

“A Return to Country Food”

3rd annual meeting and workshop

Funding for the workshop was provided by AANDC, Northern Contaminants Program and the Dehcho AAROM program

August 26 - 27, 2014

Jean Marie River, NT



Final report

Prepared by

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Acknowledgements

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List of Participants

Jean Marie River

- Chief Stanley Sanguez, Jean Marie River First Nation
- Angus Sanguez, AAROM monitor
- Billy Norwegian

Trout Lake

- Jessica Jumbo, Sambaa K'e Dene Band Environmental Coordinator

Fort Simpson

- Jermaine Gargan, Liidlii Kue First Nation Communication Officer
- Brian Deneyoua, Liidlii Kue First Nation
- Edward Cholo, AAROM monitor,
- Nicholas de Pelham, AAROM monitor

Fort Providence

- John McLeod, Métis Local 57
- Priscilla Canadien, Deh Gah Gotie First Nation, Resource Management Board
- Joe Lacorne, Deh Gah Gotie First Nation, AAROM Monitor
- Steven Nadli, Zhati Koe First Nation, AAROM Monitor

West Point/Hay River

- Sonya Frise, West Point First Nation

Resources

- George Low, Dehcho First Nation, Dehcho AAROM Coordinator
- Dr. Heidi Swanson, Research Scientist, University of Waterloo
- Mike Low, Dehcho First Nation, AAROM Technical Advisor
- Dr. Brian Laird, Research Scientist, University of Waterloo
- Carole Mills, Program Manager, Northern Contaminant Program
- Dr André Corriveau, Chief Public Health Officer, GNWT, Department of Health and Social Services
- Bruce Townsend, BEAT Environmental Inc. Facilitator and Presenter
- Dr. Marlene Evans, Research Scientist, Environment Canada
- Dr. Rhona Hanning, Research Scientist, University of Waterloo
- Meagan Ann O'Hare, Master Student, University of Ottawa
- David Menacho, Tulita Renewable Resources Council

- Joe Tambour, Interpreter
- Don Antoine, Sound Technician
- Caroline Lafontaine, Consultant, Recorder

Cover photo: Carole Mills presenting the Northern Contaminants Program to the “Return to country food” workshop participants.

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1.0 Overview/Executive Summary

The third annual “Return to Country Food” workshop was hosted by the Jean Marie River First Nation. A major theme of the 2014 workshop was “Human Biomonitoring in the Dehcho” as presented by Dr. Brian Laird. Mercury levels in some species of fish in some lakes in the Dehcho have become a concern to community members initiating the proposal for a human

Biomonitoring study. The study involves sampling the hair and/or blood of voluntary participants, as was discussed at the Kakisa “Return to Country Food” workshop in August 2013. This type of study was successful in the Sahtu in that it showed that most people tested did not have elevated levels, and participants were reassured that eating fish was a healthy low risk alternative to store bought food.

The “Return to Country Food” forum/workshop represents a key commitment of the Dehcho AAROM to address community issues and concerns and to communicate recent research results on water quality, fish, fisheries, and contaminants in the lakes and rivers of the Dehcho region. The holders of a wealth of traditional and Dehcho leadership knowledge were brought together with western scientists and government administrators to promote further discussion and understanding of community concerns.

George Low, Coordinator of the Dehcho First Nation, Aboriginal Aquatic Resources and Oceans Management Program (AAROM), and the organizer of the workshop emphasized its importance: *“Government and university researchers have an opportunity to learn more about the issues and concerns of the Dene and Métis of the Dehcho. The workshop gives everybody the opportunity to discuss issues and network with each other. The researchers in turn bring a lot of knowledge and information to us all so that we have a better understanding of the ecosystem in which we live.”*

The two-day session held on August 26 and 27, 2014 in Jean Marie River aimed at:

- Presenting the state of knowledge and current research results;
- Listening to Traditional knowledge and making it a serious part of research in the area.
- Reviewing how to proceed with contaminant research and monitoring;
- Identifying lakes and rivers that are safe sources of fish;
- Identifying species of fish that are generally low in contaminants;
- Learning about the reasons for the fluctuations of mercury levels in fish;
- Identifying and discussing the concerns of the Dehcho Dene and Métis regarding water, fish and the aquatic habitat;
- Finding ways to encourage Dehcho members to include healthy country food in their diets.

Chief Stanley Sanguetz from Jean Marie River First Nation (JMRFN) opened the gathering with a heartfelt welcome, a prayer for guidance and a special recognition and prayer for Margaret Ireland, their resource manager/coordinator and for her husband who is in hospital.

JMRFN, with the support of Margaret, has been involved with climate change research for the past three to four years. Many changes have been observed and documented in the area *“..We have seen a lot of different things that are happening to our lands. You notice that there is no water in the ditches anymore because the permafrost used to hold that water but there is no more permafrost left. All the water is just sinking into the ground.”* The country food workshop is different in that *“we are trying to get the traditional knowledge of our people and science to work together hand in hand. ... As aboriginal people, we know the land really good but there are some things that we need scientists to tell us, what is wrong with the system.”*

Chief Sanguéz noted that even scientists are struggling to find answers and solutions. He emphasized the importance of the workshop in raising awareness with government agencies with regards to what is happening to First Nations traditional foods. He also raised the concerns of the community regarding the burning forest: *“This is the second year we had fire. Our elders are crying in this community, saying why is the government letting this land burn so much? It has affected the moose, the caribou, the beavers, and the rabbits. I think it is over a million hectares that has burned this summer so far, and it is still burning.”* Community dollars ran out after two months and going into debt is not an option. *“... maybe that is why they are just monitoring the fires and why some of these fires are happening.”* Country food will be affected because fires are changing the land.

Chief Sanguéz then recognized the work of Bruce Townsend on behalf of youth and community members who learn about *“...what the food chain is like in the water, why the fish do what they do, how they breathe, and how they eat.”*

He then highlighted the initial impact of the advisories - *“even me, when they talked about the mercury in the fish, I got scared. I couldn’t eat fish because of it”!* However he has gained a better understanding through the information received in the last two country food workshops, as well as the time shared with scientists. He realizes that the risk of eating fish is low so long as you follow the guidelines. He also expressed his interest in pursuing ways to manage certain lakes: Ekali, Sanguéz, Gargan, McGill, and Deep, in particular the possibility of reducing mercury in fish by fishing out the big fish.

Finally, he emphasized the importance of getting the scientific research under way as the future holds a lot of changes *“...the climatologists always tell us that it is going to get warmer and it is going to get colder.”*

We were honored with the presence of Dehcho Grand Chief, Herb Norwegian who always has interesting stories on the subject of fish and water (see presentation below).

The remainder of the first day was dedicated to presentations by the resource people who provided research results, so that communities can make informed decisions about their consumption of country food.

The Facilitator started off the second day with a review and discussion on the highlights of the first day. Bruce Townsend, the facilitator, recognized the work accomplished in the last three years; the Dehcho *“was really challenged but has made significant strides on all levels.”* People have worked together, collectively and really moved things forward.

“Chief Stanley Sanguéz and Grand Chief Herb Norwegian really spoke from the heart yesterday. When Stan opened the workshop, he explained that the Dene know the land, but that they still need science to help figure out what is wrong with the system so that they can send a strong message to government.”

Grand Chief Herb Norwegian stated that traditional food is sacred and it is what allowed the Dene to survive. “The Land took care of us and fish were very important too”. He expressed concerns that major changes are coming and that we must be prepared for a rough ride. He feels that we must advocate for the River, and protect the food and water too. He is working towards establishing inter-jurisdictional agreements on water quality and quantity but feels that we

should start protecting sub-watersheds too as we do not have much control over what goes on upstream of us.

George Low welcomed everyone and he stated that he liked a forum where government, universities and the communities can come together to discuss issues/concerns and network. This was a statement that came through from a lot of presenters. He reviewed the on-going projects and stressed that it is important that we take a positive approach, and promote safe places and safe species. He is excited about the human biomonitoring program and also stated that he would like to pursue more traditional ecological knowledge (TEK) studies, once the mercury issue is resolved. In response to Grand Chief Norwegian; he hopes that Mackenzie River fish will always be available.

