

Revitalization of Atlantic Salmon Populations in Western Newfoundland

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Abstract

*This research project was focused on the Atlantic salmon (*Salmo salar*), and their population status, health, and related conservation efforts within the western Newfoundland region with a particular focus on the following three waterways: Harry's River, Hughes Brook and Corner Brook Stream. The main issues addressed are the efforts being undertaken by the non-governmental organizations involved, as well as the department of Fisheries and Oceans, to reestablish a healthy salmon population in the waterways of Western Newfoundland. This paper includes a discussion on Community-Based Natural Resource Management (CBNRM) and its key characteristics. These key characteristics are compared to those of the non-governmental organizations involved in the salmon revitalization projects in Western Newfoundland and consequently assertions are made regarding what constitutes a successful organization when it comes to natural resource management.*

Introduction

The Atlantic salmon is a native species to the waters of Newfoundland and Labrador and play a very important ecological role in this environment. It also plays an important role as a resource for food and tourism. Thousands of people from both inside and outside the province angle for salmon in various waterways for both sport and food (CBC News, 2010). Due to overfishing, illegal poaching, pollution and habitat destruction salmon populations have decreased in various waterways in the province (Kean, 2016); sometimes to the point where entire populations were wiped out (Crocker, 2013). Luckily, there are many organizations involved in ecological remediation and restoration, mitigation, repopulation, and maintaining a healthy environment for salmon to flourish. This paper will include an overview of the efforts undertaken by non-governmental organization such as the Salmon Preservation Association of Western Newfoundland (S.P.A.W.N.), Atlantic Salmon Federation (ASF), and the Atlantic Salmon Conservation Foundation (ASCF); as well as the Department of Fisheries and Oceans (DFO) to help conserve our Atlantic salmon populations and maintain a healthy environment.

First there will be an overview of CBNRM to identify what characteristics are common to successful initiatives, as well as a comparison of CBNRM case studies with the recognized key CBNRM characteristics. Secondly, there will be a discussion of the history of recreational and commercial salmon fishing in Newfoundland. Third, a look into each individual organization and the Department of Fisheries and Oceans. This overview will include their primary goals, mission statements, and some history about each organization and department. Fourth, there will be an overview of the focus locations of this paper. This will include their geographic location and history. More importantly there will be focus on what causes were attributed to the decline of salmon population in each waterway, and what steps were taken by the various organizations and departments to reestablish these waterways as suitable habitats for salmon to spawn and thrive.

There will be a focus on the actions that were taken to reach the goals of a revitalized habitat that is capable of producing healthy salmon populations, as well as which actions worked best, and which ones did not. Also, a look at how this can be related to unhealthy and unproductive waterways in other geographic locations on a national level, and perhaps a global level. Finally, this will bring this paper to a conclusion where methods and actions undertaken by these organizations and departments will be summarized and further discussed.

Thesis

Atlantic salmon population is highly influenced by freshwater ecology, including health of the water, substrate, availability of food, and obstructions and obstacles in waterways; as well as proper legislation set forth by the department of Fisheries and Oceans. Overfishing, poaching, waterway obstructions and pollution are some of the factors that have caused decline in salmon populations in various waterways (Canada Department of Fisheries and Oceans and Québec Ministère des Ressources naturelles et de la Faune, 2009). When it comes to community-based management, those involved in the management of a natural resource will often maintain the narrow view that success means achieving a perfect framework or plan that will ensure that goals are achieved in their fullest extent under any circumstances. This subjective viewpoint can result in unease and even conflict between members of the community involved, especially in the decision-making process. In all actuality, it may take several steps and long periods of time to achieve set goals. It is therefore important for the policy-makers, stakeholders and community members involved in CBNRM recognize the positive effects which result from their involvement, which ultimately leads them closer to completing the ultimate goal (Lawrence, Daniels & Stankey, 1997). Since the early 1970's CBNRM has been viewed as an alternative to the top-down conservation methods undertaken by government (Reid, 2015). It involves the relinquishing, to some degree, the responsibility over natural resources to the community within the region or location where the resource is found. There are a number of characteristics which can contribute to a successful CBNRM initiative. Within a community, particular individuals who share similar mindsets and goals may group together to form organizations with the aim of striving for these shared goals (Mountjoy et. al. 2013). In the case of the Atlantic salmon habitat and population health, there were like-minded individuals who banded together to form various organizations whose goals were to reestablish a healthy salmon population and habitat in western Newfoundland. Three non-governmental organizations, which were founded as stewards for salmon preservation are The Atlantic Salmon Conservation Foundation (ASCF), The Atlantic Salmon Federation (ASF), and The Salmon Preservation Association for the Waters of Newfoundland (SPAWN). These three stewardship-focused organizations will be reviewed and compared against the successful characteristics of CBNRM, and their actions will be compared to those of other CBNRM efforts from other case studies. The goal will be to find out which characteristics are embedded by each NGO in relation to CBNRM, and how these actions can be implemented in future projects for CBNRM in other contexts.

Research Methods

Relevant literature including journals, books, newspaper articles, brochures, pamphlets and website information from the focus NGO's, as well as other electronic sources will be mined for information regarding community-based management, ecological restoration, and ecological

mitigation by various organizations involved in Atlantic salmon conservation, and the acts and regulations enforced by the Department of Fisheries and Oceans. Secondary data on the historical status of Atlantic salmon will also be incorporated into the paper. Information specific to the three river systems identified (Harry's River, Hughes Brook and Corner Brook Stream) will be obtained from journals, books, articles and online sources.

Data for this project was also obtained from interviews conducted with representatives of the Salmon Preservation Association of the Waters of Newfoundland, The Atlantic Salmon Federation and The Atlantic Salmon Conservation Foundation. This is important information as it will focus on the three specific waterways, as well as provide in-depth information which is unavailable elsewhere. This research paper will employ a case study approach. A case study is, "a research approach that is used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context. It is often used when there is, "the need to explore an event or phenomenon in depth and in its natural context" (Crowe et. al. 2011. Para. 5). Case studies allow researchers to compare similar situations of interest to other real life situations. In doing so researchers can differentiate between successful situations, as well as unsuccessful situations, to implement particular elements to their situation or case without putting their objectives at risk (Crowe et. al. 2011).

Research Questions

- What are some key characteristics of successful community-based natural resource management?
- How do these key characteristics compare to NGO's involved in conservation of Atlantic salmon in Western Newfoundland?
- What projects have the NGO's been involved in regarding Atlantic salmon conservation? Also, what actions have they taken in these projects?
- How could these key characteristics be implemented in future resource management and conservation projects?

Interview Questions

- What organization are you a representative of?
- What projects have you been involved in with regards to salmon populations and habitat restoration and health?
- What methods and instruments have you used during these projects to create a healthier habitat for salmon and/or how did you go about reintroducing salmon to the habitat?
- How have these methods worked to help revitalize the salmon populations in the waterway?
- Which Methods have you found to work the best to create a healthy salmon population in these waterways?

Community-Based Natural Resource Management (CBNRM)

There are several definitions of community-based natural resource management, as there are several branches of CBNRM. According to Gruber (2010), CBNRM is "an approach to natural resource management that seeks to support long-term sustainability through broad participation of community members and resource users in decision making" (p. 53). The objective of CBNRM is to involve community, resource users and stakeholders in various processes, especially the

decision-making process, to incorporate local knowledge into the process of resource management with the aim of increasing the success of management decisions (Measham & Lumbasi, 2013). Before CBNRM, resources used to be managed solely by various levels of government, policy-makers and authorities on the local, regional and national levels (Gruber, 2010), or under control by international donors who funded the conservation of particular resources which often resulted in the resource in question benefiting elites and tourists (Measham & Lumbasi, 2013). One of the earliest examples of CBNRM took place in southern Africa. In the late 1970's there was a program initiated by community members in Zimbabwe called the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) that enabled the local indigenous communities to manage their surrounding resources, with a focus on their local wildlife. CAMPFIRE has proven that CBNRM can be a success as it still operates today after over 40 years (Measham & Lumbasi 2013). Throughout the 1970's and 1980's since its beginning, CBNRM has evolved and gained traction as a means of managing local resources by local communities opposed to strict control by governmental departments, their appointed boards, and regulations (Reid, 2015). As of 2010, there is now approximately 500,000 local CBNRM organizations that have been established in 50 countries (Gruber, 2010).

