is the advice of Hamel (1996), who pleads that we need to bring the top and bottom of the hierarchy together in order to speed up the usually painful process of chain of command, because revolutionaries exist at all levels of organizations. Further, staff at all levels need to have the courage to do the right thing. Words from Thomas Paine from the 18th century are used to reinforce this thought: “Let them call me rebel and welcome, I feel no concern from it; but I should suffer misery of devils, were I to make a whore of my soul” (as cited by Hamel, 1996, p. 79). Finally, a challenge is given to look at the world in a different way, because there can be no change, no revolution, without enlightenment. In the context of hatcheries, the challenge is to incorporate the above recommendations in order to encourage staff to make a choice, to decide to be a member of the past or a member of the future—the establishment or the movement. If there is any hope for the environment, any hope for environmentally sustainable hatchery renewal, then let all of us choose to be a member of the future.

References

- Benidickson, J. (2009). *Environmental law* (3rd ed). Toronto, ON: Irwin Law.
- Benyus, J. M. (1997). *Biomimicry: Innovation inspired by nature*. New York, NY: Harper Perennial.
- Brundtland Commission. (1987). *Our common future*. Oxford, UK: World Commission on Environment and Development.
- Building Owners and Managers Association of British Columbia. (2009). *BOMA Go Green is now BOMA BEST*. Retrieved from <http://www.boma.bc.ca/about.php>
- Canadian Green Building Council. (2009). *What is LEED?* Retrieved from <http://www.cagbc.org/leed/what/index.php>
- Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. Los Angeles, CA: Sage.
- Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Thousand Oaks, CA: Sage.
- Dale, A. (2001). *At the edge: Sustainable development in the 21st century*. Vancouver, BC: UBC Press.
- Davies, M. (n.d.). *Conducting an interview for data collection*. Melbourne, Australia: The University of Melbourne. Retrieved from <http://learner.royalroads.ca/moodle/file.php?file=%2F3048%2Finterviews.doc>
- Denzin, N. (1978). *Sociological methods: A sourcebook* (2nd ed.). New York, NY: McGraw Hill.
- Denzin, N. K., & Lincoln, Y. (2005). *Qualitative research* (3rd ed.). Thousand Oaks, CA: Sage.

- Dey, I. (1993). *Qualitative data analysis: A user-friendly guide for social scientists*. London, UK: Routledge.
- Doppelt, B. (2003). *Leading change toward sustainability*. Sheffield, UK: Greenleaf.
- Fisheries and Oceans Canada. (2004). *Audit of environmental compliance*. Retrieved from <http://www.dfo-mpo.gc.ca/ae-ve/audits-verifications/03-04/envcomp-eng.htm#Intro>
- Fisheries and Oceans Canada. (2006a). *Our water, our future: Sustainable development strategy 2007-2009*. Retrieved from <http://www.dfo-mpo.gc.ca/sds-sdd/2007-2009/index-eng.htm>
- Fisheries and Oceans Canada. (2006b). *Evaluation of the DFO sustainable development strategy 2001-2003: Project 2004-60254*. Retrieved from <http://www.dfo-mpo.gc.ca/ae-ve/evaluations/06-07/60254-eng.htm#tphp>
- Fisheries and Oceans Canada. (2008). *Salmonid enhancement program*. Retrieved from <http://www.pac.dfo-mpo.gc.ca/sep-pmvs/index-eng.htm>
- Gladwell, M. (2002). *The tipping point*. New York: Little Brown and Company.
- Government of Canada. (2007a). *A guide to green government, 1995*. Retrieved from <http://www.greeninggovernment.gc.ca/default.asp?lang=En&n=6FEEB81A-1>
- Government of Canada. (2007b). *Vehicle fleet*. Retrieved from <http://www.greeninggovernment.gc.ca/Default.asp?lang=En&n=590371C4-1>
- Grimm, C. M. & Smith, K. G. (1991). Research notes and communications management and organizational change: A note on the railroad industry. *Strategic Management Journal*, 12, 557-562. doi:10.1002/smj.4250120708
- Gunderson, L. H. & Holling, C. S. (2002). *Panarchy*. Washington, DC: Island Press.