Dr. Heidi Swanson feels that this type of workshop allows her to talk to both community members and other scientists too. Her studies focus on how mercury moves through the aquatic food chain, and she takes a high altitude big picture approach to help her consider all the things that affect mercury movement. She provided a brief summary of the lakes studied so far and feels that once all the data is in, she will be able to determine which factors (e.g., trophic level, fish growth) are driving the differences in mercury levels that we see among lakes. She is happy that the nutritional aspects were being brought into the mix.

Some of the questions generated covered granddaddy pikes, the effects of melting permafrost, beaver dam removal, and a fish down study.

Carole Mills gave some background on the Northern Contaminants Program and she stressed that it was Aboriginal Cooperation that helped affect change in persistent organic pollutants (POP) production and distribution. It promoted change at the international level. She emphasized that the work discussed here can promote and help promote change, healthy choices and bring people back to country food. She stressed that mercury levels are another story but explained that there is funding available. She felt the Dehcho Region had a proven track record and would be a good pilot region to advance human health studies. Human health priorities are: is our food good to eat; is our water safe to drink; and to make sure it stays that way.

Dr. Marlene Evans reviewed the Lockhart, Low and Evans mercury studies and then summarized recent results. She explained that trophic level, age, and lake/watershed size ratios could affect mercury levels. She showed stock assessment data and stated that mercury levels in the Mackenzie River fish were low, and that the Great Slave Lake, lake trout and burbot were OK too. She warned that the problem isn't going away: emissions are up; climate change means warming and permafrost melt; and this may cause mercury level increases.

Mike Low stated that through the AAROM program, the Dehcho is the only region in the NWT that does its own water quality monitoring, through an agreement with ENR, whereas ENR technicians do all other regions. Another good news story! The Dehcho has really taken charge of their own resources and their own monitoring programs. Mike then explained all the equipment that is used; the plastic strips (PMDs) to measure hydrocarbons, the devices that measure trace metals and the sondes that measure various water quality parameters. This produces a lot of the background information in a proactive manner, and other groups can build on them. We have some background if there is a spill, like the one that happened near Wrigley.

Dr. Brian Laird and Mike Low reviewed the return to country food survey. Mike now has this data and other groups can build on it. Brian joined the presentation; he was helping Mike crunch some of the data from questions asked in survey, such as: “are advisories affecting fish consumption?” and “is more information on mercury needed?” For some participants, the answer was yes to both those questions. In a separate presentation, Dr. Laird presented information on the nutritional benefits of eating fish.

Dr. André Corriveau explained that his focus is more health related and emphasized that fish are an important part of dietary health. He went on to explain the difference between hazard and risk, risk characterization and management approaches. He reviewed the health effects of mercury; the nervous system, the kidneys and cardiovascular system are normally the body parts targeted. Early development states are most sensitive. So moms and youngsters are really important considerations.

He reviewed how blood and hair are used to assess exposure in biomonitoring studies. Dr. Corriveau thinks the time has come to test people again and when the proposals come in, he will fully support them. This kind of partnership is really important when you are dealing with bureaucracies.

Dr. Laird is a toxicologist with a focus on public health issues. He is interested in promoting country food in a way that balances nutrient benefits and contaminant risks. He stressed the importance of eating fish because they can provide essential nutrients and explained that the loss of fish from the diet can do more harm than good. The graphs showing the relationships between the omega groupings and contaminant levels were an eye opener for many. He presented a draft idea of what a Dehcho biomonitoring study could look like and asked for input on community priorities.

Dr. Rhona Hanning explained her work on the west coast of James Bay and how this approach could be used in the Dehcho. She stated that dietary studies are not an exact science and she reviewed the barriers to eating traditional food. Her work focuses on how to get detailed information on traditional food intake and she is looking for a “Made for Dehcho” approach. She thinks that her work fits in between contaminant levels in food sources and body burdens studies in humans. She indicated that this is a drill down from Mike’s survey, and she talked about program delivery approaches such as the focus groups, sharing circles, and health promotion programming.

The real positive side to all this is that Chief Sanguéz will be taking this initiative to Leadership and he feels it is time for them to contribute. Jean Marie River and Kakisa will take part in a pilot study, funded with support from the Northern Contaminants Program, in order to develop research tools that could assist in future biomonitoring projects.

After this summary, there were more presentations on biomonitoring studies. Participants explored in further depth what a study would look like. A consensus was reached: a pilot study would be done to develop a dietary questionnaire that could become part of future biomonitoring projects. The pilot work will take place in Jean Marie River and Kakisa in November 2014. Following consultations with the other Bands, a grant proposal for a larger, multi-year

biomonitoring study will be submitted to a federal funding agency, the Northern Contaminants Program, in January 2015.

Ms. Meagan Ann O'Hare presented her Master research project, a qualitative analysis into the lived experiences of issues challenging food security and food sovereignty in Fort Providence, especially at Deh Gah elementary and secondary school. She is in the early stages of her work therefore no results could be offered.

The two-day gathering was concluded by a group talk with everyone sharing about the most important thing that they believed the workshop achieved and the message they planned to bring home.

Youth benefited from the presence of researchers who organized activities after the workshop. The event was celebrated with a fish fry at the community hall, as dense fog did not permit outings at Ekali Lake.

The next pages of this report offer a summary transcription of the presentations of the resource people and of the comments/questions of the participants. The presentations of the resource people are available on AAROM website at <http://www.dehcho.org/aarom.htm>.

2.0 Presentation Summaries

2.1 Grand Chief Herb Norwegian, Dehcho First Nation



Figure 1. Grand Chief Herb Norwegian addressing the attentive crowd is surrounded by Dr. Heidi Swanson and Chief Stanley Sanguetz

Grand Chief Herb Norwegian shared stories about his negotiations with the Government of Canada, the place of the country food and the importance of the work that is being done for the Dehcho: “... when you are negotiating with Canada they tell you that they have this policy that you are only allowed to have so much land to live on and for thousands of years our people

roamed over this whole territory. You know, there are probably moccasin tracks on every part of the muskeg and every part of the shoreline in this territory. So it is ludicrous for them to think that we are entitled to only a small piece, which goes back to the kind of work that you people are doing...the work that you are involved in, looking at country food.

The food that we depend on is something that is very sacred for our people; it was the food of the land that has kept us here. If it wasn't for the land that took care of us, we would have perished a long long time ago. There are so many different sacred places here where we harvest food."

The main source of food in the Dehcho was fish in the old days: "From the stories that I have heard, there were just so many people in the valley, here, that every once and a while the food would be gone. The moose, the caribou, porcupine, beaver, there were just so many people to feed. So the places that we cherished are the fish lakes; the five finger lakes: Sanguet, Gargan, McGill and Kelly Lake, among others. So over the years these places, especially some of the protected areas that we have set aside, those are the areas that are really, really close to our hearts."

Grand chief Norwegian then told about the changes in fish quality and water quality that are observed in the Mackenzie valley. "...And we have done quite a bit of work in trying to find out what is happening with our fish but in the Mackenzie River. We are starting to see some major changes in our fish, and the contamination continues to escalate...you know from McMurray, from the pulp mills up the Athabasca, and way up stream. We are starting to see our fish starting to change. It is coming to a point now where I am telling people you should not drink the water from the Mackenzie River.

We had some experiences there a few years ago, even up until last year where we had people working on cabins and stuff on the Mackenzie River that grabbed some water from in the middle of the river, and brought it to their camps and used it for drinking and for tea and they got really sick. And for the next couple days they tried to figure out what it was...they thought it was the food but they have screened out everything else and the only thing that they were able to pinpoint was the water. As a result of that they didn't use the water from the Mackenzie River. Instead they went to little creeks, some of them have brought water from town. So we are starting to see some major changes in the Mackenzie River." He is really concerned that if this continues to escalate, "we have to tell our people not to eat fish from the Mackenzie River".

He confirmed that in Fort Providence changes were observed and he told the story of how it used to be: "Whitefish comes in the fall time just before it freezes, and there is just an abundance of whitefish that migrate to Great Slave Lake. Fort Providence is there and the people harvest the fish. They get about 10 whitefish to one stick. They get this willow stick and they put their fish on it and they hang that, and keep it for the winter. Those fish used to be incredible...well everybody from the valley here used to go to Providence, and get those beautiful stick fish. I mean the quality was just incredible. They were in really good shape.

In the last couple of years, I have been talking to elders there where we have been picking up some stick fish and they said that the fish has changed. You can actually take the whitefish and you can put your thumb through the stomach of the fish while it is still alive. So you are starting to see some pretty major changes there."