Successful CBNRM consists of a particular set of characteristics. As Mountjoy et. al. (2013) explains there are particular types of capital: “human capital, bonding social capital, bridging social capital, organizational capital, and economical capital” (p. 1548). Mountjoy et al. (2013) focuses on 10 indicators (Table 1) of successful CBNRM initiatives: *Leadership, Motivation, Respect, Common values, Outreach, Marketing, Shared Vision/ Plan, Communication, Funding, and Equipment* (P. 1550 & 1551).

Table 1: Mountjoy's CBNRM Characteristics

Characteristic	Description
<i>Leadership</i>	<i>Leadership</i> is considered one of the important aspects of human capital. Adaptability, strategic thinking, informed decision-making, and experience are all qualities that are sought in the leaders of CBNRM. Leaders, as well as other members of the community involved in CBNRM, must maintain a high level of motivation, respect, and common values.
<i>Motivation</i>	The <i>motivation</i> to strive towards a common set of goals initiates the action required to accomplish the set goals.
<i>Respect</i>	<i>Respect</i> towards others is important to social capital. Respect allows for trust and the ability to collaborate together as a team. Respect proves to be not only important in a leadership role, but creates strong bonds of social capital amongst all involved in CBNRM.
<i>Common Values</i>	All members of a CBNRM group must share the same values and be like-minded in order for goals to be successfully met. Otherwise, several people on different levels pursuing different goals could result in a type of anarchy where the involved community will go nowhere and get nothing done.
<i>Outreach</i>	<i>Outreach</i> builds public trust and legitimacy on various social levels. It will build external relationships and allow for collaboration with diverse groups of experts, organizations and the community as a whole. Since community involvement is such an intricate component to CBNRM, it is important to build social capital, which in turn incorporates building local social

	networks, norms, and most importantly, trust (Gruber, 2010).
<i>Marketing</i>	<i>Marketing</i> can strengthen both social and economic capital. Proper marketing uses advertisements, slogans, social media amongst other media to make the community aware of the particular natural resources CBNRM organizations are aimed to manage, furthermore, will educate the community on the importance of the resources in question.
<i>Shared Vision/ Plan</i>	Again, long term, sustainable CBNRM is dependent on its members sharing a common goal, vision or plan in which they can achieve through teamwork.
<i>Communication</i>	Information sharing broadens the entire group's level of knowledge, and communication both internally and externally helps involve the community and streamline decision-making processes.
<i>Funding</i>	Since CBNRM groups cannot typically create sufficient revenue required to achieve desired goals, it is extremely important to secure a source of funding that will allow their goals to be met.
<i>Equipment</i>	Although it is perhaps the lesser of the desired components, it is still a requirement in order to create successful CBNRM. Research equipment in the field, as well as proper equipment in the office are required for successful CBNRM (Mountjoy et. al. 2013).

Gruber (2010) proceeds even further to construct a list of 12 organizational principals and key characteristics (Table 2) of effective CBNRM. He adds characteristics such as conflict resolution, enabling environment, and the devolution of power from governing bodies to the community groups, and also elaborates on some of Mountjoy's et al. characteristics to go further in depth into key components within Mountjoy's 10 characteristics. Gruber lists them as A through L as follows:

Table 2: Gruber's CBNRM Key Characteristics

Key Characteristics
<i>A) Public participation and mobilization</i>
<i>B) Social capital and collaborative partnerships</i>
<i>C) Resources and equity</i>
<i>D) Communication and Information Dissemination</i>
<i>E) Research and information development</i>
<i>F) Devolution and empowerment</i>
<i>G) Public trust and legitimacy</i>
<i>H) Monitoring, feedback and accountability</i>
<i>I) Adaptive leadership and comanagement</i>

<i>J) Participatory decision-making</i>
<i>K) Enabling environment: Optimal preconditions and conditions</i>
<i>L) Conflict resolution and cooperation</i>

Gruber (2010) explains that these key characteristics are not to be considered as “predictors of successful CBNRM initiatives but rather as organizational design principles and preconditions that have been frequently associated with successful initiatives.” And further elaborating, “following these principles will likely increase the probability of a successful CBNRM initiative” (pg. 55).

Although Gruber’s 12 principles may be similar to Mountjoy’s 10 characteristics, the 12 principles reinforce the most crucial components of a successful CBNRM initiative. The differences between Gruber and Mountjoy’s CBNRM characteristics will be distinguished to give insight on further in-depth components within the characteristics.

Principle A: Public Participation and Mobilization

Under the vague top-down approach of government, those in power resorted to “selling” their ideas to get communities on their side. In other words, Government boards or departments would persuade locals to agree with their methods. With CBNRM comes true social involvement where the community is included in the decision-making process. CBNRM allows the community, including stakeholders, who are directly affected by the state of the resources in question to be involved at each stage and on every level such as information gathering, consultation, decision-making, initiating actions and evaluation. Individuals within the affected community may harbor expertise and great knowledge or skillsets required in achieving the goals at hand, so it is objectively the most crucial component to include the community in determining actions pertaining to their resources.

Principle B: Social Capital and Collaborative Partnerships

This social and communication component further strengthens the importance of society’s role in resource decisions. Social capital is built through allowing the community to take part in all stages of resource management. One of the subjective pinnacles of including the community is that it can foster trust and a sense of pride of local ownership in society which further strengthens social bonds. Collaborative partnerships will draw from different perspectives which could build knowledge. Also, a greater variation of skills and resources can develop between multiple individuals or groups which could strengthen CBNRM initiatives.

Principle C: Resources and Equity

To maintain a team attitude within the community and make everyone feel equally important it is crucial to share both the resources and equity. Not only should everyone have equal use of resources or equal say, but should also equally share the hardships.

Principle D: Communication and Information Dissemination

Communication and information dissemination is another critical component when it comes to community involvement. Rather than scientists and experts being the only people to include in access of information regarding natural resources, the local community affected by the state of the resource has to be informed of all information in order to build the trust needed to achieve management goals as a CBNRM regime. Furthermore, information on the social wellbeing and quality of life must be included in shared information.

Principle E: Research and Information Development

In order to construct a framework for successful CBNRM initiatives it is important to conduct concise research. Technical, scientific, quality-of-life, and other forms of local knowledge form important integrated knowledge. Organizational decisions should be supported by a comprehensive and systematic body of information. Economic evaluations of environmental assets, ecosystem understanding and local knowledge should be included in the research used to derive information. Information which educates the community and creates awareness will enable those involved to make sound decisions.

Principle F: Devolution and Empowerment

Devolution is the transfer of power from political authority to the entire community. This is the important step that must take place in order for CBNRM to even exist. Government and appointed political authorities tend to take a top-down approach to resource management. Measham & Lumbasi (2013) state, “When projects are externally initiated and imposed on local communities, they can seem alien and local residence lack motivation to make the project work” (pg. 651). Gruber (2010) agrees that external political authorities employ centralized, top-down approaches which result in poor results in resource management (pg. 52). Individuals within the affected communities have a first-hand look at the state of a given resource and are present to witness the state of that resource on a long-term basis. More importantly, local individuals are directly affected by the state of their resources and feel they have a duty to ensure that resource is sustainable throughout the future, while ensuring that the resource in question doesn’t become too common so it will disrupt other components of the environment, or other potential resources. This fosters a sense of stewardship in the individuals within the community to protect their resources for their benefits. It is the community who are more capable of feeling the sense of urgency and even pride that is associated with the “ownership” of a given resource. However, in many circumstances a community may not have the sufficient resources or knowledge in order to successfully manage a resource, so it is important that community maintains a relationship with the various levels of government so they can work together to successfully manage a natural resource. To devolve power means to work as a team and relinquish responsibility to the community so that they can be included in the entire process of resource management while government at the municipal, regional, and national level should aid these communities with sufficient resources and knowledge to help them in their success in CBNRM. This true sharing of power with community will create a better relationship with government, and as stated earlier, teamwork is an important component of CBNRM.

