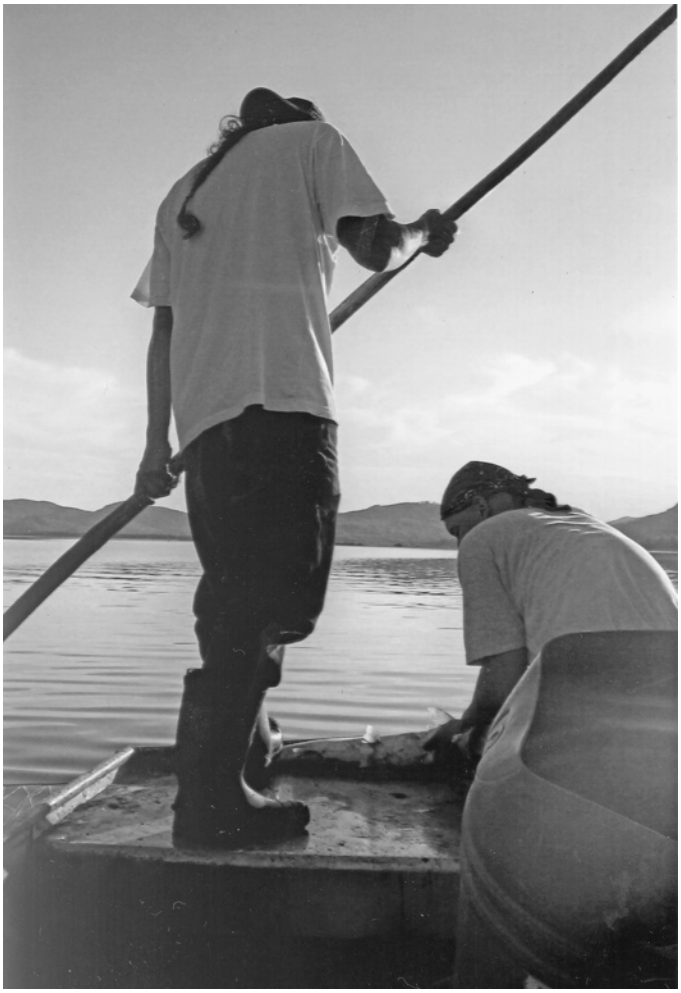
Gespe'gewaq Mi'gmaq Resource Council

A review of the health, habitat and management of the Atlantic salmon in the Restigouche River



Gespe'gewaq Mi'gmaq Resource Council
Listuguj, Gespe'gewa'gi, Mi'gma'gi
June 3, 2010

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The Creator made the world ready for man by sending the animals to help him. Every life form on the earth had to make a contribution and the salmon was the lead species in contributing to the well being of man. It is where the food and medicine would come from.[1]

(Yakama story of Creation told by Jerry Meninick, Yakama Tribal Chair)

I Introduction

Located in the community of Listuguj, the Gespe'gewaq Mi'gmaq Resource Council (GMRC) is a non-profit First Nation's environmental and natural resource provider. GMRC was formed in 2006 and serves the interests of three First Nations communities- Listuguj First Nation, Eel River Bar First Nation and Pabineau First Nation.

The vision of the organization is to assist Mi'gmaq First Nation communities by creating awareness, understanding, and support towards sustainable resource management. GMRC envisions working together to manage the resources in the Baie des Chaleurs area and, at the same time, building cultural bridges with the common goal of effective resource management practices.

The mission of the organization is to coordinate, initiate, and build capacity for activities to support sustainable resource management and further the development of the resources. Its beliefs are that integrity and commitment are fundamental to its business practice, and that it has a role in protecting Mother Earth. As an organization, GMRC aims: to advance First Nation stewardship, foster innovation, develop First Nation capabilities, and protect and enhance natural and cultural resources. We see our role as a means of empowering more of our people to respect and interact with Mother Earth "Ugs'tqamu" while simultaneously improving social-economic conditions for native communities within Atlantic Canada.

II Historical Background

The Mi'gmaq have had a relationship with salmon for thousands of years. The activity of salmon fishing has contributed socially, culturally and economically to our nation. Today, the First Nation communities of Listuguj, Pabineau, and Eel River Bar, which comprise GMRC, assert that they have a right and responsibility to protect, promote, and encourage a sustainable Atlantic salmon fishery, not only for today but for future generations. As Aboriginal peoples, these rights are recognized and affirmed under Canada's Constitution Act, 1982 (Section 35).

Our rights are recognized by Canada; however, these rights do not derive from a crown grant or statute. They are sui generis (unique). Our rights exist because even before Europeans arrived to this land, our nation was organized: we had our own cultures, economies, government, and laws.

The following passage captures our distinct understanding as Mi'gmaq of our relationship with the territory:

> Weja'tegemgeg wesgijinuiteg Nnu, Mi'gmawa'j, ne'gaw geggung aq e'w'g assusuti siawiango'tmn sipu'l, nme'jg, nipugtl, wi'sisg, aq sisipg ula tet Gespe'gewa'gig, lluignegewei maqamigew Migma'gig. Ula assusuti wejiaq Gisu'lg.
>
> Translated: Ever since the Mi'gmaq were born, we have always had and used our authority to continue to care for the rivers, fish, woods, animals, and birds, here in Gespe'gewa'gi, the Seventh District of Mi'gma'gi. Our authority comes from the Creator.[1]

As Mi'gmaq, we lived on our territory and used our rivers and woods over thousands of years. Our Mi'gmaq way-of-life,

1 Mi'gmawei Mawiomi Secretariat. Nm'tginen-Me'menaq ejiglignmuetueg gis na naqtmueg. (Listuguj, Gespe'gewa'gi: Mi'gmawei Mawiomi Secretariat, 2007)

practiced over thousands of years, shaped an understanding of territory through which our principles, values and beliefs about governance, language, culture and land tenure systems have evolved. In our use and occupation of the land and waters, we developed laws and systems of governance.

Today, despite years of colonial imposition and denial of our traditions and practices, nevertheless we retain our unique understandings and perspectives. Further, many of our communities are returning to cultural knowledge and teachings in order to develop sustainable natural resource plans.[2]

The national territory of the Mi'gmaq is called Mi'gma'gi. Mi'gma'gi is comprised of seven districts. We are part of the seventh district, which is called Gespe'gewa'gi. Generally, this district includes what is known today as the Gaspe peninsula, and portions of New Brunswick, including the rivers and surrounding waters and islands.

Gespe'gewa'gi is interconnected by numerous river systems; a few of the major salmon rivers include: Listuguj (Restigouche), Matapegiag (Matapedia), Apse'tgwejg (Upsaquiltch), Patapegiag (Patapedia), Metamgetjuig (Kedgwick), Waqamatgug (Bonaventure), Gesgapegia'jg (Cascapedia), Winpegijuig (Nepisiguit).[3]

The river systems were and remain important to our nation. Long before the establishment of land routes, the river systems enabled the Mi'gmaq to use, live and travel throughout the districts. Today, Elders still speak about the rivers as their lifelines: to their ancestors and for the future of their children.