Grand Chief kept on sharing stories about the value of the fish lakes along the Mackenzie river: *“Of course, it goes back to this whole thing of our fish lakes, especially the Edézhie (Horn Plateau Protected Area Strategy) and the fish lakes in behind here, like the Five Finger lakes, Trout lake, for instance, there are some beautiful fish lakes up in the Wrigley area, Spruce Lake, Keller Lake, they have some really beautiful fish there. Those areas were cherished because the resources would deplete down the valley... people would make a pilgrimage to get to these locations in the middle of winter ...literally packing each other, pulling each other by sleigh to get to these locations in the middle of the winter.*

And when they get to these places in late January, with what energy they had left, they would put a hole in the ice, put a line in and wait. It wouldn't be long before they would catch a fish ...maybe a nice big, 10, 12 pound trout, for maybe 10, 20 people. Everything is eaten, the whole fish is eaten, and the bones are mixed for soups. Then they continue to fish and the poor little dogs that are with them get hand-sized pieces of fish. So everybody benefits from that.

And that is what has brought us here today because we, as people, came about as a result of that hard labor, hard times that our forefathers have gone through. If it wasn't for the land and even for the fish lakes, I think that a lot of our people would have perished a long, long time ago.”

He concluded that food protection is essential considering the changes that are happening: *“ So the important thing we need to look at...is what we can do to stabilize ourselves in the next 10 or 20 years? From what I am hearing, these kinds of changes you will see them happening in massive scales for the next 20 years. And after that, then, things might slow down or something else might kick in.”* We are told: *“Prepare yourself because we are going to be in for a real rough ride.... And I think what we need to be looking at is the protection of our food.*

You know we have done everything we could to protect the Mackenzie River. We have gone all out, we have thumped tables, and we have hit just about every corporation in this land and around the world, telling them that they are slowly killing us along with the land, the animals and everything else. This increasing demand, this increasing appetite for energy is killing us. Somehow or other, we have to deal with that and we are no different, you know. We do the same thing. So, what should we be doing to protect ourselves for the next 20 years?

I think the important thing, the work that I have been doing for the last few years, has been in the protection of water.”

Grand Chief Norwegian shared about what has been done to protect the water in the last decades and emphasized the importance, when talking about water, of looking at what is going to be left for the children in the next 20 years. He also share the advices of the elders: *“About 10 years ago, we did this big Dehcho conference in Fort Simpson (Keepers of the Water gathering) where we brought people together and said, well, elders are telling us, deal with this water situation because it is happening right in front of our very eyes. So we had that good discussion and then a number of other good conferences sprouted out across the country. There the whole idea is to make people aware of your world. ... the very world that you live in.*

So for us, the lakes, the water are really important. I, myself, am involved in the provincial inter-jurisdictional water discussion that is taking place between Saskatchewan, Alberta, British Columbia, Yukon and Nunavut. The Dehcho is involved in making sure that the water is

protected. And what will happen is that there will be an agreement that would be signed and everyone would have a job to do. They have to make sure that the quality is there, that the volume will continue to stay there, making sure that all aspects of water are well protected. But in the meantime, as development is escalating upstream, there is no way that we can control that.

So I think in the meantime, our emphasis should be that if we can't protect the main Mackenzie River, that maybe what we should be doing is start looking at the sub-watersheds." He explained what he meant by sub-watersheds: "We are looking at, for instance the Jean Marie River watershed...it has this little creek here that comes out and drains from about five different lakes. These areas need to be protected immediately.

The Edézhie, where you look across the Mackenzie River, there is the mountain across there, maybe about 40 kilometers from here, roughly 3,000 feet high and there are about 13, 14, 15, fish lakes up on top of this mountain. And those are the areas that we definitely need to protect. If all hell breaks loose then we need to have a place to take refuge.

What our elders are telling us, especially the elders from Fort Providence are telling us, that we need to move to higher ground. We need to move to places, like Edézhie, where the water is protected. Especially places like Trout Lake, Trout Lake has its own body of water. It has its own watershed. Kakisa...really, really key areas.

We still have a lot of water that we can still protect, but if we just leave it open then, that of course, will just dwindle away and then we would end up with some very small places that would hardly have any protection.

So, as far as country food is concerned, food, water, land...everything is connected. And people, ourselves...this is what our job is. No one else can speak for the fish, for the little animals that are out there, the ducks, the chickens. It is people like ourselves that have to come to the microphones that have to come to the media, that have to come to the world, and tell the world the situation that we are being faced with.

So those are the kinds of things, I think, you need to keep in your mind when you talk about country food because country food is just one aspect of it".

Grand Chief concluded by acknowledging the important work that is being done by the people around the table and showed special appreciation for Chief Stanley Sanguéz who *"is the everlasting rock of Gibraltar, for the people in the Dehcho, and chief for 16 years and the first longest serving chief today is younger than him...Lloyd Chicot, 26 years or something like that."*

2.2 George Low, Dehcho First Nation, AAROM Coordinator

As Grand Chief Norwegian, George is also very concerned about climate change and thinks what is happening today is only going to get worse, as scientists predict. *"If AAROM ever puts all these mercury studies to bed, we should start concentrating with work on climate change. A first step would be to do traditional knowledge studies, to go around the communities to find out what people are seeing now, what they have seen."*

He thanked Chief Sanguéz and his team for hosting the meeting, and particularly to the band manager Pam Norwegian, and Gail Sanguéz for all the work they have done. Carole Mills from NCP is thanked for co-funding this workshop with the Dehcho AAROM program. We did not want to see this annual event die.

Judging by the past two workshops, everybody gains something from the discussions. The forum gives government and university a chance to rub shoulders with the community people, learn about what their issues and concerns are, the issues and concerns of the Dene and Metis of the Dehcho. The workshop gives everybody a chance to discuss issues and network with each other.

George then explained the Aboriginal Aquatic Resource and Ocean Management (AAROM) program. It is a community-based program designed to build capacity in communities where claims are not yet settled, in order for them to have a greater part in fisheries and aquatic management. The second phase of this program is collaborative management; working with DFO on management issues.

Dehcho AAROM core funding and most project funding come from DFO through the AAROM program and the Aboriginal Fishery Strategy. Various other groups like AANDC NCP, GNWT-ENR CIMP, ENR, Lands and Water division and GNWT, Dept. of Transportation are also great contributors to our program.

The marching orders come from the communities. Communities should drive any change in direction. AAROM is always looking for guidance from the communities.



Figure 2. The workshop is a forum to exchange ideas and discuss progress. Here Angus Sanguéz, George Low and Chief Stanley Sanguéz finalize their planning

AAROM is contributing to collaborative stock assessment projects with DFO scientists (and other researchers) on Great Slave Lake, Tathlina Lake, the Kakisa River and the Mackenzie

River and sports (angler's survey) work in Kakisa and Fort Providence. Through contracts with Katlodeeche First Nation, West Point FN, Ka'a'gee Tu FN and Deh Gah Gotie Dene Band, Dene and Metis field workers are hired to do the work. This program also brings the Dehcho leaders to the Fisheries Management table where they can influence fishery management fishing plans and regulations.

In 2014, other projects AAROM is doing with its community partners are summarized below. Further information on a few of these projects can be found in later sections:

- Arctic Grayling spawning habitat rehabilitation in a small creek near the Dehcho Bridge (Deh Gah Gotie). GNWT, Department of Transportation is providing the funding under a "no net loss" initiative. Beaver in the area destroyed spawning habitat. Most of the beaver population has moved on so reclamation has begun. Clean stone were spread in riffle areas which were silted over during the time they became beaver ponds. The Deh Gah Gotie Band has been providing field crews to count the fish in the spring run and spread Stone. Priscilla Canadian organized the project for the Band... *"Some very hard working people improved that stream"*. This spring, Bruce supervised a weir count project with a student from Aurora College and field workers from Deh Gah Gotie. The project is looking very good.
- Katlodeeche First Nation, the NWT Metis Nation and West Point First Nation are supplying boats and field workers for fisheries ecology studies on Great Slave Lake.
- Thermocline monitoring in Trout Lake (Sambaa Ke) – There were concerns about warm water and climate change so AAROM started a *Thermocline* monitoring study in Trout Lake in cooperation with Sambaa K'e Dene Band. Major changes in the thermocline have been observed. George explained that the thermocline is a layering of the water during the summer. *"You start off with the same cold temperature in the spring from surface to bottom and then the surface water begins to warm and you have a temperature barrier which prevents the mixing of the water. This results in a cold refugee on the bottom, which is especially important for trout populations. However, we are starting to see a change in that lake."* He also shared that Great Bear Lake is developing a thermocline now...it never had one before. It used to stay cold year-round from top to bottom. So there are changes that are happening in our northern waters. See Mike Low's presentation for details.
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Figure 3. Major Changes in thermocline are observed in Trout Lake.