Principle G: Public Trust and Legitimacy

Keeping the community informed and empowered through all stages of resource management and creating transparency instills trust between the community, governments and organizations involved in managing a given resource, thus lowering the chances of corruption and creating legitimacy.

Principle H: Monitoring, Feedback, and Accountability

This means that the community and policy makers involved in policies for resource management keep a strict relationship which includes full communication, and that these policies are to be reviewed by the community. Policy makers are appointed their position by the community and are to be held accountable for their actions.

Principle I: Adaptive Leadership and Comanagement

Adaptive leadership constitutes a leader who can help community member face tough realities and conflicts. An adaptive leader would not only address technical problems, but social adaptiveness as well. Adaptive leaders are dynamic in the way they can face several underlying issues rather than focus on the up front issues. Comanagement is defined by the ability for leaders and managers to collaborate with several various stakeholders, organizations and levels of government. By drawing on several different entities they are also able to access several other resources and levels of expertise.

Principle J: Participatory Decision Making

When it comes to the decision making process it has been clear how important it is to include various members of a community. Within a given community there are typically scientists, multiple levels of government, policy makers, nongovernmental organizations, resource users, and the interested members of the public. This empowerment of the general community will bring a broad wealth of knowledge and resources to the table, and can also be a tool used to share knowledge and information throughout the community. More importantly, it will make the community feel involved, and give them a chance to have their say in the matter of the natural resources they depend on.

Principle K: Optimal Enforcement: Preconditions or Early Conditions

Gruber (2010) says, “Achieving optimal preconditions before establishing a new CBNRM initiative can decrease initial challenges and increase the likelihood of success” (pg. 62). If people within a community share common interests and have a history of cooperation then the chances of working together and succeeding in a multi-stakeholder, consensus-building manner are increased. In order for a community to succeed in CBNRM there is a better chance if they, “Value their community, are dependent on the local natural resources, and are currently unsatisfied with the status quo but do not feel hopeless” (Gruber, 2010, pg. 62).

Principle L: Conflict Resolution and Cooperation

Although CBNRM is primarily focused on relinquishing some authority and responsibility to the local community, it would be ignorant to think that government involvement wouldn't be an issue in CBNRM. Naturally there are going to be conflicts between government and community. Therefore, it would be good practice to provide locations or services for discussing and resolving conflicts, while keeping them low cost so as to not create a barrier for community to take part in debates. Considering it is inevitable for government and community to have to work together when it comes to CBNRM in order to make it successful, a means of conflict resolution should be facilitated as well. When conflicts are not resolved the different levels of government and community cannot work efficiently as a team, and therefore cannot efficiently accomplish goals at hand.

Amongst Mountjoys 10 indicators and Grubers 12 key characteristics there is a trend which depicts the crucial components of a successful CBNRM. Although economic components such as marketing, equipment, resources and funding are surely imperative to the success of a CBNRM initiative, the foremost important components are social. Characteristics like leadership, communication, trust and respect are some of the most important parts that must be present in order for CBNRM to succeed. Gruber states, "Two of these 12 principles—social capital and collaborative partnerships (principle B) and participatory decision making (principle J)—were identified by a majority of both research and practitioner papers as an important characteristic of effective CBNRM organizations" (pg. 63). All the money, equipment and resources in the world could not be of any use to a community or its governing bodies and organizations if they cannot collaborate together efficiently, instill trust in one another, or respect each other. Individuals with different goals and vision cannot operate efficiently as a community, therefore cannot succeed in accomplishing goals, as teamwork is an important component to CBNRM. Compounding knowledge and resources must be focused on a particular target to succeed in achieving goals. In order for this collaboration to materialize a community must hold the resource in question near to their hearts and be proud to call it their own. This is where education comes into play. Educating the local community about their surrounding natural resources and how imperative they are to not only their economy or society, but life itself, is a key step in directing the individuals of a community in a similar direction (Ivany, 2016).

In the case of the Atlantic salmon, it is a resource to be proud of. In Western Newfoundland there lies world renowned salmon fishing rivers. Due to the pristine, wild environment found on the island, Newfoundland was blessed with a bountiful resource of Atlantic salmon. Given the arguments presented by Mountjoy and Gruber, it is important that the communities of Newfoundland are involved in the decision making process. The local community is inherently a stakeholder when it comes to their surrounding resource because they are in some way affected by the state of that resource. However, if local individuals were to become directly involved in the resource management process it would allow them more say in the decision making process.

There have been many situations where CBNRM has been successful, two of which have taken place in Kenya and Australia. These two case studies have been selected because they involve the need for proper management for a natural resource which the local communities depend on greatly, much like the Atlantic salmon of Western Newfoundland. Because of this dependence, as well as

the inherent respect and care for the resource, the local communities felt driven to take action and responsibility for the resource.

CBNRM for the Hirola Antelope in Kenya

In Kenya, in the 1970's, the hirola (*beatragus hunteri*) antelope's population was a healthy 14,000. However, today they have dwindled to a mere 600 animals due to poaching, disease, shrinking habitat, competition against livestock amongst other things. The International Union for Conservation of Nature (ICUN) has listed the hirola antelope as critically endangered. Luckily, the local communities understand that the antelope are a key component to the surrounding environment and the balance of nature. The community shared a profound bond with the surrounding environment and all its inhabitants, and the antelope was no exception. In 2007 3,500 Somali pastoralists of North Eastern Kenya pulled together and formed the Ishaqbini Hirola Community Conservancy (IHCC). Their focus was to protect and manage the hirola antelope which they held so dear to their hearts. The IHCC worked closely with the Kenya Wildlife Service (KWS) and the Northern Rangeland Trust (NRT) to create a community-based organization that would oversee the cherished antelope. Prior to the formation of the IHCC the KWS translocated 29 hirolas to Tsavo National Park in 1963 in an attempt to conserve the species. In 1996 another 29 hirolas were translocated to the Tsavo National Park. All the while the local community protested the decision as they felt the best location for the hirolas would be in their home ranges. The local community seemed to know best because population of hirola in Tsavo declined to 100 individuals due to lion predation (Measham & Lumbasi, 2013).

Finally, the KWS scientists realized that the hirolas natural range was in fact their best option. With such a respect, rich heritage and great deal of knowledge about the hirola, the Ijara fought for the hirola in a court battle against the KWS for their decision to relocate the antelope. Some of the Ijara believed that the removal of the hirola from their land would make the gods angry which would result in no rains and the ultimate demise of their livestock and community. They shared such a profound relationship with the hirola and respected them as a precious natural resource. Some young Somali men with formal education contacted the KWS and asked for training to be capable of managing the hirola so they could extend their long-held cultural practices. With this came the start of the IHCC (Measham & Lumbasi, 2013).

This group of young men closely cooperated with the KWS and NRT to further gain knowledge and resources needed to take on the initiative on their own. With the help of the KWS and NRT the IHCC was able to set 19,000 ha of land aside for the hirola. Due to this conservation effort not only the hirola benefited, but giraffes, porcupines, baboons, African hare, warthogs and many other animals as well. Community scouts were appointed to patrol this land to guard against poaching, and armed KWS rangers provided enhanced security. The KWS and NRT provided expert knowledge and initiated meetings and workshops to educate the local community of the hirola and the conservation efforts. The local community spearheaded the project and sold livestock in order to raise funds to register the conservancy and send IHCC members to meet with KWS officers for consultation. In 2007 the local community voted for leaders from the community, and so the IHCC was established. Seventeen youths were appointed as hirola scouts, and a manager and accountant were employed as well. The 17 youths received training from the KWS and NRT on hirola ecology, sex, age, and identification. Along with this training, the scouts harbored experience from livestock

herding which allowed them to have an in-depth knowledge about cattle recognition. The scouts were provided GPS and radio sets for monitoring and communication by the NRT. The NRT also facilitated fundraising until the IHCC was completely self-sustainable with the added help of investors who developed hotels for the conservancy (Measham & Lumbasi, 2013).