- Hamel, G. (1996, July–August). Strategy as revolution. *Harvard Business Review*, 74(4), 69–82. Retrieved from <http://my.execpc.com/~jpurtell/HBR-StrategyasRevolution.pdf>
- Hardin, G. (1968). The tragedy of the commons. *Science*, 13, 1243–1248.
- Hesse-Biber, S., & Leavy, P. (2008). *Handbook of emergent methods*. New York, NY: Guilford.
- Houston, C. (1975). *History of B.C. fish hatcheries*. Unpublished manuscript located at Fisheries and Oceans Canada library, Vancouver, BC.
- Kastenhofer, K., & Rammel, C. (2005). Obstacles to and potentials of the societal implementation of sustainable development. *Sustainability: Science, Practice, & Policy*, 1(2), 5–13.
- Kvale, S. (1996). *Interviews: An introduction to qualitative research interviewing*. Thousand Oaks, CA: Sage.
- Kvale, S., & Brinkmann, S. (2009). *Interviews: Learning the craft of qualitative research interviewing*. Los Angeles, CA: Sage.
- Luke, T. (2005). Neither sustainable nor development: Reconsidering sustainability in development. *Sustainable Development*, 13(4), 228–238.
- Mathison, S. (1988). Why triangulate? *Educational Researcher*, 17(2), 13–17.
doi:10.3102/0013189X017002013
- Meadows, D. (1998). *Indicators and information systems for sustainable development*. A Report to the Balaton Group. Hartland, VT: The Sustainability Institute.
- Meadows, D. (1999). *Leverage points: Places to intervene in a system*. Hartland, VT: The Sustainability Institute.

- McKenzie-Mohr, D., & Smith, W. (1999). *Fostering sustainable behaviour: An introduction to community-based social marketing*. Gabriola Island, BC: New Society.
- McManus, P., & Haughton, G. (2006). Planning with ecological footprints: A sympathetic critique of theory and practice. *Environment and Urbanization*, 18(1), 113–127.
- McMillan J., & Schumacher, S. (1984). *Research in education: A conceptual introduction*. Boston: Little, Brown.
- National Institute for Health and Clinical Excellence. (2007). *How to change practice: Understand, identify and overcome barriers to change*. London, UK: Author.
- Office of the Auditor General of Canada. (2008). *Comissioner of environment and sustainable development*. Retrieved from http://www.oag-bvg.gc.ca/internet/English/cesd_fs_e_921.html
- Perlesz, A., & Lindsay, J. (2003). Methodological triangulation in researching families: Making sense of dissonant data. *International Journal of Social Research Methodology*, 6(1), 25–40.
- Peters, G. (2001). *The politics of bureaucracy* (5th ed.). New York, NY: Routledge.
- Pezzy, J. (1992). Sustainable development concepts: An economic analysis. *World Bank Environment Paper No. 2*. Washington, DC: World Bank.
- Robbins, S., & Langton, N. (2001). *Organizational behaviour: Concepts, controversies, applications*. Toronto: Pearson Education Canada.
- Simpson, J., Jaccard, M., & Rivers, N. (2008). *Hot air*. Toronto, ON: Emblem.

- Smid, G., Bernaert, H., & Derksen, H. (2003). *Trust, e-innovation and leadership in change* [In progress]. Retrieved from <http://www.hdconsult.com/SCANS/paper-innovation.pdf>
- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research* (2nd ed.). Thousand Oaks, CA: Sage.
- Terazono, E. (1999). *Barriers to change: Re-engineering faces high risk of failure*. Retrieved from http://www.paconsulting.com/news/about_pa/1999/about_pa_199910011.htm
- Wackernagel, M., & Rees, W. E. (1996). *Our ecological footprint: Reducing human impact on the earth*. Gabriola Island, BC. New Society Publishers.
- Wu, M., Mintz, M., Wang, M., & Arora, S. (2009). Water consumption in the production of ethanol and petroleum gasoline. *Environmental Management*, 44, 981–997.
doi: 10.1007/s00267-009-9370-0

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Footnotes

¹Unless otherwise noted, statements made about the Department of Fisheries and Oceans are my opinion, based on my 30-year career with the Department.