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- **Community patrols.** “A lot of communities (Deh Gah Gotie, JMR, Liidlii Kue, Sambiaa Ke, Pehdzeh Ki, and Nahanni Butte) just want to know what is going on out there. So we have boats in all the communities, we contract the Bands to hire seasonal workers to patrol the area.”
- Dehcho AAROM, with the help of our community partners are now monitoring *water quality and contaminants* under an agreement with GNWT, ENR, Lands and Water Division. In the Dehcho, AAROM is collecting all of the water quality and contaminant data for ENR to analyse. This agreement really strengthens our ability to monitor the aquatic environment.
- Mike Low led this project with help of Kyle Nault, a student from Aurora College.
- Stations locations were:
 - Mackenzie River; at Fort Providence, Fort Simpson and Wrigley
 - Liard River – above Liard River ferry crossing
 - Trout Lake and Island River – Several stations monitored by the Sambiaa Ke Dene Band
 - Jean Marie River – AAROM is cooperating with the band, collecting information for them on the Jean Marie River.
- A DFO researcher is doing both Bull trout and Arctic grayling work on Prairie Creek. This is important work as there is a mine upstream. The researcher, Neil Mochnacz is also doing some basic research with the help of Nahanni Butte Dene Band.
- Research on mercury levels continues. Dr. Marlene Evans of Environment Canada presented the latest results for Ka’a’gee Tu, Sambiaa K’e, Pehdzeh Ke, Liidlii Kue, Deh Gah Gotie, JMR. Marlene has analysed a large number of fish from the water bodies in the Dehcho during her temporal study. Lyle Lockhart did that work back in the 90s. Marlene is looking at that information again. It seems to be increasing in some cases.

- AAROM, with funding from Health Canada, conducted community surveys on country food, including fish and water, in the six most affected communities (see Mike Low and Dr. Brian Laird sections).
- Research on biomagnification and bioaccumulation of mercury in the aquatic environment. (JMR, Samba K'e, Ka'a'gee Tu, Liidlii Kue, Deh Gah Gotie; see Dr. Heidi Swanson section).
- Bruce Townsend continues to develop and deliver youth education on aquatic ecology at AAROM annual Youth Ecology Camp, and other forums. George acknowledged the good work Bruce is doing and that of Dahti Tsetso, who organizes the events.

Finally, George explained that the latest Dehcho AAROM project, human biomonitoring stems from discussions at last year's Kakisa workshop. This type of study was successfully completed in the Sahtu. Over the past year, AAROM has had discussion with NCP and with Brian Laird a research scientist at the University of Waterloo to put together a study in the Dehcho Region:

- Dr. Brian Laird and Dr. Rhona Hanning will be explaining how the study works.
- David Menacho from the Sahtu Renewable Resources Board speaks to their experience of the study in their region.
- Dr. Andre Corriveau, the Chief Public Health Officer for the NWT supported the study
- Carole Mills, Manager of the Northern Contaminants Program has assured NCP financial support of the study

George then introduced the biomonitoring program, which will be discussed in detail by the researchers. He hoped that communities get involved, as it may close the loop of the mercury cycle studies; it would help the understanding of dietary consumption and human mercury exposure. AAROM is in support of the program.

In closing, George emphasized that AAROM is trying to take a positive approach to fish and contaminants. Species of fish, like whitefish, are always low and always safe to eat in the Dehcho. Suckers, as well as coney (inconnu), are also low risk. In some of the other lakes, the trout are fine, and the walleye are fine, and the northern pike are fine. *"We have to be selective to what species we are eating and what lakes we fish."* AAROM is building up an inventory of safe places and safe species for fishing in each of the communities, and that, so far, includes Great Slave Lake, Mackenzie River, Willow Lake, up in Horn Plateau along with Big Island and Mustard lakes.

He reminded us that at the workshop last year, Elsie De Roose, a GNWT nutritionist, spoke to nutrition and the importance of eating fish: *"...the risks of not eating fish are probably higher than eating fish. The amount of fish that people eat these days is not usually harmful."*

An article from News North by Dehcho reporter, Roxanne Thompson, was presented to the participants. It sums up what AAROM is trying to accomplish with these workshops. The article can be found on AAROM website.

2.3 Dr. Heidi Swanson, Research scientist, University of Waterloo.

After a sincere Maḥsi Cho for having the opportunity of being on JMR traditional lands and working with the people from the Dehcho for the last couple of years, Dr. Swanson presented herself and her work. Having been raised on a farm on the South Saskatchewan prairie, she understands the importance of taking care of the land and quality food. She spent the last 15 years working on fisheries issues in the Yukon and Nunavut, as well as in Alaska and the Northwest Territories. She is now doing a lot of joint traditional knowledge and western science work in the Northern Territories. Her area of expertise, as a scientist, is to study how mercury moves through lake food chains, but particularly, how that happens and why it is different in some lakes than in others. She concluded about herself: “...*the reason why I want to understand this is that I am also a wife and an auntie, and I want everyone to have access to safe foods.*”

She then commented on how her work in the NWT began. “*George called and mentioned that some communities up here were interested in mercury. After a meeting with Chief Stanley Sanguéz and Chief Dolphus Jumbo to talk about community priorities and what everyone here wanted to learn about mercury, a project was designed.*” The question that needed answers are:

- Why some lakes have high mercury and others have low mercury?,
- Why some of them are increasing and why some of them are stable?
- What could happen with climate change? How will climate change affect mercury?
- And if mercury levels are high, is there something we can do about it?

In 2013, data were collected on Kelly (or Ekali) Lake, Sanguéz and Trout Lake. This year, Tathlina, Gargan and McGill Lakes were sampled. During year 3, Willow, Mustard, Big Island and maybe Kakisa, will be sampled.

Climate is really changing. Dr. Swanson acknowledged the comments from Grand Chief Herb Norwegian pointing in that sense and the observations of people who were at Tathlina Lake a week prior to the present workshop. “*Oh, there is more water at the camp. We can get into the camp; we can pull the floatplane closer. But that doesn't make any sense because it has been such a dry summer with no rain so where is that extra water coming from?*” community members commented. Around the campfire, it was discussed that the origin of this water may be from the melting permafrost.

Heidi is convinced that it is really important to understand how all of these changes are going to affect the security of food and the safety of food. “*We want to feel safe eating the fish, and we want the same for our grandchildren.*”

She then introduced the concept of biomagnification: “*All that means is that mercury is low at the bottom of the food chain, in the bugs, and each time something eats something else, the mercury gets higher..... so those big predatory fish have more mercury than the smaller fish at the bottom of the food chain.*” She then clarified bioaccumulation: “*... all that means is that big fish have more mercury than small fish, and old fish have more mercury than young fish. ...so if*

we can figure out how big the fish are, which of course we can, and how old the fish are, which we also can, we can figure out what is called bioaccumulation.”

She then discussed the factors contributing to mercury accumulation she studies that are essential to understand the big picture: *“...So, how clear is the lake that fish came from? How old is the fish? How fast was it growing? How many nutrients are in that lake? Is my lake tea colored or is it clear water? Where does the fish eat, and what does it eat? And what other fish are in that lake? All of those things are going to affect the mercury. So I am looking at all of those things in the lakes around here...”*

She noted that it is important to study mercury in fish but it is key to link it to human health. She, too, emphasized that fish is very beneficial: *“So yes, some of the fish have some mercury, but they also have lots of good things in them, like fatty acids and nutrients. Most of the time, eating fish is going to be healthier for you than frozen pizza.”*

Dr. Swanson evidenced a weak point of scientists, their tendency to work in isolation, and recognized the importance of this workshop: *“... we are talking to communities but we are also doing a better job of talking to other scientists to put the big picture together.”*

She then gave the details of her studies. Her group compares two sets of lakes, one set with high and increasing mercury, and the other set with low and stable mercury. They want to figure out what is different about them and what is making them behave differently. The lakes were selected with community input.