The IHCC still operates to this day and since its implementation vegetation has improved and poaching of all species has almost been eliminated. Due to the strong relationship and profound respect the Somali community has with the hirola, as well as the strong cooperation with the KWS and NRT, the IHCC has become greatly successful in their actions of conserving the hirola, and more so, conserving the land along with various other animals within (Measham & Lumbasi, 2013).

CBNRM for the Vegetation of the Red Gum Plains

Another successful conservation initiative has been founded in Australia in the Gippsland Red Gum Plains. Concerns over remnant vegetation management and revegetation in the threatened grassy woodlands of the Gippsland Plains pushed local farmers and some retired forestry professionals to team up and create the Gippsland Plains Tree Health Group (GPTHG) in 2004. “Dieback” which is essentially the deterioration of the native vegetation became a troublesome problem in the 1,500 km² region. The GPTHG began collaborating with the NGO Australian Landscape Trust (ALT). ALT already had an interest in the conservation of the Gippsland Plains. GPTHG started by developing a survey for local landholders. Through this survey they could hopefully further understand the vegetation management actions taken by their fellow landholders while sharing knowledge with them about vegetation management initiatives as well. Through a series of meetings with Bairnsdale RSL Club members the survey was constructed by one of the authors who helped the group members convert their interests into the survey questions. Upon completion, group members and surrounding land owners met to conduct the survey. From these survey results a new vegetation management plan was initiated from the knowledge gained by the GPTHG from understanding the attitudes towards diebacks, remnant vegetation, and revegetation among fellow land holders. From learning of these attitudes and gaining further knowledge the organization was able to push for a change in policy regarding roadside vegetation management (Measham & Lumbasi, 2013).

Both of these CBNRM initiatives have several things in common. Both the IHCC and the GPTHG resulted in local community initiatives to conserve a resource that they felt was an important component to their lives. Both communities cherished and respected their natural resources. This common value resulted in a set of common goals which drove the two organizations to step up and take charge of their natural resources. Both organizations also collaborated with different NGO’s which helped them materialize a structured CBNRM initiative through collaboration, communication, sharing knowledge and providing funding and important resources. These two similar CBNRM initiatives can also be compared to the Zimbabwe conservation organization CAMPFIRE. Much like IHCC and GPTHG, CAMPFIRE was founded by the local community who had a profound respect for their natural resources. They also contained the drive to take matters into their own hands and fight to conserve their land and the wildlife which inhabited it. There were also several groups who CAMPFIRE collaborated with to construct a structurally sound organization capable of managing their local resources. Groups like USAID, NORAD, EU, WWF, W.K. Kellogg Foundation and many more helped CAMPFIRE become a sustainable

CBNRM initiative (CAMPFIRE, 2016). It was the political, economic and social capitals found in all CBNRM initiatives which allowed them to succeed. These successful organizations highlight the critical key components needed for CBNRM to thrive and be sustainable, especially the social aspect.

This History of the Atlantic Salmon Fishery

When the fisheries first began in Newfoundland there was no regulations in place to limit actions or quotas of salmon. Salmon was weighed by the tierce, which was a large wooden barrel which holds 360 pounds in weight. In the beginning the fishery was driven by the economy and fishermen would take as much as possible. Some of the numbers taken in the 1700's was, 2,000 tierces from Gander and Exploits Rivers in 1775, and 400 tierces by a single fisherman in Gander Bay in 1786. These 400 tierces equaled 120,000 pounds, or 15,000 salmon at 8 pounds each. Due to the fruitful resource that the fisheries offered in Newfoundland, many European settlers began flocking to the island. This marks the time when pressure and stresses to the salmon stocks of Newfoundland began taking place (Hustins, 2010). The earliest form of enforcement wasn't necessarily the enforcement of the salmon stocks or regulations against poachers or people overfishing, rather from foreigners who tried to fish for salmon in the commercial areas of the island. British naval officers patrolled the English coastline while the French claimed exclusive rights on the French shore (Hustins, 2010).

The 1800's brought added pressures to the salmon stocks due to increases in catch. The first method of catching salmon was to completely bar off rivers with nets, seines, and weirs. In many rivers and brooks multiple nets were used to ensure that salmon who made it past the first nets eventually got caught in more nets upstream. By the mid 1800's the salmon stocks began to decrease visibly as tierces were decreasing as time passed. With this first visible decline in salmon stocks came the first involvement by the community (Hustins, 2010).

Locals began to worry as salmon stocks grossly declined and many grouped together to establish 'The Salmon Fishery on the Island'. This committee did not do anything directly in regards to conservation measures or enforcement, but did note that 30 years prior there were 1,000 tierces of salmon caught in Grand River alone, and now that number was down to less than 30 tierces. In Biscay Bay River there were 80 to 100 tierces of salmon caught 40 years prior, while now that number dwindled to 10 to 20 tierces. Despite the fact that they did not take any action, they at least noticed the issue and addressed it (Hustins, 2010).

Throughout the mid to late 1800's many people and local groups continued to make recommendations to the Newfoundland government. One gentleman named Winter stated, "This is an evil of long standing, and one, which, if perpetuated must ultimately destroy brood salmon and annihilate the salmon fishery" (Hustins, 2010. Pg. 5). After several local recommendations and public pressure, the Newfoundland government finally began to act on local recommendations in the 1860's. By 1862 they implemented the first set of regulations which included the prohibition of completely barring rivers with nets, and rather stretching them across only 1/3rd of the river width. However, with no enforcement in place, people continued to bar the rivers until the first wardens were appointed in 1871. Even then, many fishermen exploited some loopholes such as stretching their net across the 1/3rd of the river where the majority of salmon ran, and 1/3rd of the

width of the mouths of rivers where during low tide the only water present or deep enough for salmon to run was netted. Throughout the decades to come the warden service experienced many ups and downs due to lack of funds. One thing is certain however, the warden service provided great conservation efforts. The wardens in place not only enforced the laws, but educated people across the island about the regulations, and monitored the habitat to make many sound recommendations regarding debris clearing and the construction of salmon ladders to allow safe passage. Unfortunately, the government was still rather inexperienced and lacked any resources to put any plans into action (Hustins, 2010).

In the late 1800's the construction of the railroad began. This allowed easier access further inland to new untouched rivers and bodies of waters. Before the railroad people were only familiar with Newfoundland's coasts and accessible rivers. With easier access further inland pressures continue to build on the inland fish stocks. Because of the extended accessibility more foreign people began to tour Newfoundland to exploit the fisheries which by that time was world renown. The Reid Company, who constructed the railroad, realized the potential of the fisheries and advertised to residents and non-residents alike. The 'Trout Train' became a crowd favorite which transported people to various fishing areas during the May 24 weekend. Due to the lack of regulations and sufficient enforcement the railroad added much more pressure to the inland fisheries (Hustins, 2010).

Due to the added pressure of the fisheries by the railroad public pressure built a great deal. The government finally acted on local outcries for conservation and in 1883 John Martin set up The Newfoundland Game Fish Protection Society which was a membership based group with the objective, "to encourage the sport of angling and the propagation and protection of freshwater game fish of the inland" (Hustins, 2010. Pg. 76). Recognizing Martin's success in introducing brown trout and rainbow trout from his Long Pond hatchery, the government decided to encourage fish breeding by leasing ponds and rivers to private parties under section 19 of the Crown Lands Act 1884-1885 (Hustins, 2010).

The turn of the century brought with it some great changes in the salmon fishery. Throughout the 1900's there is an evolution in the way the salmon fishery is viewed by the government, therefore an evolution in regulations and protection. Scientific research comes into play, thus bringing better management. The fishery itself changes dramatically from what was once commercial focused, to more desire for recreational angling. More importantly, CBNRM begins to appear in Newfoundland to develop into what is seen today in the modern CBNRM (Hustins, 2010).