For thousands of years, the Mi'gmaq used the rivers systems and also relied on the salmon, a resource that could be found, in abundance, in rivers throughout Gespe'gewa'gi. We named our rivers- and we also named fishing places, portage routes, and campsites. In our language, our place names indicate the extensive knowledge, as well as our uses and understandings, of the territory – which includes the river systems and the salmon –as well as other wildlife- which inhabit the lands and waters. This report, however, is about one river – the Restigouche River - and in particular it focuses on one species that can be found in this river- the Atlantic salmon.

The Restigouche River is historically renowned for producing wild Atlantic salmon. With the arrival of Europeans to the area they too benefitted from the rivers and in particular from the salmon. From the 1800s up until the 1970s, the Euro-Canadians actively participated in the development of a commercial salmon fishery. By the 1970s, however, this resource had become scarce and the commercial salmon fishery was increasingly regulated and in 1970's and eventually a moratorium was placed on the commercial salmon fishery.

Nevertheless, the salmon remains important to both Mi'gmaq and Non-Mi'gmaq peoples in the territory – culturally and socially. However, in determining how best to manage the salmon fishery, there are competing visions. Although Western scientific research continues to be relied upon in order to manage the salmon, there are calls to integrate Indigenous knowledge and ways of knowing into the management of this resource in order to ensure the common goal – which is to ensure that the salmon remain healthy and abundant.

III Working together to manage the salmon fishery

In his analysis of research practices, Shawn Wilson emphasizes the need for accountability and relationship building in research; he writes, "for researchers to be accountable to all our relations, we must make careful choices in our selection of topics, methods of data collection, forms of analysis and finally in the way we present information."[4]

There are concerns over the state of the waters, the health of the species, including the salmon. There is a pressing need, therefore, to explore alternative methods of understanding and managing the resources. As Wilson suggests, there is a need to examine carefully our research practices in order to be "accountable to all our relations."

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2 In the past, and still today, the Mi'gmaq concept 'netugulimgewe'l' is considered a key guiding principle of the Mi'gmaq governing system.2 Netugulimgewe'l is a codification of behavior that speaks about land management and how people are expected to properly act within the territory. Mi'gmaq Perspective of the Battle of 1760. (Listuguj, Gespe'gewa'gi: Mi'gmawei Mawiomi Secretariat, 2004)

3 Mi'gmawei Mawiomi Secretariat. Nm'tginen-Me'menaq ejiglignmuetueg gis na naqtmueg. (Listuguj, 2007)

4 Shawn Wilson. Research is Ceremony: Indigenous Research Methods (Ferwood Publishing, 2008)

According to the Department of Fisheries and Oceans (DFO), the current management program for wild Atlantic salmon in many rivers is restrictive due to low stock abundance. As well, management of the resource is relatively complex because of the involvement of numerous government organizations, the local First Nations and Aboriginal/Native councils, recreational anglers' organizations, private interests and special considerations related to international agreements.[5]

In order to deal with the complexity of managing the Atlantic salmon – in consideration of the above factors – we suggest that there is a need to understand the salmon (its habitat) and to develop management plans through a combination of both Western science and Mi'gmaq Traditional Knowledge. In so doing, it will be possible to have a management program for the Atlantic salmon that will i) promote harmonious relations among all stakeholders; and ii) establish a sustainable salmon fishery. In this manner, we are attempting to make careful choices and be accountable to all of or relations and in that way develop a sustainable fishery.

Part One of this report examines the salmon – the biology, habitat, health, and threats - using information from both Western science as well as Aboriginal ways of knowing. In Part Two of this report, we examine the management of the salmon fishery, including Aboriginal, and Recreational fisheries, and Federal and Provincial responsibilities.

Part I: Understanding the Salmon: Life Cycle and Environment

1.0 The Salmon Life Cycle

1.1 Mi'gmaq Perspective and Western Science

From a Mi'gmaq perspective, in order to understand the salmon, we need to understand the environment. It is from our observations and relations with the environment that it is possible to understand the life cycle of the salmon. The following quote illustrates this:

> *They know that as soon as the ice leaves the river, the fiddleheads will blossom. They know that the black salmon have been here all winter and now are on their way out to the ocean. Even though they know that these fish are good to eat, they don't generally fish those because they are going out, and they will have to come back some time. They know that not long after that, the big males and females will be coming in. They know that you have to pay attention to the moon, the birds and the moon tides, as all of this has an effect on when the salmon decide to move up river. When the bugs are out in June and the birds are around in the afternoon and the winds start picking up; fishers know it's the good time to go fishing. You can tell by the size of the salmon where they are in their cycle, where we are in ours.*[6]

As indicated by Metallic, the Mi'gmaq/salmon relationship is complex and takes into consideration all aspects of the environment. Further, the connection between the fisher and the salmon is evident by the statement: "You can tell by the size of the salmon where they are in their cycle, and where we are in ours."

Comparatively, the Western scientific view of the salmon is compartmentalized. The salmon is viewed as a subject, which can be studied from a distance without personal attachment. This objective way of viewing the salmon can be seen in many scientific and/or government reports and publications. For example, in its literature Parks Canada describes the salmon cycle through the development of its seven distinct life stages, which are: 1) eggs; 2) alevins; 3) fry; 4) parr; 5)

5 Department of Fisheries and Oceans. Five Year (2008-2012) Integrated Management Plan for Gulf Region Atlantic Salmon Stocks. (Government of Canada, 2010)

6 Fred Metallic. "Strengthening our Relations in Gespe'gewa'gi, the Seventh District of Mi'gma'gi." Lighting the Eighth Fire: The Liberation, Resurgence, and Protection of Indigenous Nations. Ed. Leanne Simpson. (Winnipeg: Arbeiter Ring Publishing, 2008)

smolt; 6) migratory adults; and 7) spawning adults.[7]

The following diagram demonstrates the life cycle of the Atlantic Salmon:

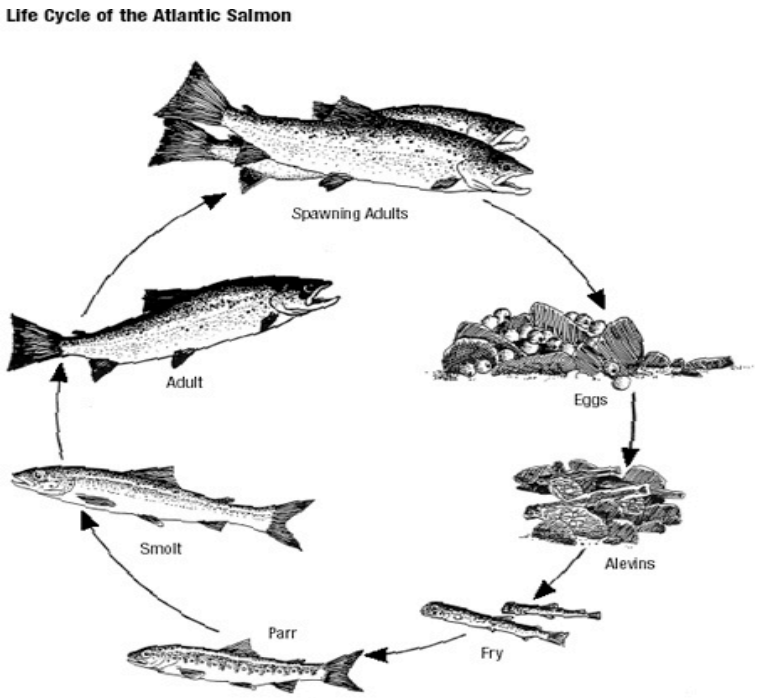

Figure 1. Life Cycle of the Atlantic salmon (Parks Canada, 2005)

We suggest that a combination of both views can be used to gain a greater understanding of the habitat, as well as in the development of management plans, for the salmon. There is a need to understand our relationship with the salmon by watching and paying attention to the environment –the wind, tides, and other species (e.g., relying upon an Indigenous approach). As well, there is a need to be able to quantify (through a Western scientific approach) the salmon's growth and what it needs from its environment in order to grow and mature into a healthy species.