She explained the data collected: *“All the lakes are harvested for fish, bugs, algae, water and sediment. We take small nets and we kick the bottom of the lake. When you kick the bottom of the lake, you get all these bugs that come up. The Whitefish and the little tiny Stickleback love eating those bugs. Then we take a really fine net and drag it through the water, and we collect these tiny, tiny little bugs called zooplankton. The Cisco like eating those. We measure the samples, we weigh them and then we have a whole army of poor students, who do a million hours of lab work. So each of those bugs has to be dragged, then we grind it up and run it through our instruments to test it for mercury, and test to figure out the whole food chain. So we figure out who is eating who, and where they are eating it”. Water and fish samples are collected with the help of community monitors.*

She then presented the latest preliminary results for Stickleback, Cisco, Whitefish, Jackfish, and Pickerel (see presentation on the website): *“...It is pretty much good news ...all of the Whitefish are safe, all of the Cisco are safe, and all of the Walleye that we caught last year in Kelly Lake are safe. The only ones that were a little higher in mercury were Pike, and only the bigger pike.”*

With a graph showing fish size, mercury concentrations and the health guideline, Heidi explained how fish size on advisories are figured out and concluded her example: *“From Kelly Lake, it is only those really big Grand Daddy jacks that are a little higher in mercury. Everything else is fine. So when you see those numbers on the consumption advisory signs that is just what they mean.”*

She then provided and explained the results for a few lakes: *“Walleye and Pike bigger than about 400 mm, have higher mercury. Sanguéz Lake isn’t fished very much anymore and when you put a net in the water, that net is full of pickerel in half an hour. There are just so many fish, and they are all the same size. We are not catching little ones. This tells me there are too many big fish, not enough little fish, and we need to get the density down.”*

For Trout Lake, some Burbot, Trout and Walleye were above guideline, but again, usually only the bigger fish. For Trout and Walleye, it was the old fish that are the problem. So while they are the same size as the other fish, they may be older.” She gave an example of 37 years old fish that is the same size as younger fish.

One difference found is that Sanguéz Lake has higher mercury, less nutrients, and less algae than the other two lakes studied in 2013. *“When you don’t have many nutrients or algae, it means that overall there isn’t much fish food in the lake. We know there are lots of Walleye in Sanguéz (partly because it’s not fished, we think), and these Walleye are all competing with each other for the little food that is available. That makes them grow more slowly, which makes mercury higher.”*

Heidi finished her presentation by noting that she was pleasantly surprised by the results – there are some fish with higher mercury (the biggest, oldest ones), but all of the whitefish are safe to eat, and in general, the fish around here are pretty good to eat. (See presentation for more data.)

Comment/Questions from participants:

Chief Stanley Sanguéz asked if fishing out the large predator fish, particularly pickerel would make a difference in Kelly Lake. He was also concerned about the disposal of large amounts of fish. He shared about their traditions and the potential use of large quantities of fish: *...“I know some of us use it for making our own baits. You know, trapping baits, we use them as fish oil. ...you just rot the fish in a container, you just keep adding it and dump the water. In the fall time, all the water freezes and it just pushes the fish oil out.”*

Chief Sanguéz commented on the reported results and the impact the results had on community members in the past: *“I thought the Pickerel were still good, but...I am happy with that report now because in the last two reports it scared a lot of us in the community here. But now with that study that you did, it is not so high anymore.”* He asked if there is a time in the year when mercury peaks or when it doesn’t. *“...I know it has to do with the temperature we are having.”* Finally, he commented on the confusion he has about the release of mercury and permafrost: *“I tried to ask Bill Quinton about the amount of mercury being released from permafrost. Basically the scientists are telling us that we are not sure yet that it is not coming from the permafrost thawing.”*

Dr. Swanson answered his questions: *“Definitely you could look at fishing some of those big fish out but in Kelly Lake but it doesn’t really seem to be as much of a problem in Kelly as in*

Sanguéz which is not fished anymore and basically receives no fishing pressure. ...taking out some of the big Pickerel from the Sanguéz would be worth taking a look at, for sure.

For the permafrost question, an experiment in Alaska taking a look at the thawing permafrost on the lakes will help us understand what is going on here. The reason that we (scientists) say we don't know is that we think some mercury might be released from the permafrost, but when the permafrost melts, it also releases nutrients to the lake. When you release nutrients to the lake, the fish grow faster and the mercury can actually go down. So you have a couple things happening. If you have permafrost melting you might actually see the mercury go up, or you might see it go down. It really depends on each particular lake and region. So that is why people say they don't know. It is because there is no simple answer. But we will know more once some of these studies come out of northern Alaska, and also similar work is going on in the Hudson's Bay lowlands, near Attawapiskat and Peawanuck."

Chief Sanguéz asked if, in Sanguéz Lake, the mercury is high because they are high predators. Dr. Swanson clarified that she looked at how high the trophic levels were in every lake, and compared all the fish of the same size from different lakes. She looked at ages in all the different lakes. She found in Sanguéz Lake, the pike are growing very slowly, and that is leading to higher mercury. They are also feeding slightly higher in the food chain than in Trout Lake. What was interesting in Trout Lake, is that mercury is low in Pike. In Trout Lake, a half a meter pike will be about six years old, while in Sanguéz lake that Pike will be 12 years old, so that is definitely part of the reason why it has higher mercury. It has more to do with the growth than the length of the food chain.

Carole Mills asked if there is a difference in the food chains and gave an example from the Yukon where the abbreviated food chain in Lake LA Barge lead to increased levels of mercury compared to other lakes. Carole inquired if the results were for muscle or other organs. Dr. Swanson confirmed that the results were for skinless fillet. For the food chain question, she thought there might be something going on with the food chain in Sanguéz Lake, but it looks really similar to Kelly. Trout Lake is different because there is so many more species. Between Kelly and Sanguéz, the food chain is really similar but the mercury is quite different. The results are still very preliminary, the first results got back a week before the workshop. It seemed to her that a mixture of differences in growth and differences in water chemistry would explain the results. At this point in time, Dr. Swanson thinks that water chemistry is driving a lot of the differences here. Further results may prove that wrong.

Chief Sanguéz explained that a lot of beavers dammed the creeks over the years and that fish used to move to the three lakes. Now there is a big rock dam between Kelly and Sanguéz and fish don't seem to move around anymore. He asked if this makes any difference and if this is why the fish is so abundant in Sanguéz. Dr. Swanson confirmed, "Beaver can definitely affect mercury, and that is because they back up the water and they change the water chemistry. So some of the differences between Kelly and Sanguéz could be because that water is not flowing the way that it could if there weren't beavers. Some people have looked at beaver dam removal...because the more that water is flowing the less mercury goes up the food chain in general. However, it doesn't always happen like this." She then explained that the form of mercury is important for bioaccumulation to occur. "... *The silver mercury in a thermometer*

isn't harmful. Mercury gets harmful when it gets into the mud and then little bugs turn it into a different kind of mercury and those little bugs do a much better job when the water is still and when it is warm and when it is tea colored. And all of those things happen when there are beavers."

Dr. André Corriveau commented on trees and fire with respect to mercury: *"trees are very good at storing mercury that is in the environment. So when you flood an area, whether it is through a man-made dam or a beaver dam, the wood gets covered with water and it rots, and then the mercury that is trapped in the wood is released. We expect that after (the last summers) forest fires, there will be a plus of mercury in the water over the next year, or two, because that mercury that was in the trees, now is going to be released. And so in the next few years, we will probably see an increase in mercury levels. If the waters are warm next year, it is going to be transformed and it will get into the food chain. So that is another aspect of forest fires. We are becoming more aware now of how everything is connected."*

George Low inquired about the way a fish down should be done. Dr. Swanson suggested that, *"ideally, that would be a project because what we would want to do is look at the mercury and the numbers of fish, so we would want to know numbers of fish per square area of a lake, get the density of fish before you fish it down. Fish it down, and then look at it afterwards. Then you would be able to tell if it works. ENR, Lands and Water Division, has shown some interest in doing that. Obviously the community would choose the lakes and do the fishing but if we had a before and after, we would have a really good idea of whether it is a good way to go forward to get some of the mercury levels down."* George noted that this method is not suitable on a trout population because they can easily be fished out. But something that bounces back, like Pickerel or Pike. *"You definitely don't want to fish down your trout or you might lose them altogether"*, confirmed Dr. Swanson.