In the 1900's the Newfoundland government began to realize just how important the sport fishery was to Newfoundland. In fact, it proved to be more valuable than the commercial fishery. Prowse estimated the sport fishery to be worth \$25,000 per year from visiting tourists on the West Coast alone. This began an important shift in the salmon fisheries and soon tourism and the recreational fisheries would work hand in hand to create a more sustainable fishery that would run more smoothly (Hustins, 2010).

In 1906 Sir E. P. Morris presented a petition to the House of Assembly requesting that the government establish a game and inland fishery board to administer laws independent of government. The government agreed and enacted legislation for the creation of the 'Inland Game

and Fisheries Board.” Three years later the Inland Game and Fisheries Board was appointed. The Inland Board consisted of sportsmen who were appointed regardless of any political affiliation. The only government member was the minister of Marine and Fisheries. The Inland Board was given authority to preserve, protect and propagate game birds, moose, deer and other game, as well as fur bearing animals. The Inland Board appointed 90 wardens who were stationed away from their communities so there would not be a conflict of interest due to their friends and families. They could not act as guides so they could devote themselves to patrolling full time, and they were paid sufficiently to do so. Finally, with the authority to protect and preserve the salmon stocks appointed to those other than government, there is a stronger drive to follow through on community desired preservation (Hustins, 2010).

Throughout the years leading up to the turn of the century there was much debate and consideration on which would be the best way to raise funding to afford enforcement and conservation measures. The two main options were the leasing of rivers and the implementation of a rod tax. Leasing rivers have turned out to be successful in Canada and the United States at the time due to the ability to quickly raise funds to contribute towards enforcement and conservation efforts. Although leasing rivers would indeed provide incoming funds and bring some stability to the anarchy of the fisheries, there were many downsides. Once a river was leased by the rich entrepreneurs it would mean that the river was only accessible to the party leasing it. Furthermore, they could then do as they please with that river which could mean increased exploitation with no restrictions to the party who maintained the lease. Worst of all, the leasing of river would ultimately cut off access to the local community (Hustins, 2010).

Luckily, after much consideration, the government decided to go with the rod tax. The upside of the rod tax was that the rivers would continue to be accessible to the local community, and any undesirables would stop coming to Newfoundland. The undesirables were those who would come to the island and exploit the fishery resource as much as possible and leave. All the while, not spending much of their own money, which in turn would not allow for input into the islands economy. Instead, the only non-residents who would continue to travel to Newfoundland were ones who appreciated the rod tax and its use to support enforcement and conservation. Because of this, now the tourism board of Newfoundland could promote Newfoundland as a desirable destination, and even promote their world renowned fisheries to attract conservation minded anglers, thus providing more income for conservation efforts. So, in 1927 the Tourism Board and Inland Board begin to work together to promote the recreational fishery. The government distributed 143,000 pamphlets about Newfoundland to tourists and produced a promotional film about salmon and trout fishing. This was a turning point for the fisheries. By the mid 1940's the government began to realize how much more lucrative the recreational fishery was than the commercial fishery and began to promote it further through the Tourism Board. Tourism advertisements were not only promoting the world renowned fishing that the island had to offer, but the importance of conservations as well (Hustins, 2010).

It is around 1928 CBNRM associations began to emerge. Anglers and hunters were growing more frustrated with the Inland Board's failures to preserve fish and game and began to form several public citizen fish and game protection associations. There were local groups forming in St. John's, Grand Falls and Corner Brook. The local people who formed these groups cherished their fishery resources and maintained the drive to fight for the conservation of this valuable resource. They

believed locals should be given responsibilities in preservation and protection. The group in St. John's was successful in removing nets near Salmonier River to a point 4 miles out into the bay. They also managed to raise their own funds to hire a warden to patrol Metcalf's Falls and Salmonier River. Another very important accomplishment of the group was the education of students in the St. John's area. Students in several schools were encouraged to recite a pledge to save fish and game every school day. Other fish and game associations hired wardens to patrol Bay du Nord River and the upper part of Grand Codroy River. They also hired undercover wardens to patrol the Salmonier and Placentia Rivers. Many of these groups worked closely with the Newfoundland Game and Fish Protection Society to stock rivers and ponds with rainbow trout. This collaboration with other groups is another important component of successful CBNRM that these early CBNRM groups portrayed. These CBNRM groups also presented numerous recommendations to the Inland Board and government including: the prohibition of bait fishing for salmon rivers, the control over winter ice fishing, setting a maximum size limit for trout and a daily rod limit on salmon and trout. They were also effective in highlighting public awareness to conserve Newfoundland fish and game resources due to their close involvement in the community. Another important aspect of the early CBNRM groups is that they provided a voice for the community which created added pressure on the government and Inland Board, and made them more accountable for their actions in preventing overfishing (Hustins, 2010).

In 1949 a new chapter for Newfoundland began. With Joey Smallwood's government in office the Newfoundland people voted in favor of confederation with Canada. This meant great things for the tourism industry and salmon fishery. Gander airport was established and more roads were developed to make travel to and around the island easier. Rivers and streams became more accessible which, if conserved properly, meant more revenue to the province, and in turn, more money for conservation efforts. More importantly, this meant that the fisheries would now be in the federal governments hands which made Newfoundlanders feel more at ease (Hustins, 2010).

After confederation the recreational fishery began to form into what is represented today. Salmon licenses sold in 1959 reached 9,376 and grew to 26,508 in 1993. As for the commercial salmon fishery, after confederation drastic changes were about to come. The total commercial and angler salmon harvest peaked in 1931 at 6,100 tons. In 1967 that number declined to 2,800 tons, then to less than 500 tons in the 1990's. This drastic decline in salmon was due to various factors including poor forestry and land management practices, agriculture spraying, and hydroelectric projects. However, it cannot be denied that the most influential factor for the decline was due to overfishing. In 1992 John Crosbie, the federal fisheries minister, noticed the poor state of the salmon stocks, and much like the cod fisheries, declared a moratorium on the commercial salmon fishery. It is at this time the current style of regulations and conservation methods begin to take a familiar shape. With the help of Salmonid Council of Newfoundland and Labrador, DFO began to implement new conservation strategies such as the individual classification system seen on rivers today. The Salmon Preservation Association of the Waters of Newfoundland and DFO worked together to implement the barbless hook regulations so anglers wouldn't damage the fish if it would need to be released. Even after all of the efforts made to save the salmon populations the salmon stocks have not increased near to historical numbers. The International Council for the Exploration of the Sea has reported the salmon population to be approximately 625,000 in 2008, while they were up to 1.8 million in 1975. As for enforcement, today there are about 90 seasonal wardens hired during the inland fishing season to compliment the DFO fisheries officers (Hustins, 2010).

There are many other aspects to take into consideration regarding the salmon stocks. For instance, due to further developments of logging roads and access by ATV, helicopter and many other means of transportation there isn't a waterway humans cannot reach. There exists no salmon ecological reserves and the only rivers not fished are those that have such low populations of salmon that there is a closure until the population is again high enough to fish. There's also pressure on our stocks from Greenland, and St. Pierre et Miquelon which doesn't even contain salmon rivers. Unfortunately, the Canadian government will not pressure France to stop their commercial fishing of salmon in St. Pierre et Miquelon. Luckily, there are various CBNRM organizations which are stepping up to the plate and putting pressure on the government. The Salmon Preservation of the Waters of Newfoundland, the Atlantic Salmon Federation, and many outfitting groups, just to name a few, are acting as a voice for the local community that the government will hear. With their added pressure on the various levels of government there are important changes being made and recommendations are no longer being ignored. These CBNRM groups bring the passion and fight to the table when the governments cannot (Hustins, 2010).

Atlantic Salmon Conservation Foundation/ La Fondation Pour la Conservation du Salmon Atlantique

The Atlantic Salmon Conservation Federation is incorporated as a non-profit organization under the Canada Corporations Act, and is registered as a charitable organization. The Board of Directors is comprised of volunteers from five of the provinces and aboriginal communities for whom the ASCF/FCSA is intended to assist. The members of the ASCF/FCSA Board possess great deals of knowledge and skill sets which ensure the organization is successful in meeting its objectives.