Recommendation #1:

We suggest that a multi-disciplinary approach is need in order to gain a deeper and more comprehensive understanding of the salmon. By understanding the life cycle of the salmon from different perspectives we may gain a whole new understanding of what it means to "manage the salmon sustainably."

1.2 Mi'gmaq Life Cycle – Seven Stages of Life with the Seven Gifts

From a Mi'gmaq worldview, teachings shared by Elders are important to Mi'gmaq culture and traditions. Undoubtedly, there are numerous teachings, values, and beliefs; for the purpose of this report, we have drawn upon a Medicinal Wheel teaching, as described by Elder Murdena Marshall.[8] This Medicinal Wheel describes a Mi'gmaq life cycle, more specifically this life cycle teaches that there are significant life changes (or stages) that occur every seven years.

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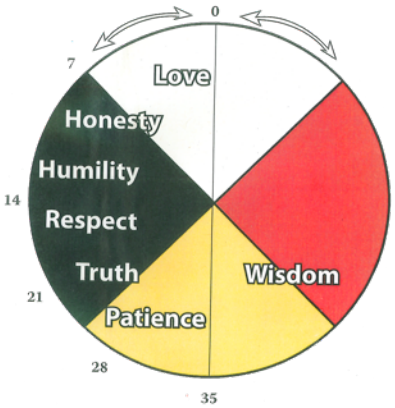
7 Parks Canada. Special Places: Eco-lessons from the National Parks in Atlantic Canada. Information Sheet: Atlantic Salmon. (Government of Canada, 2005)

8 Murdena Marshall. Mi'kmaq Sacred Teachings: 7 Stages of Life with the 7 Gifts (Unama'ki, 2009)

Mi'gmaq Life Cycle:

"Through the reciprocal nature in which we view our relations with others and our surroundings, it is believed that our innate abilities do not develop in isolation, but rather through the interdependent relationship we have with our surroundings. It is through these relationships, with others and with the land, that we experience these life changes (or stages), at which time we acquire a new gift which helps to develop or restore our way of being.



Upon birth, our families shower us with the gift of Love. Thereafter, approximately every seven years, as you continue to experience life, you continue to receive these gifts, one after another, the gifts are:

- Love
- Honesty
- Humility
- Respect
- Truth
- Patience
- Wisdom

It is said that if all of the gifts are visible in a person, that person is an Elder. The cycle then completes itself, with Elders returning to the age of seven, or in Mi'gmaq, it is referred to as 'Apaji-mijua'ji'juen". Apaji (preverb) – repeat, go back again. Mijua'ji'j (root word) – child under 7. Uen (inflection) – in the process of, to be, state of being.

It is at this time when our Elders, full of wisdom and integrity, become our teachers, passing on their life experiences, acquired knowledge, and honesty to the next generation. This is how to keep our world in constant motion, continually keeping the life energies flowing."[9]

Using the Mi'gmaq Medicine Wheel, we may gain an understanding about the necessity and cyclical nature of life stages. Further, these changes come with teachings, or principles, which guide our actions and understanding of relationships with each other and with our environment.

In the following, we have attempted to merge the life stage processes as described in the Mi'gmaq Medicine Wheel with the life cycle of the salmon (seven distinct life stages)[10], as understood by Western science.

Life Cycles: Merging Western science with Indigenous Knowledge

The salmon are ready to spawn in October; in preparation, they seek out shallow, rapid areas of the main river and its tributaries where spawning gravel is available. Once the female has selected her spawning site, she digs a shallow depression with her tail and deposits her eggs. The eggs are immediately fertilized by the male and covered with a layer of gravel.

If the salmon were to be following similar life stages and life gifts of the Mi'gmaq, this is the time when the eggs would receive the gift of love. The Earth receives the eggs and offers coverage and protection.

Western science continues its study of the salmon, finding that: "depending on water temperature eggs will take between 6 to 8 weeks to reach the Alevin stage." This second stage, the alevins, being a newly born fish, derive their nourishment from the yolk sac from which they were born.

From within a Mi'gmaq understanding of life cycles, the second life gift of honesty helps us to understand this life stage

9 Murdena Marshall. Mi'kmaq Sacred Teachings: 7 Stages of Life with the 7 Gifts. (Unama'ki, 2009)

10 Parks Canada. Parks Canada. Special Places: Eco-lessons from the National Parks in Atlantic Canada. Information Sheet: Atlantic Salmon. (Government of Canada, 2005)

of salmon. At this delicate stage, we need to be honest about our intentions for the salmon so that we can begin taking the appropriate steps to ensure its life can continue and that the salmon may fullfill its life purpose.

Following the salmon's life cycle, once an alevin's egg sac is absorbed, the fish must find food for itself. Western science describes this stage as the 'fry stage.' The fry will swim about feeding on tiny invertebrates, an important food source at this stage.

It is at this stage that fry will begin to develop humility – the third life stage within the Mi'gmaq life cycle. The fry at this stage learns to hide and school together - in this way, the fry learn that they are not greater than the environment. Rather, they must work with the natural elements rather than trying to alter the elements. This is also the transitioning time which scientists now refer to as post-yearling parr. The majority of them spending a total of three years in the stream before going to sea. Much of this stage of the salmon life cycle is in skill development and learning its place in the world.

As we grow, we are often met with the option to expand our horizons, to extend ourselves out into unknown territory where we will find the provisions and where our skills can be tested. For salmon, this expansion means migrating out to the sea. This migration takes place in May and June after the parr has achieved a desirable length of about 15 cm. At this time the parr takes on the silvery appearance of its parents and is called a smolt.

With a foundation of love, honesty and humility – the fourth life stage is possible –respect. In Mi'gmaq communities, modeling behavior - following the ways of our elders - is a great sign of respect. By following the way of our elders, listening, we are demonstrating that we trust their path. Similarly, the smolts are trusting their parents' path by taking on their appearance and way of being.

In the spring, where new beginnings are made, the smolt goes through a body chemistry change; now weighing about 2 ounces, they are ready to follow their parents path into the salt water. They will continue to migrate to the ocean where they will spend about 2 or 3 years testing their survival skills and develop into mature salmon. During this time, truth and patience are learned.

The cycle continues and in the spring, the spawning adult salmon returns to its river of birth. At this time, we – the Mi'gmaq will greet the salmon, with ceremonies, by offering tobacco, and sharing the first catch. We welcome the salmon back to its native stream where their energies will continue to flow with the natural rhythms of the land. In this way, the salmon completes its life cycle and teaches us the gift of wisdom.

Recommendation #2:

The challenge, we suggest, is to use Indigenous Knowledge processes, such as the Medicinal Wheel, in order to a) understand the fishery and b) guide the development of management plans for the fishery.