Chief Sanguetz further commented *"because the water level is so low in the north, in the Dehcho, beaver are building dams all over the place"* and inquired about the possibility to get financial support to remove the dams. He wondered if it would be harmful to do so and continued: *... "Even our elders had done that before, they busted them before because of the water they hold back. They told us that sometimes beaver dams are creating problems in our area. In Fort Providence Area, way back in the culvert area, they always harvest a lot of the beaver because of the flooding."*

Dr. Swanson explained alternative ways of managing beaver: *"In Ottawa, they had beaver that just kept coming back and flooding an area. What they did is play a recording of running water in a place where they don't care where the beavers go. Beaver are obsessed with the sound of running water. So you distract them and you let them build a dam where you don't mind them building a dam. This way you move them out of the area where you don't want them. They have successfully used that around the Ottawa area where they keep flooding the roads. So you could try blowing some things up, but also try using some running water."*

George mentioned the work AAROM is doing on rehabilitating a stream with a beaver problem. *"We let it go from 1970 to now and the beaver finally ate themselves and flooded themselves out of house and home. There are no more poplar trees to eat so they are moving out. There is one active dam that we left alone, high up in the watershed, because it sort of holds up water levels"*

after the snow melts. The areas that we are fixing up now were deserted. We took two small old dams out physically. Then we installed a fish weir in there and so far we have put down 40 cubic yards of stone and we have another 40 yards to spread this fall. It is a little different than acting on an active beaver dam because they just go back in and build.”

Regarding funding, neither Heidi nor George knew of funding sources. ENR is known to cooperate and work along the highway. George offered to look into it.

The facilitator, Bruce Townsend, acknowledged George Low’s skills: *“He is such an expert connector, networker and bringing quality researchers into this issue with this support. Wonderful support.”* He also acknowledged the field support he received from JMR monitors, Angus and Ernest, and the involvement of the community.

2.4 Carole Mills, Manager, Northern Contaminants Program

Carole Mills who has been with the program for over 20 years told the crowd that it could take advantage of NCP funding as the focus will be on mercury for the next 5 years.

Carole then introduced the program and its history. *“NCP started in 1991. Everyone in the world thought the Arctic would be really low in contaminants because we had no factories and no industry. When they first went up into the Arctic and took samples, they were surprised because they found elevated levels of contaminants in an area where they didn’t think they would find anything. In the first 10 years, NCP looked at contaminants in everything, including belugas, fish, mink, beavers, seals, every kind of food, berries. They realized that some areas had more exposure to contaminants than others. The second 10 years focused on the priority areas and the people most at risk.”*

She then talked about the possible origins of the contaminants found in the North (natural, anthropogenic and transported from long distances) and specified that sometimes the contaminants are not even made or used in Canada. She introduced the grasshopper effect: *“In general, most of our contaminants come from regions in the hot areas around the world, around the equator and they make their way up into the Arctic by going up into the clouds, and then it gets cold, so they fall down to the earth, then it heats up in the summer and it keeps going back up.”*

NCP focuses on the contaminants that come from far away. CIMP looks at contaminants that come from mining. There are three kinds of contaminants that are looked at in the NCP. There are persistent organic pollutants (POPs), they are all man made. Heavy metals, which are natural to the environment but increased due to man’s activities, that is exactly where mercury lies. This group is a bit complicated because sometimes it is difficult to tell between what was natural from what was brought by air currents, or what was added because of mining. The third group is called radioactive nuclides and this is found around Great Bear Lake, primarily.

Carole explained the reason why NCP is so exciting: *“It is because of our research that the whole world has entered into these agreements to reduce the usage of certain contaminants. So*

it is strictly the NCP that produced all the results, that showed that POPs were increasing in the Arctic, and we had no source. Because of our work, we got the whole world to stop using them and producing them really quickly. Since we started that work from 1990, POPs was really high and by 2012 it went down by 50 per cent.

And a similar thing is happening with mercury. Again, it is NCP research that lead the way to a whole new mercury agreement being signed in Japan that had all the countries reduces their use of mercury.

So this is what you guys can be part of. So we do have a new mercury agreement but we need to be measuring everybody and people and the environment. Is this agreement working? Is it reducing our mercury levels?"

Carole then shared a picture of an Aboriginal delegation with Nelson Mandela. A group composed of aboriginal peoples was formed and travelled to the United Nations meetings to fight the POPs fight. When the group was in South Africa, Mr. Mandela asked to meet with them. Carole was part of the group who spent at least an hour at Mandela's home. She reported that he was excited that Aboriginal people could make a big difference in the world.

Carole depicted the big picture about mercury and the necessity to conduct biomonitoring studies to convince the world of what is happening in the North. She presented the results of researchers Birgit Braune and Gary Stern and showed that mercury increased in birds and fish between 1975 and 2010. *"Once you start to see an increase in the biota, you know you have to start looking at people and seeing what the impacts could be. What we also heard from our scientists is that 95 per cent of that increase is due to sources from outside of Canada. So it is not something we can fix ourselves in the NWT, but is something that has to go to the world. Most of it comes from China because China's population is huge and is becoming industrial, burning more coal and that is where you get more mercury. So as China becomes more prosperous, we are going to have more mercury in our environment."*

NCP identified that looking at mercury in all of NWT is going to be a priority for the next few years, including biomonitoring hair and blood. It is trying to look at all of the regions of Denendeh, not just one region. Carole suggested that Dehcho becomes a pilot region. *"It is better if you can pick a few communities and work with them and learn from that, and then, make a program that is good for the whole region. The other region that has been involved is the Sathu. They did some monitoring work a few years ago where they did look at hair, and they did look at fish and I think they looked at blood. So we have lessons we can learn from that project, what worked well."*

Carole then gave insight into the preparation and communications needed for such a study: *"I worked on a program that looked at the blood for POPs for women 20 years ago and it took a year of prep work just to make sure your CHRs know what is going on, just to make sure the doctors know so that when you get the results back and go to a health professional they will be able to help you understand what those levels mean."* Various scenarios were thought through ahead of time: *"What if the results come back high? Who will you tell first and what are you going to tell them? What if they come back low?"*

Communication materials were also prepared to explain the following: What is mercury? What does it mean to me? What if I find out I find a high level? Can I take a pill to reduce my mercury level? What does it mean to my baby? She recommended to think of those ahead of time so that you are not scaring people when the results come out and make sure that people have had a chance to think about it.

She then explained the four funding envelopes NCP has and explained how priorities are determined. The program is very rigorous, guided by a document called the Blue Prints and this is important to anyone who is going to apply. The “Call for Proposals” comes out around November; the deadline is normally in January. *“Every year, scientists get together and determine the priorities for the following years. These are the species we are going to look at, these are the locations, these are the things...so these are the things we need and it has to meet the blue prints.”*

Right from the start, it was acknowledge that NCP had to be managed by the Aboriginal people, not just a committee of scientists. A third of the money goes toward communicating results, not just doing the research but making sure that the results come back in a way that communities understand them and so this is how we get a lot of money out of capacity building. There is NCP committee that has representatives from the five Dene regions and the Inuit. Dahti Tetsho from Dehcho First Nations is the representative of the region on that committee.

NCP also promotes the use of traditional knowledge. So projects that use traditional knowledge will get a higher priority. *“And in fact, George Low’s work, we holdup to everybody across Canada and say this is how you do it. You do it like George Low does it! Get the local people hired.”* George has been invited to the management committee meetings to present how the work is supposed to be done properly. Carole then emphasized another good reason for the participants to jump on this bigger project opportunity: the region has a good reputation. Thanks to George.

Carole can be contacted to determine to which of the four envelopes (Human Health, Environmental monitoring and research, Community-based monitoring and research, Communication capacity and outreach) one should apply to have the best chances to get funded. She suggested getting into the bigger envelopes which have multi-year funding and lots more funding.