²Text quoted from interview transcripts has been slightly edited for clarity and smoothness of expression.

³Malachite green was used in hatcheries to treat oomycete *Saprolegnia*, which infects fish eggs during incubation. It was also used to treat ichthyophthirius in freshwater rearing of salmon. The principal metabolite, leuco-malachite green, is found in fish treated with malachite green which is the basis of controversy and government regulation. Malichite green was banned in 1992 and classified as a Class 11 Health Hazard (information from Wikipedia, http://en.wikipedia.org/wiki/Malachite_green).

⁴Mr. King Whitney Jr. was the president of Personnel Laboratory Inc. when he made this statement at a meeting. It was first quoted in the Wall Street Journal on June 7, 1967.

⁵The purpose of the National Environmental Compliance Audit Program “is to provide a current assessment of the level of environmental compliance status for DFO facilities and to assess progress in achieving compliance over a three year period at specific sites. The work builds on the results of previous studies and included an on-site examination at seventeen representative facilities” (from the Fisheries and Oceans Canada website, *Audit of Environmental Compliance*: www.dfo-mpo.gc.ca).

Appendix A: Table of Themes

Embracing Change

General Theme	Subthemes
Good (or effective) Governance	Advice/Communication/Collaboration/Participation/ Influencing upper management
Good Governance	Support/Expert consultants
Good Governance	Force/Top-down initiatives/Economic Action Plan
Good Governance	Staff Commitment/Autonomy/Responsibility
Good Governance	Less bureaucracy
Benefits	Funding/Budget/Cost
Benefits	Work/Time/Efficiencies
Benefits	Benefit/Perks
Benefits	Visible progress
Benefits	Fish health
Benefits	Water initiatives/Saving Energy
Education & Research	Research/Monitoring/Analysis/Studies/Pilots/Audits/Assessments
Education & Research	Education/Training/Media coverage/Mentoring
Culture & Personal Beliefs	Young people
Culture & Personal Beliefs	Personal beliefs/Eco-awareness/Cultural awareness
Culture & Personal Beliefs	Small community/Seeing other's habits
Culture & Personal Beliefs	Trouble maker
Culture & Personal Beliefs	Goals

Barriers To Change

General Theme	Subthemes
Lack of Good (or ineffective) Governance	Top-down management style/Command and control
Lack of Good Governance	Lack of reality/Ridiculous general codes/Recommendations not practical/Regulations prohibit making money/Regulations exceed stupidity/Regulations waste of time and money/Lack of common sense

Lack of Good Governance	Empty Promises
Lack of Good Governance	Confusing or conflicting messages from upper management/Slow decision making/Not truly listening to staff's ideas/Stressed or preoccupied with other issues/Wrong priorities/Lack of leadership/ Lack of interest or no time/Lack of strategy/Lack of direction/Insincere/Not paying attention/Upper management not in positions long enough to provide consistency of leadership/Interim or acting positions/window dressing/
Lack of Good Governance	Overtaken by administration/Convolutd process for new ideas or request/Extreme bureaucracy/Little flexibility/Controlling
Lack of Good Governance	General Eco-friendly talks with no substance
Lack of Benefits	Work disruption/Negative impact on operations
Lack of Benefits	No or little payback/Benefit/Incentive/Not big enough benefit/Too menial/Money or water savings used by hydro anyhow
Lack of Benefits	Saved money taken away
Lack of Benefits	Drop in lifestyle
Lack of Benefits	Funding uncertainties/Shortage/Long-term costs/Budget cuts/One-year budgets lead to waste/Government preaches sustainable development but doesn't fund it
Lack of Benefits	Shortage of staff/Hiring issues/Retirements so no continuity
Lack of Benefits	Lack of time to learn and prioritize/extra training/Lack of job exchanges
Lack of Benefits	Remote small towns have lack of recycling facilities
Lack of Education and Research	Lack of fish culture study/Not enough detail/Confusion of facts/Poor analysis/incomplete Information/Lack of monitoring
Culture and Personal Beliefs	Regretting a previous decision/Fear it won't work
Culture and Personal Beliefs	Conflicting personalities or relationships
Culture and Personal Beliefs	Older staff/ Just don't care/Not open-minded/Egg target focused/Culture/Stuck in old ways/Antiquated thinking/Stubbornness/Change in philosophy/Life approach/ Battling cultural shift
Culture and Personal Beliefs	Skepticism about political correctness or a fad
Culture and Personal Beliefs	Unable to convince staff/Difficult to train staff/
Culture and Personal Beliefs	Fear of job loss
Culture and Personal Beliefs	Feeling of disappointment/Abandonment/Bitter