By using Indigenous Knowledge processes in this manner, we suggest that we will promote a holistic view of the salmon, which in turn may help to establish harmonious relations among the stakeholders.

2.0 The salmon journey

2.1 Guiding the young

The salmon are extensive and complex traveller's. The wild Atlantic salmon of eastern North America travel predominantly in the west Atlantic area in the waters off Western Greenland, the shelf off Newfoundland, and in the Labrador Sea.[11]

Recently, the Atlantic Salmon Federation began studying the travel patterns of the salmon through the use of sonic telemetry, tracking the movement of smolts in the Restigouche and Miramichi Rivers. A transmitter is placed on each fish, with each one having an individual code. As the fish pass by a system of receivers their signal is recorded.

11 The Atlantic Salmon: Genetics, Conservation and Management. (Blackwell Publishing, 2007)

The objectives of the project are to follow smolt movements - tracking their survival through fresh water and as far out to sea as possible in order to compare travel patterns of the fish from different rivers within and among years. The information collected should answer questions on whether smolts from different rivers migrate together in the ocean and whether or not their migration patterns are important for the biology of the salmon.

Results indicate that smolt survival in freshwater is not a major problem. Approximately 90% of the smolts are surviving in the fresh water of the Miramichi and Restigouche; however, only about 40-50% of the smolts in the Miramichi are still alive when they get to the ocean and only 20-25% are alive from the Restigouche.[12]

The migration pattern of the smolt was found to be mostly passive; the smolt followed the currents on their way to the North Atlantic through the Straits of Belle Isle. However, science is telling us that the mature fish and the juvenile salmon and smolts are traveling together - the spawned out salmon and the juvenile are arriving at the Strait of Belle Isle at the same time.

The question is: how do the young fish know to get to Greenland? Originally, it was thought that the bigger fish (adults) would arrive earlier as they can swim faster. But, they are all arriving at the same time. (It takes the fish about 35 days to get from the Restigouche to the Straits of Belle Isle traveling at around 17 km per day. Also there is no difference in size between the fish that make it and those that die.) Size does not affect the speed of swimming and this possibly indicates that the fish want to be with companions as they cross the ocean, with the adults teaching the little fish the migration routes.[13] These findings represent a significant shift in the understanding of salmon biology since the smolts seem to be following the adults. Further, this example illustrates the need to explore alternative ways of understanding the salmon.

Recommendation #3:

In the development of management plans, we need to take into consideration diverse ways of knowing and be open to different perspectives and interpretations of data.

2.2 Returning home as adults

From a Western scientific perspective, much has been written about the salmon's life cycle. The following describes the adult salmon's typical return from the sea to the river where they grew as juveniles:

> Atlantic salmon typically return to coastal-home waters from their feeding grounds at sea several months prior to spawning, with multi-sea winter salmon returning prior to one-sea-winter. Like other anadromous salmonids, they show high fidelity to their river where they grew as juveniles, with a homing accuracy averaging between 97% and 99%.This specificity has allowed for local adaptation. Furthermore, timing of river entry has been associated with several river characteristics, including hydrological conditions, temperature regime, length and physical difficulty of ascent. Upon entry, the Atlantic salmon often remain for several months in the lower reaches of the river before ascending to the spawning grounds.[14]

From a Mi'gmaq perspective, there is a strong cultural tie and relationship with the salmon who –in following its natural life cycle – returns each year from the oceans to the rivers. For the Mi'gmaq there are cultural practices and ceremonies associated with the salmon's return. For example, some Elders speak about "welcome ceremonies" for the salmon. As

12 Gespe'gewaq Mi'gmaq Resource Council. Melgigna'tu'g Ta'n Telmawo'ma'ti'gw Plamu Strengthening Our Relationship with the Salmon Workshop Report. (Listuguj, 2009)

13 Dr. Fred Whoriskey. Presenting at "Melgigna'tu'g Ta'n Telmawo'ma'ti'gw Plamu: Strengthening Our Relationship with the Salmon" (Listuguj, 2008)

14 Ian Fleming. Reproductive strategies of Atlantic salmon ecology and evolution. Reviews in Fish Biology and Fisheries. Norwegian Institute for Nature Research. (Springer Netherlands publishing, 1996)

well, there are protocols with respect to the "first fish caught."[15]

Recommendation #4:

The development of a sustainable management plan needs to take into consideration both biology (i.e. protecting salmon spawning areas in the rivers) as well as protecting Mi'gmaq cultural practices and traditions, (i.e. ceremonies and protocols, which encourage "respect for the salmon.")

3.0 Life skills and inherent characteristics of the salmon

3.1 Navigational characteristics

Through Western scientific knowledge, we have increased our understanding about inherent characteristics (biology) of the salmon; for example, its ability to navigate long distances from fresh to salt water. Atlantic salmon may use several means of navigating through the sea including guidance by the stars, using the magnetic field, ocean currents and even chemical memory.[16] They also have a lateral line that allows them to detect water currents as well as detect the movement of other fish. This allows the fish to determine which direction is downstream. This is particularly handy when the salmon are making their movement to the sea as a smolt. This same lateral line can also assist in finding its way upstream. When rapids or waterfalls are detected, it helps the salmon locate upwelling currents that will give it a boost in its jumping ability.[17]

3.2 Defense mechanisms

Salmon have compact rows of protective scales that are firmly attached to the skin and are primarily made of calcium. These scales offer superb protection against injury and infection. In addition to the scales, there is a mucous covering that is very effective at trapping and stopping bacteria and viruses from entry. The mucus contains antibacterial-like agents that help to kill off the trapped bacteria on its skin. Additionally, the mucus helps to reduce friction and allows the fish to move through the water more easily.[18]

Recommendation #5:

Continue to monitor the health and well-being of the salmon in terms of its life skills and inherent characteristics (i.e., navigational characteristics and defence mechanisms). Further, with respect to developing sustainable management plans, these findings need to be accessible and shared with all stakeholders.

4.0 The Salmon Environment

The Atlantic salmon is unique in that it lives in both fresh and marine environments. The salmon is born in fresh water and remains there until it undergoes a physiological transformation allowing it to tolerate salt water. After one to three years at sea, the salmon returns to its river of origin to spawn (reproduce). It therefore has two distinct habitats: freshwater rivers and ocean.

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15 Fred Metallic. "Strengthening our Relations in Gespe'gewa'gi, the Seventh District of Mi'gma'gi." Lighting the Eighth Fire: The Liberation, Resurgence, and Protection of Indigenous Nations. Ed. Leanne Simpson. (Winnipeg: Arbeiter Ring Publishing, 2008).

16 Atlantic Salmon Trust. Atlantic Salmon and Sea Trout, Sentinels for our Environment. (Perth, 2010)

17 Atlantic Salmon Trust. Atlantic Salmon and Sea Trout, Sentinels for our Environment. (Perth, 2010)

18 Department of Fisheries and Oceans: Canada Department of Fisheries and Oceans Animal-User Training Template. (Government of Canada, 2004)

4.1 Freshwater environment

Females deposit their eggs as discrete groups in one or more nests in composite structures called redds. Spawning sites are selected by the female based on locally variable criteria of water depth and velocity, gravel size, stability, compaction and porosity, and the availability of nearby cover. Redds are often constructed in stable gravel at the tails of pools or on gravel bars where water flow is accelerating, and the gravel contains low concentrations of fine materials (i.e. Silt and sand) and good through flow (of percolation and upwelling) of oxygenated water. The rate at which eggs and alevins develop is primarily a function of water temperature. The thermal environment to which the eggs and alevins are exposed varies significantly within and between spawning locations, and within and between catchments, with higher temperatures causing a faster rate of development and consequently a shorter incubation period and earlier emergence date. Groundwater, when low in dissolved oxygen, may also affect egg survival and hatching times. Laboratory studies show that the key egg stages can also be affected by low pH, particularly below pH 4.5. Chronic exposure to acidic conditions can lead to extended alevin development times and reduced growth.