She mentioned that an interesting question was raised and it could become a project for the fourth envelope: The situation around Sanguex Lake, *“Was it because there was advisories on the lake that people stopped fishing the lake, so the fish got bigger and the mercury went up? Did we communicate this properly and did it actually lead to something we were not expecting it to lead to?”*

Carole ended with a message she promotes: *“Generally, our traditional food is safe to eat. The health risks of not eating our food are often greater than us eating the food. Our water is safe to drink. We have to make sure it stays that way.”*

Comments/Questions from participants

Chief Sanguéz inquired about NCP supporting food security initiatives. Carole clarified that it would not but it could confirm the safety of the food. He also inquired about the quality of rain water as it is used for drinking. Caroline Lafontaine mentioned that the rain water from water barrels of elders from Trout Lake was tested a few years ago and there was nothing to worry about, beside the total coliforms that built up because the water was sitting in barrels and were not cleaned frequently. Water from barrels needed to be boiled.

2.5 Marlene Evans, Environment Canada; Saskatoon

Dr. Marlene Evans has been up here working on issues related to contaminants in the north since about the 1990s. After acknowledging her coauthors (George Low, Mike Low, Shannon Landels, Johnathan Keating and Heidi Swanson), she presented a broad overview of where mercury is in the environment, and past studies on mercury in the Dehcho region. She explained why mercury concentrations can be high in some lakes, but not others. And then she presented summary results of the work done over the last few years, including an overview on contaminant studies on Great Slave Lake.

“What is mercury and where does it come from? Mercury is one of many elements that make up our life. It has been around since the universe first formed. It is just another element that we are familiar with like oxygen, iron, copper, and carbon. It is found everywhere. You can’t see it, except in very rare circumstances. In some cases, it is in an ore called cinnabar. Some people, back in time, were extracting the mercury from the ore to make things, like mirror and paint.”

Measuring mercury concentration requires very specialized instruments and procedures. “So if you saw silver in a fish that is not mercury in the fish that is just the fish!”

“So even though mercury has been here since time began, as a natural compound, there still can be concerns with mercury. Like a lot of elements in our world, although the quantities haven’t changed, where they are is no longer what it used to be, and that can cause problems.”



Figure 4. Participants exchange ideas continuously. Here, Dr. Marlene Evans upload her presentation with the help of Bruce Townsend, facilitator.

Marlene drew a timeline from the dinosaurs age, about 3 or 4 hundred million years ago, to our present time to put a perspective on how we, as humans, affect our planet: *“It is only when we started forming small societies, beginning about 500 thousand years ago, human started having impacts on the environment. And in the last 200 years, humans have had huge impacts on the earth. We are now at four billion in population from couple hundred million years ago. So we have changed many things ... changes in the greenhouse gases and carbon dioxide. ... There is more mercury now circulating around in the air than there was 2,000 years ago because of our activities. We are burning more coal, oil and gas and that puts mercury in the air, then we are very good with our technology so we have all sorts of things where mercury is concentrated and it gets into the environment. Things like batteries, those sorts of things.”*

She then reminded the crowd of the discovery of mercury in fish in the Dehcho: *“It really wasn’t until the 70s that people were aware that mercury in fish could be a problem. Some early measurements started on mercury, but it was normally in areas where there was lot of industries, around the Great Lakes where there was reservoirs, where there was gold mines. DFO was measuring mercury on a periodic basis in fish. And in the early 1990s, it was realized that some of the fish in the lakes up here had very high concentrations of mercury in it. And by high, it is above what is called the commercial sale guideline.*

So there was two fortuitous studies, one, was a study George Low did with the Dehcho and the Sathu. They went into about 10 lakes in each region and they did stock assessment studies on the fish. So that is when you put fish nets out and catch fish of a variety of sizes, and you see how many fish are in a lake, and what their ages is; everything about them.

And then when Lyle Lockhart was with DFO, he measured all the mercury in the fish, so he was able to define the mercury problem better. And then we with Environment Canada worked with George to try and find what about the environment caused the mercury to be high in some spots and not others. So as a result of Lyle's work, he pulled together a bunch of data, not only the special studies that were done in the Dehcho and the Sathu and found out that whitefish, on average, have very low concentrations of mercury. So most of the whitefish mercury levels were below 0.2 ppm while in the fish eating fish (trout, pike and walleye), it is more common for those fish to have higher mercury levels in them, and the walleye in particular. More of those fish populations had fish with levels above 0.5 ppm. And this occurs elsewhere, it is not just up in the territories. It is northern Ontario, northern Quebec, in fish in the ocean. ..."

Then Marlene explained what seems to contribute to the variation in concentration in mercury in fish: "And then what we found out with our studies was that the lakes where the fish had more mercury in them, tended to be small lakes, and shallow and warm lakes. (...) Small lakes just have more mercury in them because the mercury is coming in off the landscape. And more of the mercury is in the form that can move up into the food chain. And the small lakes have more tea colored water and that allows the mercury to accumulate, more and more of the mercury to be converted to the form that gets into the fish."

She then showed how mercury varies with fish with an example from Tsetso Lake "where hundreds of fish were collected and hundreds of fish were measured for mercury." Length mercury concentration relationships show that whitefish had low concentrations while walleye tended to be a bit higher, and then the pike more so. The age mercury concentration relationship revealed an average fish age of about 15 in Tsetso Lake in 1997 with higher concentration of mercury: "Once predatory fish are around 12 years old, they have been living a long time, eating a lot of other fish, taking up mercury, and by the time they get to be about 12 or 15, in the small lakes in particular, they can have a fair bit of mercury in them."

The second example was from a detailed stock assessment from Willow Lake. "But for the predatory fish, once they get above 600 mm, as they get larger they tend to have more mercury in them. And again, you have very old fish in these lakes here too, 15, 20 years old."

In conclusion those studies showed that it is not that the mercury levels are high in the water - they are very low, very hard to detect- it is just that the fish tend to be old because they are not fished a great deal and they can live a long time. And in the small lakes that are warm, more mercury can get into the shoreline. In the big lakes, it gets diluted with rainfall. So it is more of an issue for small warm lakes."

Periodic assessments followed these discoveries but it wasn't very systematic. It is only in 2010 that George Low developed a focus program in the Dehcho. Since then, a number of lakes have been assessed for mercury levels in the fish.

Marlene then presented the highlights of these studies with histogram showing the average concentrations of mercury over the years for various lakes:

"Tathlina and Kakisa Lakes are pretty large shallow lakes. They have a commercial fishery, and because there is a commercial fishery there is older data for these lakes. In Kakisa lake,

walleyes are below 0.5ppm, the commercial sale guideline, but above 0.2 ppm so the concentrations are what we consider moderately low. Concentrations seem to be holding pretty much the same over time, which is encouraging.

The fish sizes vary, they have gotten a little bigger in recent years but overall there doesn't seem to be a big increase. If there is an increase, it will take some special statistics to analyze the data.

In Tathlina Lake, mercury concentrations are above 0.5 ppm on occasion, but that occurs when you get the bigger fish. Mercury concentrations might be going up but not sharply so. So it is a good lake to keep having a look at.

Trout Lake is mostly shallow but there are some deep holes in there for lake trout. It is a big lake so it doesn't have a lot of shoreline contact and it has big rivers flowing into it. Lake trout, on average, show mercury concentrations below that 0.5ppm. The concentrations are a little higher than in the past but the fish are a little bit older than in the past, so mercury is probably going up a bit but not at a fast rate. And again, it is another lake that might be a good one to keep an eye on.

In the Mackenzie River at Jean Marie River, a river out the front door with five species of fish showed that mercury concentrations are low in all species so it looks like the river is a good place to get fish from. Even those pike were on the large size and quite low.

George and Mike Low have looked at three lakes on the Horn plateau, Mustard, Big Island and Willow Lakes. Earlier work had shown that mercury concentrations weren't that high in the fish from Willow Lake, in part maybe because it is a larger lake and then because it is on the plateau, so it doesn't have a huge watershed draining into the lake.

From Big Lake and Mustard Lake data, you can see the mercury concentrations are low in all the species. They are below 0.5 ppm.

Willow Lake has been sampled before and the concentration is a little bit higher in 2012 than 1999 in many species, but not appreciably so. Again the fish tend to be over 10 years old so you would expect to have the higher mercury concentrations.