Appendix B: Interview Guide

1. The Dept. plans to implement a sustainable development strategy and is currently working on details. Already we've been hearing a lot about green or eco-friendly initiatives. What I'd like to know is when you hear these terms; environmental sustainability options, eco-friendly, sustainable development, or green options, what does that mean to you or how would you define those terms?
2. What do you see as the major concern or barrier to change with regards to incorporating environmentally sustainable options at this hatchery?
3. What options would work and what options wouldn't work? Why?
4. Other issues I would like your opinion on:
 - i. Collection and use of grey water around the hatchery site
 - ii. Recirculating water from
 1. fish rearing systems
 2. fish incubation systems
 - iii. Alternate heat and power sources such as
 - geothermal heating
 - solar and wind power
 - on-site hydro power
5. Who or what has been most helpful in encouraging eco-friendly options?
6. Who or what has been least helpful in encouraging eco-friendly options?
7. Are there any other concerns you have? What would be your approach?
8. Do you have any other comments or questions?

Appendix C: Letter of Recruitment



Letter of Recruitment

Wayne Krause
(*Department of Fisheries and Oceans*)
200 – 401 Burrard Street
Vancouver, BC. V6C 3S4
Phone: xxxxxxxxxx
Email: xxxxxxxxxxxxxx

<date>

Dear <first and last name>;

Subject: Invitation to participate in a research project conducted by Wayne Krause

I would like to invite you to participate in a research project that I am conducting as a student of Royal Roads University. The research is a requirement in obtaining a Master of Arts degree in Environment and Management. Your participation would involve an audio-taped interview and would take approximately one hour. It could take place at a date, time, and location of your convenience. It could also take place during working hours and at your work site, if you so choose. Your identity would be anonymous and confidential. Any sensitive information given during the interview would be ‘masked’ to protect your identity. Interviews will be conducted by me.

As you may know, I am an Engineering Technician with the Department of Fisheries and Oceans, Real Property and Technical Services. The Department is also my sponsor and I have their permission to conduct this research. It should be noted that the research is not specifically for the Department nor does the research belong to them. Rather, the research is the property of Royal Roads University and myself. Nonetheless, once the research is written up in my Thesis, it becomes publicly accessible.

The name of my project is “Capital Improvements Incorporating Environmentally Sustainable Options At Federal Fish Hatcheries.” The purpose of the research is to identify what principles and changes are being considered in capital improvements, what are the responses of hatchery staff, and why they hold these views. One of the benefits of the interview would be to help determine the thoughts, concerns, advice, and opinions of hatchery staff towards any of these changes that affect their work environment.

I believe your participation would provide valuable information for my research project and I hope you consider my request to interview you. Nonetheless, please realize that you are free not to participate. If you do participate you have the right to withdraw at any time without prejudice.

Also, please realize that I am not involved in any decisions with regards to infrastructure renewal or program changes at hatcheries, therefore, anything you say during the interview does not have a right or wrong answer or a positive or negative affect.