The soils and vegetation along the streams and rivers also play an important role in protecting and maintaining salmon habitat. The vegetation both nourishes the river ecosystem and protects it by stabilizing the riverbanks, preventing them from collapsing and silting the river.

The substrate of good spawning site will have coarse, loose gravel 3-7 centimeters thick, a moderately strong current to prevent the eggs from being smothered by settling silt, and well oxygenated water.

4.2 Marine water environment

Knowledge of how Atlantic salmon are distributed in the sea is based largely on studies of tag recaptures in marine fisheries, in West Greenland, the Faroe Islands and in the northern Norwegian Sea, associated with major marine feeding areas. At sea, Atlantic salmon appear to be opportunistic pelagic feeders that exploit a wide range of crustacean and fish prey. Typically, their diet consists of euphausid shrimps and prawns, squid, and a range of fish species such as sand-eels, herring, sprat, lantern fish, capelin, and pearlside. Atlantic salmon survival and production is heavily dependent on the ocean environment, where most growth and mortality occurs.

5.0 Current Threats to the Salmon's Habitat

There are a number of threats to the salmon's habitat resulting from exploitation and use of resources including both surrounding lands and water. Road construction, dams, logging practices, and farmed salmon are among the factors, which are threatening the salmon's habitat and ultimately the well-being of the species.

- Siltation: This occurs when a riverbed is covered with fine particles. It can be caused by poor or improper road construction, irresponsible logging practices, the use of all-terrain vehicles in riverbeds, and any other activity that erodes riverbanks or disturbs river bottoms. Siltation destroys spawning areas and smothers salmon eggs. It can cause gill abrasion and makes feeding more difficult because the fish cannot see their food.
- Altering/Diverting Water Flow: This can result in water flow that is too high or low for the salmon, which can affect spawning and survival rates. Additionally, because the of the complexity of interactions between ice and flow processes in tidal rivers, one should expect profound effects on many important fish habitat parameters such as substrate, cover, temperature, water depth, and water velocity.
- Erecting Dams or Barriers: This creates barriers for migrating salmon and destroys spawning beds.
  Altering/Destroying Riverside Vegetation: This reduces the food supply to the river ecosystem and causes siltation.
- Altering/Destroying Riverbanks: This causes flooding and siltation.
  Logging: This can aggravate flooding and cause flash floods and siltation of water bodies. This can impact on salmon populations, especially eggs and juveniles. The use of insecticides and herbicides can also be a

problem.

- Aquaculture: With the decline of the commercial salmon industry, there has been an emphasis on raising Atlantic salmon in artificial environments (aquaculture). If farmed salmon escape they can introduce new disease and new genes into a watershed.
  At-Sea Mortality – A result of by-catch, global climate change, predation.[19]

As well, at a workshop held by GMRC with Mi'gmaq Elders, many participants expressed concerns about the contaminants in the water; the declining stocks; and the need to share (sustainable) Mi'gmaq fishing practices with the youth.[20]

At this workshop, participants expressed the need to begin identifying and mapping the different ways that the lands and waters are being used so that management plans can address the threats to the salmon's habitat.

Recommendation #7:

In order to ensure that the salmon's habitat is protected, management plans must involve multiple stakeholders in concrete ways (i.e., providing a venue for dialogue and sharing information and technology constructively).

It is also recommended that the salmon's habitat and potential threats to their habitat be mapped using GIS technology. Further, this information should be shared amongst the stakeholders in order to foster dialogue, reconciliation, and partnerships leading to a sustainable fishery.

5.3 Protecting the Salmon's Habitat

Western science has provided us with information about what is necessary – environmentally - in order to ensure the health and survival of this species. The salmon depends upon both fresh water and marine water, it travels great distances (from the Restigouche River to Greenland), and returns to the same spawning grounds –year after year. More information is needed, however, to understand the habitat from a Mi'gmaq perspective.

Recommendation #6:

In developing management plans that are sustainable, information about the salmon's habitat – both fresh water and marine- need to be factored into the development of plans for the future conservation and management of stocks. Further, it is recommended that more research is needed in order to understand the habitat from a Mi'gmaq perspective (for example, similar to how the 'life cycle of the salmon' is explained in this report, Section 2.1)

6.0 Current trends in salmon population

Using a variety of methods, scientists have been monitoring the Atlantic salmon population. Since 1971, there has been a significant decline in the numbers of salmon returning to Canadian rivers, including those rivers within Gespe'gewa'gi.

Scientists have noted that between 1971 and 1985, the estimated abundance of North American Atlantic Salmon at one-sea-winter (1SW) of age fluctuated between 0.8 and 1.7 million fish annually. Between 1995 and 2004, the estimated abundance declined to about 0.4 to 0.7 million fish. These figures represent an approximate decline of 50% to 60% percent. The largest decline occurred in the age component destined to return to Canadian rivers as two-sea-winter (2SW) salmon.[21]

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19 Parks Canada. Special Places: Eco-lessons from the National Parks in Atlantic Canada. Information Sheet: Atlantic Salmon. (Government of Canada, 2005)

20 GMRC Strengthening our Relationship with the Salmon workshop (Listuguj, 2008)

21 Department of Oceans and Fisheries, Atlantic Salmon Integrated Management Plan (2008-2012) Gulf Region. www.glf.dfo-mpo.gc.ca/fam-gpa/plans/salmon-summary-e.php (Government of Canada, 2010)

Atlantic salmon returning to rivers of the Maritime provinces are captured and counted at monitoring facilities. Salmon are captured using various methods. Counts of salmon at barrier fences, counting fences, fishways and at dams usually represent the total run size of fish at that point in the river. Counts at trap-nets in estuaries represent partial counts to the river.[22]

Similarly, Mi'gmaq fishers have also noted the decline in numbers. Fishers speak about the difference, saying:

> *The big salmon are not coming back in the river, the grandfathers are not coming back in, and grandmothers are not coming back in. Any time your grandfather or grandmothers ignore you, there's a reason why they are ignoring you. It's a particular form of discipline.*[23]

A Mi'gmaq perspective about the decline in salmon population, that is "the grandfathers" and "grandmothers" who are not coming back in – points to the unique cultural understanding of, and relationship between, the Mi'gmaq and the salmon. This relationship and understanding, however, requires further research.

Both practices – Western science, which provides quantitative data about the abundance of salmon population – and Indigenous ways of knowing, which asks us to become more aware of our behavior and relationship with the environment – contribute to increasing our understanding of current trends of the salmon population.

Recommendation #8:

Continue to monitor the trends in salmon population using a variety of methods. As well, using Indigenous approaches, speak with Mi'gmaq fishers to gain an understanding of Mi'gmaq cultural perspectives, in particular with respect to the declining numbers and what these numbers "are telling us."