Their mission statement is, "To promote enhanced community partnerships in the conservation of wild Atlantic salmon and its habitat in Atlantic Canada and Quebec." (ASCF, 2016). The ASCF's goals are as follows:

- To be an effective source for funding for community volunteer organizations in conserving, restoring and protecting wild Atlantic salmon and its habitat.
- To enhance cooperation and partnerships between governments, Aboriginal organizations, community volunteer groups and others in the interests of conserving, restoring and protecting wild Atlantic salmon and its habitat.
- To promote and improve conservation planning and management at the watershed level as the basis for ensuring effective use of and accountability for funds made available for wild Atlantic salmon conservation initiatives.
- To improve public awareness, education and research respecting the conservation of wild Atlantic salmon habitat.

The ASCF was established by the federal government of Canada through a one-time grant of \$30 million. The ASCF uses the interest generated from the investment of this grant to support projects related to the conservation of the Atlantic salmon and its habitat. The ASCF is focused on funding projects that have a high probability of success with favorable results for the conservation of Atlantic salmon and its habitat. The Foundation is interested in funding projects that involve watershed planning, including feasibility, engineering and design, implementation, monitoring or a combination of such characteristics from the following categories:

- Development of salmon and salmon habitat conservation plans for a watershed or sub-watershed.
- Conservation, rebuilding and restoration of wild Atlantic salmon habitat
- Conservation and restoring of wild Atlantic salmon stocks and populations
- Restoring access of wild Atlantic to salmon habitat
- Public education and awareness of the importance of conservation of wild Atlantic salmon and its habitat (ASCF, 2016)

The ASCF gives priority to projects involved in conservation needs of a watershed based management plan concentrated on the conservation of Atlantic salmon and its habitat. Non-governmental organizations, municipalities, educational institutions and First Nations and Aboriginal organizations which possess the legal capacity to enter a binding contract with the ASCF are eligible for funding from the foundation considering they demonstrate a successful track record in carrying out such salmon conservation projects. The amount of funding is allocated fairly among the five provinces on an annual basis, although amounts of funding may vary year to year. There is \$50,000 expected availability in the foreseeable future for the five provinces. Individual projects are eligible for funding between \$5,000 and \$50,000 (ASCF, 2011).

Atlantic Salmon Federation

The Atlantic Salmon Federation is dedicated in restoring, protecting and conserving wild Atlantic salmon, as well as the ecosystems in which their survival and wellbeing depend. They work in a variety of environments such as inland North America, at sea, and even internationally wherever the Atlantic salmon can be found. Their priority is to bring Atlantic salmon to their historic population levels. In order to achieve this goal they focus on aquaculture, low marine survival, freshwater recreational fisheries, dams and fish passage, watershed habitat, water quality, first nations fisheries, Labrador interceptory fishery, endangered species status, amongst other areas (ASF, 2012).

Salmon Preservation Association for the Waters of Newfoundland

The Salmon Preservation Association for the Waters of Newfoundland (S.P.A.W.N.) was established in 1979 in Newfoundland once anglers noticed a decline in Atlantic salmon population. It was founded by the former magazine editor Ches Loughlin, and a small group of people who shared an interest in rehabilitating the salmon populations in the waterways of Newfoundland. Thanks to a generous donation of five dollars from hundreds of salmon anglers, S.P.A.W.N. was born. As a member of the Salmonid Council of Newfoundland and Labrador and an affiliate of the Atlantic Salmon Federation, SPAWN works in cooperation with various groups to undertake projects focused on reestablishing salmon populations and healthy habitats to create a sustainable resource for anglers for generations to come. SPAWN has worked in cooperation with government and has been responsible for the implementation of laws such as the use of barbless hooks, and catch and release on rivers with low salmon populations (SPAWN, 2016). SPAWN has played an extensive role in the implementation of various projects throughout Newfoundland and Labrador, especially on the West coast of the island of Newfoundland.

The Department of Fisheries and Oceans

The Department of Fisheries and Oceans is a department overseen by the federal government of Canada. They have the lead role in safeguarding Canadian waters and managing the nation's fisheries. The role of DFO is as follows:

- Supports strong economic growth in our marine and fisheries sectors by Supporting exports and advancing safe maritime trade;
- Supports innovation through research in expanding sectors such as aquaculture and biotechnology; and
- Contributes to a clean and healthy environment and sustainable aquatic ecosystems through habitat protection, oceans management, and ecosystems research (DFO, 2016).

DFO's mission is to work towards three strategic outcomes:

- Economically Prosperous Maritime Sectors and Fisheries;
- Sustainable Aquatic Ecosystems;
- Safe and Secure Waters (DFO, 2016).

DFO works towards enforcing 5 acts. *The Ocean Act, The Fisheries Act, The Species At Risk Act, The Coastal Fisheries Protection Act, and The Canada Shipping Act.* Their mission is, "Through sound science, forward-looking policy, and operational and service excellence, Fisheries and Oceans Canada employees work collaboratively toward the following three strategic outcomes: Economically prosperous maritime sectors and fisheries, sustainable aquatic ecosystems, and safe and secure waters" (DFO, 2016. Mission, vision and values).

These NGO's and the Department of Fisheries and Oceans have all taken particular positions and played various roles in the conservation and resource management of the Atlantic salmon in Western Newfoundland. The ASCF do not take part in the projects directly, but provide the much needed funding for the projects undertaken by ASF and S.P.A.W.N. It is ASF and S.P.A.W.N. who conduct the projects on the three waterways in focus. The Department of Fisheries and Oceans conduct the scientific research and implement the laws and regulations, as well as enforce those laws and regulations, for the marine and freshwater environments, including the waterways in focus, Corner Brook Stream, Hughes Brook, and Harry's River.

Corner Brook Stream

The Corner Brook Stream is a stream which intersects the town of Corner Brook in Newfoundland. The stream is fed by Corner Brook Lake and runs approximately 18.5 kilometers out into the Bay of Islands (Google Maps, 2016). The stream plays an important role in Corner Brook's history. When the pulp and paper mill was being constructed in 1923 to 1925, the operators and construction crews decided to use the stream as a water source for the mill (Virtual museum, 2016). In 1924 the stream was dammed to create a reservoir for this water supply near the Glynmill Inn (Falconer, 2014).

Before this dam was constructed there was no obstruction for salmon to migrate upstream, which once did. However, the dam was built long before any regulations were put in place, therefore no fish ladder was implemented with the dam. With no clear passage to their spawning grounds, the

Atlantic salmon which once populated the stream were completely wiped out. For almost 50 years this obstruction stood without safe passage for fish. Then finally in 2002, a fish ladder was constructed after much protest by various conservation organizations, primarily S.P.A.W.N. (Corner Brook Stream Development Corporation, 2016). S.P.A.W.N. and ASF began a fish friends program with various local schools in the Corner Brook area in 2001 (McCarthy, personal communication, 2016) in which the school children would be responsible for raising juvenile salmon in aquariums in the classroom until they were in the fry stage of their lifecycle. Then the students would go to Corner Brook stream to release the salmon fry. This occurred for 7 or 8 years without monitoring the results (Crocker, 2013). In recent years S.P.A.W.N. has been monitoring a fish counter placed at the top of the fish ladder in Corner Brook stream. It seems that the fish friends program has been a huge success. In 2009, 2010, 2011, and 2012; 85, 147, 83 and 121 salmon were counted respectively (Kean, 2012). This year (2016) 151 salmon has passed the counter. S.P.A.W.N. has a measure set up in the counter and also weighs the salmon before they open the trap door of the counter to allow them to pass upstream. Of the 151 salmon recorded this 2016 season, some salmon have weighed as much as 18 pounds (McCarthy, personal communication, 2016). The success of the work undertaken by S.P.A.W.N. and ASF has shown the remarkable outcome CBNRM can achieve. Not only were they successful in growing a salmon population to 151 fish in a stream where the salmon populations were completely wiped out, but they educated upcoming generations of youth about natural resource conservation. Involving this community of youth in a successful project can instill a profound respect and pride in them which could never be established by just typical education. To stand in front of a group of youth and lecture about facts and topics is something youth encounter in any regular school day, but to include them in the hand-on workings of such a project will mean something much more special.