Please contact me via phone or email (see letterhead) if you are interested in participating or if you wish to discuss anything further. Alternatively, you can contact Dr. Laura Rempel @ xxxxxxxxxx (Thesis supervisor at DFO) if you wish to verify the authenticity of the research project. I look forward to your response.
Sincerely

Wayne Krause

Appendix D: Consent Form

By signing this consent form you are agreeing to participate in the research project as outlined below:

Title of project:

Capital Improvements Incorporating Environmentally Sustainable Options At Federal Fish Hatcheries

Researcher: Wayne Krause (phone: xxxxxxxxxx; email: xxxxxxxxxxxxxxxxxxxxxx)

University affiliation: Royal Roads University, Victoria, BC.

Contact: Dr. Laura Rempel (Thesis Supervisor); phone xxxxxxxxxx

Nature, and expected duration, of the subject's participation: face to face interview (audio recorded) for approximately 1 hour

Nature of questions to be asked during the interview:

It is apparent that The Department of Fisheries and Oceans is leaning towards a sustainable development strategy for hatchery infrastructure renewal and hatchery operations. Already we are hearing a lot about “green” or “eco friendly initiatives. The interview questions will centre around your response to the path the Department is taking and various eco friendly options related to hatcheries.

How the information obtained will be recorded: audio taped and then transcribed

Protection for privacy, confidentiality and anonymity:

- No personal information such as name gender, age, hatchery location will be used in any documentation or recorded.
- The interview location will be at a time, date, and location that is comfortable for the participant.
- The digital audio tape will be kept in a secure password protected location and destroyed within five years.
- Any sensitive information will be ‘masked’ in order to maintain privacy, confidentiality, and anonymity.
- Coded numbers will be used to identify the results obtained from individual participants.
- A peer-debriefer may have access to raw data (i.e. audio tape and transcription) but will sign a confidentiality agreement.
- If a participant decides to withdraw at anytime then the digital audio tape will be destroyed and the data will not be used.
- Recordings or transcriptions will not be used publicly.

Description of any foreseeable harms, benefits, or inconveniences to the participant:

There are no foreseeable harms. Benefits may include improvements to hatcheries and the work environment. The only inconvenience would be taking the time to meet for the interview.

Disclosure of any and all conflicts of interest: There are no conflicts of interest. The researcher has no influence on hatcheries, their programs, or their staff. Anything discussed in the interview does not have a right or wrong answer. There is also no positive or negative affect on views or opinions expressed.

Right to withdraw: Participants have the right to withdraw from the research project at any time without prejudice to pre-existing entitlements. Employees of the Department of Fisheries and Oceans, whether they choose to participate or not, will have no effect upon their employment or advancement.

Commercialization of research findings: There is no anticipation that the research findings will be commercialized.

Researcher's offer to answer any questions before proceeding: The researcher is willing to answer any questions before proceeding, either in person, email (XXXXXXXXXXXXXXXXXXXX), or phone (XXXXXXXXXX).

Research results: The research results will be published as a thesis at Royal Roads University Library. Participants will be informed via phone, email, letter, or in person when the thesis is completed and the thesis will be made available to them.

I agree to participate in the research project as described above.

 signature

 date

 print name

Appendix E: Suggested Reading

Capra, F. (2002). *The hidden connections*. New York, NY: Anchor Books.

Dale, A. (2001). *At the edge: Sustainable development in the 21st century*. Vancouver, BC: University of British Columbia Press.

Doppelt, B. (2003). *Leading change toward sustainability*. Sheffield, UK: Greenleaf.

Field, B. C., & Olewiler, N. D. (2005). *Environmental economics* (2nd ed.). Toronto, ON: McGraw-Hill Ryerson.

Gladwell, M. (2002). *The tipping point*. New York, NY: Little, Brown.

Gunderson, L. H., & Holling, C. S. (2002). *Panarchy*. Washington, DC: Island Press.