Finally, we recommend that the information about the salmon population gathered through Western scientific methods and Indigenous ways of knowing (i.e., by working with local Mi'gmaq fishers) needs to be shared among the stakeholders and considered in the development and implementation of a sustainable resource management plan.

7.0 Current trends in quality of salmon health

Since 2007, there has been an increase of salmon mortalities caused by the fungus – saprolegnia - on the Restigouche River and its tributaries. Saprolegnia is a pathogen fungus that attacks the skin of fish after an injury or other event that disrupts the skin. Further, a weakening of the immune system of the salmon and the decline in the water temperature promotes the growth of this fungus on the skin. The first significant cases of death caused by this phenomenon appeared in 2003 in our watershed.

The causes and effects of the variations of infections are not well known.[24] Further, more research is required in order to reduce the prevalence of infections to the salmon.[25]

The Gespe'gewaq Mi'gmaq Resource Council (GMRC) has also conducted an environmental contaminants' study.[26] The

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22 Department of Oceans and Fisheries, Atlantic Salmon Integrated Management Plan (2008-2012) Gulf Region. www.glf.dfo-mpo.gc.ca/fam-gpa/plans/salmon-summary-e.php (Government of Canada, 2010)

23 Fred Metallic. "Strengthening our Relations in Gespe'gewa'gi, the Seventh District of Mi'gma'gi." Lighting the Eighth Fire: The Liberation, Resurgence, and Protection of Indigenous Nations. Ed. Leanne Simpson. (Winnipeg: Arbeiter Ring Publishing, 2008)

24 RRMWC. News Archives: Saprolegnia back in 2007. http://www.restigouche.org/news.php C. (RRWMC, 2007)

25 RRWMC. Upsalquitch Salmon Management Plan, Draft. (RRWMC, 2009)

26 GMRC. "Impacts on Mi'gmaq Traditional Food from Environmental Exposure in the Restigouche River" (Listuguj, 2010)

purpose of this study was to:

- Determine the levels of contaminants (dioxins and furans) found within wild Atlantic salmon of the Restigouche River.
- Determine if individual consumption of wild salmon is within acceptable levels of exposure for dioxins and furans.
- Survey and interview community members to assess socio-cultural and historical aspects affecting salmon consumption patterns.
- Initiate discussions among community, scientists, and industry about each stakeholders relationship with the salmon; be it economical, cultural, social, or environmental, to develop effective partnerships to maintain healthy salmon and community relations.
- Identify the extent to which actual and/or perceived levels of dioxins and furans may affect the community's cultural, social, and physical health.

The lab analysis and subsequent calculation for the "recommended maximum monthly intake levels" revealed that salmon alone will not cause any adverse effects to your health (in terms of the presence of dioxins and furans). Other studies also indicate that the positive effects of consuming traditional food, in a relatively healthy environment, outweigh the contaminant risks.[27]

From its contaminants' study, GMRC also learned that salmon - and salmon fishing - is so intricately woven into "who we are as a people," that to restrict the consumption could in fact cause undesirable effects. When someone fishes, one gets a sense of responsibility, accomplishment, productivity, respect, companionship and knowledge. Taken together, these factors provide the basic foundation for the development of a healthy community.

Recommendation #9:

Further research is required to monitor trends in the quality and health of the salmon (i.e., causes and effects of infections).

As well, the significance of the salmon to the 'health and well-being' of the Mi'gmaq communities cannot be underestimated. There is a need to ensure that Mi'gmaq perspectives, knowledge and cultural values about the salmon its health and well-being be incorporated into management plans.

Finally, information from the various studies should be shared among the stakeholders in order to help develop a common understanding about the salmon – its health, as well as what it means – socially and culturally – to the different stakeholders.

Part II: Managing the Fishery

8.0 Federal and Provincial Legislation for the Management of the Recreational Salmon Fishery

A mix of federal and provincial legislative and administrative responsibilities exists for recreational fish species within the Maritime provinces. In general terms, the federal government manages the diadromous and other marine species, while the provinces manage the freshwater species and license all recreational fisheries in inland waters except within national parks where the federal government's Parks Canada Agency license recreational fishing.

Because the federal government retains legislative authority for inland fisheries, the provinces forward all recommendations for amendments to regulations under the Fisheries Act, 1985, R.S.C. (e.g., bag limits, seasons, and close times) to DFO to obtain Governor-in-Council approval.

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27 Government of Ontario. Eat Right Ontario. Traditional Food for Aboriginal People" (Government of Canada, 2010)

General responsibilities and commitments of federal and provincial governments to manage the recreational fish species are outlined in Memoranda of Understanding (MOUs) between DFO and the provincial governments for New Brunswick and Nova Scotia.

The Gulf Region's main objectives for the Atlantic salmon recreational fisheries and its role in their management are:

(1) To ensure sustainable recreational fishing opportunities for salmon;

(2) To collaborate and/or share responsibility for the management of the salmon resource and the recreational fisheries it supports with the respective provincial governments and parties participating or otherwise having an interest in the salmon angling fisheries.

The responsibility for achieving these objectives remains with the region's respective Recreational Fisheries Program.

In addition, DFO is committed to collaborating and integrating its efforts (pertaining to the management of the recreational fisheries resources), with the provinces through the Canadian Council of Fisheries and Aquaculture Ministers (CCFAM).

At the direction of CCFAM, a DFO-led Federal/Provincial/Territorial Forum on Recreational Fisheries was established. This forum on recreational fisheries held its first meeting in November 2005 and is co-chaired by representatives of the federal and provincial governments.

This forum is intended to act "as a unified and collective assembly to promote national cooperation on recreational fisheries issues and will provide a mechanism for strategic liaison with other federal, provincial and territorial initiatives related to recreational fisheries."

To conclude, the Federal government (through DFO) and the provinces are collaborating to ensure a sustainable recreational fishery. As such, MOUS are agreed upon between the parties. Additionally, the federal government established a national council - CCFAM, which is intended to foster cooperation and strategic planning among the federal, provincial and territorial governments.[28]

Recommendation #10:

At the local level, there is a need to understand the complex policy environment in which the recreational fisheries is situated. In the development of a sustainable management plan, we will need to consider the authority, scope and mandate of each party, respectively.

Further, for First Nations, there is a need to be able to participate in national forums, such as the CCFAM, to be able to engage meaningfully in dialogue, to represent our own unique perspectives, and to contribute to the fostering of cooperation and strategic planning for the fisheries.

9.0 Working Together: Federal and Provincial Governments

The Department of Fisheries and Oceans (DFO) and New Brunswick's Department of Natural Resources (DNR) are signatory to MOUs with watershed management organizations for the Miramichi and Restigouche systems (e.g., the Miramichi Watershed Management Committee and Restigouche River Watershed Management Council, respectively).