S.P.A.W.N. continues their work on the Corner Brook Stream by maintaining the fish ladder and fish counter. They also take the responsibility to clear any debris which obstructs the safe passage of salmon throughout the stream, especially around the damn and ladder which collects high volumes of debris. If the salmon population continues to increase the way that they are John McCarthy, the president of S.P.A.W.N., hopes that soon the stream will be a scheduled catch and release stream which could be used by the public. Due to its wheelchair accessibility, McCarthy says that it would be a great stream to be open for angling, as it would enable those in wheelchairs to enjoy the magnificent sport of angling (McCarthy, personal communication, 2016).

Hughes Brook

Hughes Brook is another waterway which flows out into the Bay of Islands. From its origin in Balls Pond it stretches approximately 20.2 Kilometers to the bay (Google Maps, 2016). The salmon population decline in Hughes Brook was due to a number of factors such as obstructions of dams from a high number of beavers, was a victim of gross overfishing and high levels of poaching (McCarthy, personal communication, 2016), and debris from log driving for the Corner Brook pulp and paper mill (Gibbins et. al. 1995). There is also agriculture taking place around the brook which could potentially create a higher concentration of agricultural pollution from excessive nutrient loading.

The only fish counting data recorded began in 1984 and ended in 1992 (Table 3), (Gibbins et. al. 1995). However, fish have been counted in Hughes Brook up to this day, and it has been

determined that their population is increasing to healthy levels (Mullins, 2003). Catch and release was just opened in Hughes Brook this year and the recorded catch was 24 salmon (Angler's Guide, 2015-2016 & 2016-2017).

Table 3: Salmon Counted at the Hughes Brook Fence (Mullins & Jones, 1992)

Year	Salmon Counted
1984	93
1985	13
1986	65
1987	43
1988	55
1989	65
1990	107
1991	175
1992	153

Surprisingly the Hughes Brook population began to increase just before the moratorium on commercial salmon fishing. This was due to conservation efforts which began in 1983, yet, the population was still low in comparison to what a waterway of this size could typically hold.

Operations to revive Hughes Brook began in 1983 by the North Shore Bay of Islands Development Association (NSBIDA) and ASF. Their first goal was to clear up obstructions and debris from logs and debris from when the brook was used for log driving for the paper mill. In 1984 the NSBIDA constructed a fish counting fence to begin recording populations so they could monitor the results of their work. They received funding to build an egg incubation facility in 1986, which they would construct in one of the Hughes Brook tributaries. Streamside incubation boxes were used to hatch the salmon eggs, and the first salmon fry were released into Hughes Brook in 1987. The incubation facility seemed to be working so well that it was also used to incubate eggs for North Brook and Bound Brook, and it was upgraded in 1989 to include three large hatchery troughs to cycle salmon from eggs to the eyed stage, and again in 1992 to increase the size of the building to allow for egg incubation and to lower the risk of spreading fungus and disease through individual quarantined hatchery boxes which used upwelling to cycle fresh water past the salmon eggs (Ivany, personal communication, 2016). The NSBIDA also increased public awareness in surrounding communities through education, as well as increased patrols of the river because poaching was identified as one of the key causes of the original stock decline of Hughes Brook. The projects conducted by the NSBIDA proved to be successful due to various reasons including their focus to develop a highly trained workforce, as well as their close cooperation with the groups involved in the North Brook and Bound Brook projects, Humber Valley Development Association and Central Development Association respectively (Gibbons et. al. 1995).

The NSBIDA has survived for 33 years. However, in recent years the original members have grown into their 70's and what used to be a board of 19 members, three representatives from the six communities and the president, now consists of just seven members. After several tries to elect a new board to keep the association running, the board members held their final meeting on December 8th of 2015, and decided to try one more time or they will have to dissolve the

association and liquidate its assets. Warren Blanchard, the mayor of the town of McIver's and original board member of NSBIDA states, "I'm going to be 72 next month. I'm ready to give it up as well" (Montague, 2015. Paragraph 3). As of November 25th, 2016, Blanchard stated that due to the lack of interest from anyone else to continue the board the NSBIDA has been dissolved and the assets are in the process of being liquidated (Kean, 2016).

Where the NSBIDA has ended other groups like S.P.A.W.N. have continued to devote their time towards the waterway. In recent years S.P.A.W.N. has undertaken projects in Hughes Brook such as clearing debris, introducing salmon fry to the brook through their Fish Friends program, and constructing and monitoring a counting fence to research migration. In 2006 Keith Piercy of S.P.A.W.N. and Don Ivany of ASF, along with a group of youth, released salmon fry into the brook. In 2007 S.P.A.W.N. constructed a counting fence and collected scale samples and DNA to record migration patterns (SPAWN, 2016). Due to an increase beaver population there were several dams built throughout the length of the brook. S.P.A.W.N. has worked with local beaver trappers to thin out the surplus population by allowing the trappers to set up traps near problem dams and beaver lodges. Once the beavers have been trapped S.P.A.W.N. will then dismantle the dams and clear the logs and brush out of the brook to allow safe passage for fish. S.P.A.W.N. has been monitoring the brook, and have even used drones to get a bird's eye view. They continue to clear debris that may impede on safe passage and spawning grounds, as well as keeping an eye on the fish counter (McCarthy, personal communication, 2016).

Thanks to the NSBIDA and S.P.A.W.N., with the help of the ASCF for funding, Hughes Brook has shown some spectacular improvements. Poaching continues to be an issue, but there is safe passage for salmon, as well as healthy spawning grounds. There was a time when Hughes Brook was closed to angling due to its low salmon population. Because of the NGO's involved, and with the help of DFO, Hughes Brook is now a scheduled salmon river. However, it is scheduled as a schedule 0 river, meaning that no salmon may be retained by anglers. Rather, the salmon stocks have increased enough that catch and release will not put too much stress on the population. If proper management continues the brook could very well become a schedule 2 river which would allow the retention of 2 salmon, making it a useable resource once again.

Harry's River

Harry's River runs roughly 39.6 km from Georges Lake to Bay St. George near Stephenville, NL (Google maps, 2016). The river's headwaters reach far into Pinchgut Lake, including all of its tributaries. This makes for extensive spawning grounds for the Bay St. George population, and a valuable river system for conservation efforts. The two primary causes for population declines on Harry's River include overfishing and extensive poaching (Mullins et. al. 2009).

Various conservation efforts have taken place in Harry's River and its network of lakes and tributaries. Most of which have been through scientific research. In 1992 when the commercial salmon fishery underwent a moratorium DFO constructed a counting fence in Pinchgut Brook to monitor the salmon populations. While DFO, ASF and SPAWN were monitoring the counting fence and collecting data of returning salmon and salmon escapement they were also collecting other data such as redd surveys. Redd's are the nesting grounds for salmon which take place in areas where small round rocks (gravel) are common. This makes a suitable environment for salmon

eggs due to its protection from predators and high water currents (DFO, 2016). They based their desired salmon returns and escapements off of the assessment and calculation of spawning ground area (DFO Science, 2005). However, due to the vastness of habitat within this system, one counting fence in Pinchgut Brook did not provide accurate results for the entire system despite the fact it was the most productive tributary of Harry's River. Realizing that making decisions based on the results of just one section of spawning ground would not enable them to make sound decisions in regards to the Harry's River angling, DFO has since implemented multiple counting fences.

A DIDSON fish counter has been put in place in lower Harry's River near Stephenville Crossing, and a fish counter to collect specimens and data in upper Harry's River near Gallants. Since 1998 S.P.A.W.N. has been hiring post-secondary science students to monitor the various fish counters on Harry's river and the fence located on Pinchgut Brook (SPAWN, 2016). However, there has been some conflicts between S.P.A.W.N. and DFO over the DIDSON counter. John McCarthy of S.P.A.W.N. has expressed his concerns about the way the DIDSON counter is designed to work. Any fish scanned to be over 30cm is considered to be a salmon, yet McCarthy has witnessed large sea trout running the river. If enough large sea trout run through the counter and is counted as salmon then the data may suggest a greater number of salmon than what is actually running the river (Kearsey, 2016). If regulations change to permit Harry's River to increase to a schedule 4 river due to a miscount of salmon it could cause negative implications on the current salmon stocks.