The MOUs confirm an understanding whereby the signatory parties agree to work together to manage the salmon resource in their respective watersheds.[29]

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28 Department of Oceans and Fisheries, Atlantic Salmon Integrated Management Plan (2008-2012) Gulf Region. www.glf.dfo-mpo.gc.ca/fam-gpa/plans/salmon-summary-e.php (Government of Canada, 2010)

29 Department of Oceans and Fisheries, Atlantic Salmon Integrated Management Plan (2008-2012) Gulf Region. www.glf.dfo-mpo.gc.ca/fam-gpa/plans/salmon-summary-e.php (Government of Canada, 2010)

The existing community salmon management organization for SFA 15A (e.g., the Restigouche River Watershed Management Council) encompasses and represents the stakeholders (i.e., the local Aboriginal groups, recreational fishing interests, main industries in the watershed, and several of the municipalities) from both the New Brunswick and Quebec portions of Restigouche River system.

The involvement of the collective interests from both provinces is required to effectively manage this inter-provincial salmon resource.[30]

10.0 Aboriginal Fisheries

10.1 Legal Landscape

The legal landscape has changed significantly over the past fifteen years with respect to Aboriginal Rights and Title. For example, significant decision include (but are not limited to): Delgamuuk (1997), Marshall (1999), Bernard and Marshall (2005), and Ahousaht (2009).

Although it is beyond the scope of this report to elaborate on the individual court cases and the impact of the decisions with respect to the salmon fishery, nevertheless, we argue that we need to recognize that the laws have changed with respect to Aboriginal and Treaty Rights and Aboriginal title.

Recommendation #11:

On the ground, and in the development of management plans, there needs to better understanding about how to implement Aboriginal Rights and Title into policies intended to manage the salmon fishery.

10.2 DFO: Integrating Aboriginal Fisheries

Aboriginal peoples have rights to the fishery, which are recognized and affirmed under Section (35) of the Canadian Constitution Act, 1982.

Furthermore, under Canadian law, numerous court cases have attempted to define Aboriginal Rights, that is the scope of these rights and how they may be practiced and exercised by Aboriginal peoples. R. v. Sparrow is viewed as the leading case with respect to Aboriginal Rights. This Supreme Court of Canada decision confirmed that Aboriginal fishing for food, social and ceremonial purposes has priority over other fishing activities. The decision also confirmed a fiduciary obligation on the part of governments to consult with Aboriginal people regarding any and all aspects pertaining to their fishery.

Accordingly, DFO objectives for the Aboriginal fisheries for Atlantic salmon in the Gulf Region are:

(i) to ensure local First Nations and Aboriginal/Native councils priority in terms of access to
fish for food, social and ceremonial purposes over other fishing activities,
(ii) to ensure that Aboriginal and other fisheries for salmon do not adversely affect stock conservation,
(iii) to build a trust relationship with Aboriginal people,
(iv) to determine the interests that the individual First Nations and councils have in the salmon resource and to work with them to realize those interests
(v) to involve the local First Nations and councils in the management of their own fisheries and the salmon resource upon which they are dependent.[31]

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30 Department of Oceans and Fisheries, Atlantic Salmon Integrated Management Plan (2008-2012) Gulf Region. www.glf.dfo-mpo.gc.ca/fam-gpa/plans/salmon-summary-e.php (Government of Canada, 2010)

31 Department of Oceans and Fisheries, Atlantic Salmon Integrated Management Plan (2008-2012) Gulf Region. www.glf.dfo-mpo.gc.ca/fam-gpa/plans/salmon-summary-e.php (Government of Canada, 2010)

Recommendation #12:

While DFO has stated objectives for the Aboriginal fisheries for Atlantic salmon, there is a need to review and assess whether or not these stated objectives are being implemented in the fisheries.

10.3 'Listuguj Salmon Management Plan'

In 1996, the Listuguj First Nation leadership, in collaboration with the traditional governing body (Tribal Council), developed and implemented a management plan for the Atlantic salmon fishery in the Listuguj River watershed. This plan is entitled The Listuguj Mi'gmaq First Nation Law on Fisheries and Fishing; it is also referred to as The Listuguj Salmon Plan. The plan, which was developed after extensive consultation with communities, was sanctioned by the Listuguj Mi'gmaq government in 1996.[32]

Further, the management plan identified that the Listuguj Mi'gmaq Government (LMG) together with the Tribal Council would be "solely responsible for the implementation of the fishing plan as provided in this law"; secondly, the plan stipulates that "the LMG may enter into co-management arrangements with adjacent governments in the interest of conservation and management of fisheries resources"; and, finally, "the LMG shall exercise its responsibility in respect of the Fishing Plan through the Aboriginal and Treaty Rights directorate."[33]

Listuguj Mi'gmaq government has the overall responsibility to monitor the fishing activities of the Listuguj Mi'gmaq community, which includes conducting stock assessments, scientific activities for the purpose of establishing harvesting limits, identifying protection zones, enhancement activities, and develop a commercial component to the Listuguj Fishery.

Recommendation #13:

There is a need to review the Listuguj Management plan. Since its inception in 1994 and implementation in 1996 there has never been a comprehensive review to measure the impact of the plan, whether or not it has been successfully implemented; and, finally, whether or not it is relevant and continues to meet the social, cultural and political aspirations of the community.

11.0 Conclusion

When we speak about the salmon, we are talking about a relationship that the Mi'gmaq have had for a long time. We've always trusted that the salmon –in following the natural cycles and seasons - would return each year. However, there are concerns from all parties about the health of the salmon and its habitat.

In the management of the wild Atlantic salmon, modern conservation policies relied on Western scientific data and were primarily geared towards protecting wild Atlantic salmon populations. These policies, however, have largely been unsuccessful. The salmon populations are still threatened- dams, roads, infection and disease, etc. Further, fisheries policies have not adequately considered the cultural, spiritual and social importance of land, waters, and the natural resources to First Nations. For the Mi'gmaq the salmon signifies more than a 'resource', rather it symbolizes a way of life and a deep connection with the land and waters of what the Mi'gmaq know as 'Gespe'gewa'gi, Mi'gma'gi.'

The relationship between culture and the resource is important to consider when developing programs, strategies and/or polices intended to regulate natural resource activities (in this instance the salmon fishery) within Mi'gmaq territory.

It is possible to dialogue, share information, and work across different systems of knowing –western science and

32 Listuguj Mi'gmaq Government. The Listuguj Mi'gmaq First Nation Law on Fisheries and Fishing. (Listuguj, 2005)

33 Listuguj Mi'gmaq Government. The Listuguj Mi'gmaq First Nation Law on Fisheries and Fishing. (Listuguj, 2005)

Indigenous practices. Tools and communication strategies have emerged, which are allowing us to take a new approach to resource management. It is the time to share and participate in dialogue that will fuel action to ensure a balance of the many competing interests regarding our resources.

By working together – and respectfully integrating different ways of knowing – it may be possible to ensure that the salmon will continue its journey, as it has for thousands of years, returning home to the Restigouche River.

Appendices

Appendix A: General Recommendations

Recommendation #1

We suggest that a multi-disciplinary approach is need in order to gain a deeper and more comprehensive undertanding of the salmon. By understanding the life cycle of the salmon from different perspectives we may gain a whole new understanding of what it means to "manage the salmon sustainably."

Recommendation #2:

The challenge, we suggest, is to use Indigenous Knowledge processes, such as the Medicinal Wheel, in order to a) understand the fishery and b) guide the development of management plans for the fishery.

By using Indigenous Knowledge processes in this manner, we suggest that we will promote a holistic view of the salmon, which in turn may help to establish harmonious relations among the stakeholders.

Recommendation #3:

In the development of management plans, we need to take into consideration diverse ways of knowing and be open to different perspectives and interpretations of data.

Recommendation #4:

The development of a sustainable management plan needs to take into consideration both biology (i.e. protecting salmon spawning areas in the rivers) as well as protecting Mi'gmaq cultural practices and traditions, (i.e. ceremonies and protocols, which encourage "respect for the salmon.")

Recommendation #5:

Continue to monitor the health and well-being of the salmon in terms of its life skills and inherent characteristics (i.e., navigational characteristics and defense mechanisms). Further, with respect to developing sustainable management plans, these findings need to be accessible and shared with all stakeholders.

Recommendation #6:

In developing management plans that are sustainable, information about the salmon's habitat –both fresh water and marine- need to be factored into the development of plans for the future conservation and management of stocks. Further, it is recommended that more research is needed in order to understand the habitat from a Mi'gmaq perspective (for example, similar to how the 'life cycle of the salmon' is explained in this report, Section 2.1)

Recommendation #7:

In order to ensure that the salmon's habitat is protected, management plans must involve multiple stakeholders in concrete ways (i.e., providing a venue for dialogue and sharing information and technology constructively).

It is also recommended that the salmon's habitat and potential threats to their habitat be mapped using GIS technology. Further, this information should be shared amongst the stakeholders in order to foster dialogue, reconciliation, and partnerships leading to a sustainable fishery.

Recommendation #8:

Continue to monitor the trends in salmon population using a variety of methods. As well, using Indigenous approaches, speak with Mi'gmaq fishers to gain an understanding of Mi'gmaq cultural perspectives, in particular with respect to the declining numbers and what these numbers "are telling us."

Finally, we recommend that the information about the salmon population gathered through Western scientific methods

and Indigenous ways of knowing (i.e., by working with local Mi'gmaq fishers) needs to be shared among the stakeholders and considered in the development and implementation of a sustainable resource management plan.

Recommendation #9:

Further research is required to monitor trends in the quality and health of the salmon (i.e., causes and effects of infections).

As well, the significance of the salmon to the 'health and well-being' of the Mi'gmaq communities cannot be underestimated. There is a need to ensure that Mi'gmaq perspectives, knowledge and cultural values about the salmon –its health and well-being - be incorporated into management plans.

Finally, information from the various studies should be shared among the stakeholders in order to help develop a common understanding about the salmon – its health, as well as what it means –socially and culturally – to the different stakeholders.

Recommendation #10:

At the local level, there is a need to understand the complex policy environment in which the recreational fisheries is situated. In the development of a sustainable management plan, we will need to consider the authority, scope and mandate of each party, respectively.

Further, for First Nations, there is a need to be able to participate in national forums, such as the CCFAM, to be able to engage meaningfully in dialogue, to represent our own unique perspectives, and to contribute to the fostering of cooperation and strategic planning for the fisheries.

Recommendation #11:

On the ground, and in the development of management plans, there needs to better understanding about how to implement Aboriginal Rights and Title into policies intended to manage the salmon fishery.

Recommendation #12:

While DFO has stated objectives for the Aboriginal fisheries for Atlantic salmon, there is a need to review and assess whether or not these stated objectives are being implemented in the fisheries.

Recommendation #13:

There is a need to review the Listuguj Management plan. Since its inception in 1994 and implementation in 1996 there has never been a comprehensive review to measure the impact of the plan, whether or not it has been successfully implemented; and, finally, whether or not it is relevant and continues to meet the social, cultural and political aspirations of the community.

Appendix B: Other Recommendations to Consider in the Development of a Sustainable Salmon Fishery Management

- Develop a Mi'gmaq Salmon Management Council, which would:
    - Develop a vision for our relations with salmon and other stakeholders;
    - Assist in the planning of a Mi'gmaq natural resource management conference for all stakeholders involved in salmon management (reconciling conventional western scientific technique and indigenous ways of knowing in salmon management);
    - Identify current monitoring and research tools and best practices for salmon management;
    - Review and assess other First Nation agreements regarding self-governance and natural resource management.

Indigenous Methods

- Cultural and Spiritual:
    - We recommend that GMRC further study the principles and spirituality behind Netugulimg (traditional resource law) and its current relationship understanding with Mi'gmaq people. Perhaps also drawing on parallels with other current management practices used by other Aboriginal tribes in North America;
    - Based on our research incorporate a modern or contemporary Netugulimgewel (resource standards) to fit the needs of the salmon within our territory. To assist in our efforts, further research and study is required;
    - Develop a bi-cultural research strategy that complements indigenous methods and theories and conventional western scientific technique;
    - We need to raise community awareness on the importance of Netugulimgewel would be necessary to gain support and understanding for the development of a sustainable natural resource (salmon) management plan.

Western Science

- Mapping (GIS):
    - A key recommendation to emerge from the research is to map critical habitat areas, migration routes, logging stressors and our Mi'gmaq traditional uses of the salmon. Through GIS technology we can zone in and identify areas that need protection or areas that need assistance to support habitats for the salmon.
- Monitoring:
    - Develop and conduct salmon monitoring plan; examine number and size of adult salmon using tools such as DIDSON along with community fishing surveys.
- Physical Analysis:
    - Non-invasive measures to examine size, agility of salmon.

- When salmon are collected for consumption or testing, examine for physical abnormalities, which may be an indicator of water quality, or also a source for secondary infections such as fungus (saprolegnia).

- Biological/genetic Analysis:
    - Identify partnerships with national or international organizations that examine the relation between genetic biodiversity and fitness related traits of the salmon, and to examine how these studies can be relevant to the Restigouche River population.
    - Also recommend is that genetic differences between farmed salmon and the wild salmon be studied. From other studies it has been concluded that when farmed salmon escape this causes chaos to the ecosystems. We need to know more about the relationship between farm salmon and wild salmon and how this affects their health and fitness.
- Chemical Analysis:
    - Identify labs that GMRC can partner with to conduct various analysis of persistent organic pollution and heavy metals that may be harmful for consumption when consumed through salmon.
- Habitat surveys (aquatic):
    - Monitor trends for water temperature, dissolved oxygen, pH (as spawning sites are selected based on water depth and velocity, gravel size, stability, compaction and porosity, where the gravel contains low concentrations of fine materials (i.e. Silt and sand) and good through flow of oxygenated water. Furthermore, the rate at which eggs and alevins develop is primarily a function of water temperature with higher temperatures causing a faster rate of development and consequently a shorter incubation period and earlier emergence date. Groundwater, when low in dissolved oxygen, may also affect egg survival and hatching times. Laboratory studies show that the key egg stages can also be affected by low pH, particularly below pH 4.5. Chronic exposure to acidic conditions can lead to extended alevin development times and reduced growth).
- Habitat surveys (substrate):
    - Conduct substrate surveys to identify, protect, and/or enhance good spawning beds (The substrate of good spawning site will have coarse, loose gravel 3-7 centimeters thick, a moderately strong current to prevent the eggs from being smothered by settling silt, and well oxygenated water.
- Habitat surveys (river bank/vegetative cover):
    - Conduct a survey/develop database of the solids and vegetation along the streams and rivers as they play an important role in protecting and maintaining salmon habitat. The vegetation both nourishes the river ecosystem and protects it by stabilizing the riverbanks, preventing them from collapsing and silting the river.

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