The primary problem identified on Harry's River is poaching. ASF has been cooperating closely with DFO during their research to devise conservation measures for the river. They decided to allocate extra enforcement from other surrounding rivers to address the problem of poaching, during which time a notable increase in salmon inhabited the river, making it the most productive river system in its area (Ivany, 2016). Assessments done on Harry's River in 1995 showed that spawning productivity was at 49% of the minimum requirement in order to maintain a sustainable salmon population and fishery. It was suggested that mortalities from poaching was as high as 50%, meaning that in order to create sustainable spawning production all that would have to be done is to stop poaching (Mullins, 1995).

The most important actions taken by ASF and S.P.A.W.N. on Harry's River, as well as Hughes Brook, Corner Brook Stream and various other rivers in the province, was the fish friends project. There was no salmon fry introduced into Harry's River like in Corner Brook Stream and Hughes Brook, but ASF and S.P.A.W.N. implemented the Fish Friends program in schools in the Port-Au-Port area. The main focus of fish friends is to educate the younger generations, so the introduction is an added bonus. Although the students involved in the fish friends project did not release their fry into Harry's River, the students had a hands on experience which provided valuable education. Students were so engaged during the project that they naturally developed a consciousness around conservation. The youth were so excited to learn how long will it take for their salmon to be ready and when they would be able to release them, that this excitement for being a part of these conservation efforts continued well after the salmon fry were released. This fostering of conservation education and respect for the well-being of the salmon will translate into care and respect in the real world setting (Ivany, 2016).

Thanks to the scientific research taking place on Harry's River and its extensions into the many lakes and tributaries, decision makers can begin to develop regulations and policies needed to

manage the recreational fishery to ensure sustainable salmon stocks. Furthermore, they can begin to develop a framework which they can apply to other river systems in the province, and perhaps worldwide. Due to early research, the extensions into Pinchgut Lake, especially Pinchgut Brook, have been recommended to be closed to fishing in 1996 due to the productivity of spawning grounds in the area. By closing such productive areas salmon populations will have the chance to increase without interference (Mullins et. al., 1995). While projects involving rehabilitating habitat are surely important to ensure a suitable environment for salmon to thrive, it is the ongoing scientific research of salmon behavior and habitat production that will allow governing bodies and policy makers to gain sufficient knowledge to produce a framework that can be applied in other fishery conservation efforts in various locations.

Table 4: Salmon Returns to Harry's River (DFO Science Stock Status D2-05)

Year	Count
1992	227
1993	619
1994	610
1995	780
1996	639

Table 5: Recreational catch of Atlantic salmon on Harry's River (Mullins et. al. 1995)

Year	Count
1955	560
1960	694
1965	1437
1970	1869
1975	720
1980	583
1985	173
1990	728
1995	279

Conclusion

This research analysis a group of characteristics which have been identified by Mountjoy and Gruber as key components which are common to successful community-based natural resource management. These characteristics were taken and compared to several CBNRM case studies to identify a trend in successful resource management. Throughout all of the case studies researched, CAMPFIRE, IHCC, GPTHG, S.P.A.W.N. and ASF, common characteristics begin to surface. When it comes to adaptive leadership and comanagement, each group consists of local members of the communities who felt the need to take action and responsibility for their local resources. Rather than sit and wait for something to be done, a small group took control of their situation to make things happen. These locals harbored the motivation to step in, take control, and begin to mobilize a movement towards management of the surrounding resources. Unlike the governing bodies who isolated themselves from the thoughts and feelings of the community, These CBNRM groups pushed for public participation. More importantly, they instilled trust and respect into their community members. The members of these organizations all shared the common goals and shared visions or plans to create a sustainable resource for their communities. Through these shared goals and common values, they were easily enabled to cooperate together as one and stay on track with their initiatives. With these strong bonds and cooperation, they were able to collaborate with various partnerships and levels of governments essential to achieving their initiatives. Through strong communication with the various groups they collaborated with they were able to build strong social capital. Furthermore, they can create a healthy environment to settle internal conflicts existing between the collaborating groups. Through the establishment of strong social capital with various other groups, levels of government, policy-makers and the local community, they opened up a partnership with those who could offer support in the means of funding and essential resources needed to accomplish the goals at hand. In each case study the groups used their resources and available equipment for research on the nature and state of their resources, and developed information that can guide them in making decisions and building a framework pertaining to the management of their resources. The NSBIDA has recently shut down their operations and one major characteristic, or lack thereof, stands out. The NSBIDA did not incorporate much marketing into their organization. SPAWN and ASF promote their objectives through various publications such as the magazine SPAWNER, news articles, web sites and various other publication. The NSBIDA's lack of marketing and publication has kept them in the background which may very well attribute to their dwindling members, and the lack of new locals to join the board and continue initiatives.

Through the devolution of power from government and policy-makers, and handing over that power and responsibility to the local community, it allows the community to take part and have their say in the decision-making process. This is an important responsibility to bestow upon the local community and requires trust from governing bodies. However, due to the dependence that the local community has on their surrounding resources, they are often driven by the respect that they harbor for the resource to treat it with care. Another way to ensure proper resource management by the community is to closely monitor them, provide constructive feedback, and to hold the community accountable for outcomes. However, it's quite inherent that the local community would naturally be held accountable either due to their direct dependence on the natural resource in question, or the economic gain they receive from that resource.

The NGO's involved in salmon conservation in Newfoundland manifests all of the CBNRM characteristics. They have been established due to a lack of proper management regarding the salmon stocks, and consist of locals who had the drive and desire to take responsibility in managing the salmon stocks. They maintain an open dialogue with the affected communities and stakeholders. Furthermore, they act as a voice for the local communities during collaboration with various levels of government and policy-makers. Although they may create pressure on the governing bodies and policy-makers to take action in managing the salmon resource, they also closely collaborate with them to function as a team, because at the end of the day they all share the same goals to conserve the salmon stocks. Through their teamwork with government, policy-makers, funding organizations such as ASCF, and the local community they maintain access to a variety of resources which they can use. They also share their resources with those whom they collaborate with in implementing various projects and research.

One of the most valuable projects undertaken by S.P.W.A.N. and ASF is the Fish Friends' project. Through the fish friends program, they are able to open up valuable dialogue and paths of communication with upcoming generations. Although it incorporates the restocking of streams and rivers with salmon fry that these school children raise, it is not the most important aspect. The education the youth receive through their involvement in the program is what matters most. Through a hands on project where youths are given responsibility for the wellbeing of this precious resource, the youth begin to foster a profound respect for salmon, while learning to be responsible stewards as well. The ultimate goal of the fish friends program is that well after their fry are released into the waterways they will maintain the knowledge and respect that will cause them to help conserve their surrounding resources rather than poach or destroy them.

With the use of these CBNRM characteristics we can begin to create a framework which can be applied to various other natural resource management initiatives. Although it may not be what you could call objectively perfect, it is certainly a good guide to go by. In the future perhaps we could add new characteristics or fine tune existing ones to improve on this CBNRM framework. Perhaps under the characteristics of communication, research and information development there could be an emphasis on the importance of education, as it is important to share knowledge.

Much room still remains for further research in CBNRM. Further research into constructing multiple frameworks which can be applied to the various types of resource management could prove valuable because the management of a resource like water, and the management of a resource like wildlife or trees can vary quite a bit.

It is very important that we can devise a plan with regards to managing our natural resources. With the growing human population we are currently struggling to provide everyone with sufficient materials for clothing, building homes, and more importantly, we are struggling to provide the earth's population with sufficient food and water. Perhaps with sufficient management plans and CBNRM initiatives we could devise a plan that can create the sustainable resources that the world needs to survive on earth.

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