Dr. Evans then showed some of the stock assessment studies that were done on Willow Lake with the 114 mm and 140 mesh fish net that they used (the commercial mesh size). There are plenty of fish in the lake that are low in mercury that could be eaten. She mentioned that whitefish have very low mercury levels and then the suckers, or the cisco. Whitefish was the most common fish species caught and they are low in mercury. So she pointed out that *"if you want to go out and do some harvesting to get fish for domestic uses you would get a lot of whitefish in your netting."*

Ekali, Sanguex and Gargan Lakes are long, narrow lakes that are part of a river chain. *"These are lakes that you would expect to have higher mercury concentrations in them. So Gargan is the upstream lake, and then as it goes down you have Sanguex and Ekali lake so you might expect the concentrations in the fish to increase as you go downstream. Ekali is the most downstream lake and predatory fish do have a higher concentration of mercury in them. A*

little bit higher in 2011 than in 1996, but it is what you would expect for a lake of this type. Things haven't changed"

She continued the review of each lake studied. The details are in her presentation that can be found on AAROM website. In summary, predator fish show levels above 0.5 ppm in most lakes. Increase in mercury concentrations in predator fish (90's vs 2010s) were as expected. In most lakes, if somebody were to set nets, they would catch a large percentage of fish from species with low levels of mercury, such as cisco and whitefish.

The size of the watershed feeding the lake also has an impact on the quantity of mercury expected in this fish. Little Doctor Lake is an example of that, it is a very large lake with a very large watershed so it is a kind of lake that could have high mercury levels. And it does for the walleye and the northern pike, they do tend to be above the .5.

Marlene finished her talk by presenting the result of the monitoring studies on Great Slave Lake and discussing organic contaminants: *"Contaminants in fish from Great Slave Lake have been monitored since about 1992, and this is a really good lake to get fish from if you want to get lake trout for example and you want to have fish with low mercury. Concentrations are well below 0.5 ppm, same thing with the burbot.*

There is a trend for the mercury to be increasing in these fish, especially the lake trout and probably now in the northern pike but the concentrations are really low in so large lakes. In Great Slave lake and Great Bear Lake, the predatory fish there will be quite low in mercury."

Marlene's group also studied organic contaminants because of concerns in the environment. Things like DDT, lindane, and other chemicals that used to be manufactured accumulate in organisms and don't break down quickly in the environment. One of the purposes of their monitoring study is looking at the rate at which the concentrations of these compounds are declining. They finally got enough data to see significant decrease in the Lake trout fillet and burbot liver in West Channel only. *"So that is good news, these fish are getting better with respect to Lindane. DDT concentrations have been declining, so what that means is these compounds are breaking down and just disappearing from the environment."*

PCBS that is used in capacitors, used to be used in dyes and stuff. It actually consists of about 180 compounds. The PCBs aren't declining so rapidly. They are just tougher compounds to break down in the environment. And some people think with the warming climate, some of these PCBs are evaporating from the landscapes down south and might be coming north, which makes it harder to see the decline.

Dr. Evans finally presented her new initiatives: *"We are also studying new compounds like flame retardants, and these are not showing any trends of increase."* The team is staying aware of trends of a variety of compounds and will be in position to work with groups to stop manufacturing if increases are noticed. *"So chemistry and all these things that make our life more comfortable, it is always regulated. So these flame retardants are a new compounds and they are being monitored and regulated, and they act really rapidly if they notice something they don't like."*

In summary, *"for mercury it is a naturally occurring element. It has to be in certain conditions to be in a certain form that it can move easily and not concentrate in animals. And*

bacteria require that. Concentrations increase with fish length and age and it is higher in the predatory fish. And the concentrations that go into the food web tend to be higher in small warm lakes with lots of wetlands. It is not so much of an issue in big, deep cold lakes. And average mercury concentrations are very low in the predatory fish in the Great Slave Lake, and great bear also. For the lakes on the Horn Plateau, the Mackenzie River and the Jean Marie River, and Tathlina, Trout and Kakisa Lake, those lakes we consider to be moderately low, and then the small river in lakes that is where you commonly get mercury concentrations in the fish above the 0.5ppm.

As many, Marlene thinks the future for mercury is not that rosy. Unlike lindane and DDT, the mercury issue will not go away because two things are happening. One, in Asia, people are coming out of poverty and “*with their economy strengthening, they are building coal fired power plants (about one a week apparently). These are state of the art coal fired power plants that take out a lot more mercury than our existing power plants. Nevertheless, I think they are building about one a week. So there will be more mercury coming into the air as more power plants are built ... There are international agreements now to reduce the mercury in the environment and reduce that increase, but it is believed that despite best efforts mercury in the air will still go up.*

Two, it is also getting warmer. Life become more productive, bacteria transform the inorganic mercury into the organic mercury which gets into the food web.”

Dr. Evans ascertained that many people support the overall program. It had its foundations in the NCP, AAROM, CIMP DFO, Environment Canada, and with many NWT communities.

She thanked George Low for all the work he did under the original stock assessments and the work he is doing now, and Lyle Lockhart who got the original mercury measurements on the fish.

Comments/Questions from participants

Chief Sanguetz about the peaks in the graphs. He was wondering if a warming trend caused the peak to come down all of a sudden. Marlene explained that the mercury concentrations would go up and down for a couple reasons. The first reason is that the size range varies a little from year to year and the second is that there are slight variations in the fish feeding habits. She further commented on the effect of temperature: “*When we analyzed our Great Slave Lake data it looked to us like the mercury concentrations tended to be a bit higher in warmer years than in colder years. We can't really explain the ups and downs and that is the problem with the trend studies as they are now designed. All we do is measure the fish, we are not measuring other aspects of the environment. So it makes it difficult for you to know if other things are changing in the environment that would affect the mercury in the fish.*”

Chief Sanguetz reiterated that the elders are really concerned about the mercury and confirmed that he would like to see Jean Marie and Trout Lake targeted for the biomonitoring pilot projects. He also shared that scientist are sometimes unclear. Marlene explained: “*One thing you have to realize with scientists is that we are always asking questions and that is how we spend our day, asking questions and thinking about things. So when we come and talk to you*

we are telling you what we know. Because we are scientists we always tell you what we are thinking about and what we are trying to understand so we don't always present a simple picture." She also suggested that it would be a good idea to be measuring other things in the environment so that communities can get a better handle on the variations on the mercury levels and what is causing it. At Ort Resolution, Marlene's group are trying to keep track on the water quality through the year. There was a low productivity this year. Yes, it would be nice with the monitoring studies to do more than just measuring 10 or 20 fish a years.

Chief Sanguéz have been asking Bill Quintin's team if the permafrost has been contributing to the mercury increase. More studies are needed. A 10 meter bore hole with different temperature gauges is installed in Scott creek area. Chief Sanguéz requested help from Marlene to make sense of the scientific reports written by the permafrost team. "I can't make sense of it because he is using big words and I am not a scientist."

Marlene explained *"researchers believe that when permafrost melts and brings water and sediments into the lakes, it will bring more mercury into the lakes. But it will depend on how that water and sediment will come into the water whether it will make the mercury problem worse. But all in all, more mercury should be coming into the lakes with the permafrost melting. But the mercury has to be transformed before it causes a problem. If the mercury comes in and gets buried in the mud then it might not be a problem. If it comes in and the water is clear then it wouldn't cause the mercury to go up. These mercury problems are complicated which is why each researcher tends to take a small piece and look at it."*

Chief Sanguéz captures the difficulty community members have to grasp the mercury issues: "It is like cancer. You can't seem to get a grip. Even our elders when we use medicine men to capture it, it is hard for them to get a hold of it. We seem to be getting hold of it. It is like mercury, you can't grab it. This is why the elders are asking what can we do to get a hold of it?"

Marlene commented: *"There has always been cancers. You can dig up a mommy from Egypt and the mummies got cancer. I think it was Bloody Mary, Henry Tudor's daughter died of breast cancer. So it has always been around. We are starting to understand what better causes cancer, it is certain things in our diet, and things like smoking, exposure to certain compounds that we used in the past. The medicines are a lot better. When a woman gets breast cancer now they can get it out and use some chemotherapy...and she can have a normal life. Leukemia kids use to die of leukemia...leukemia has something like a 90 per cent survival rate now. The survival rates on these things are improving. It is scary but we know more about it. We have made a huge amount of progress. Even from 100 years ago with these ailments. I like to be optimistic but I understand people's concerns because they are getting cancer."*

Chief Sanguéz clarified that community members are not swaying away from country food because of what is happening with mercury and climate change. The efforts invested in the Dehcho encourage. *"More of our people are going to country foods than anything else now because it is our way of life here. Sure you could have a rib but elders say they would like to have chicken or beaver meat. That is why our communities are not swaying away. Because we are being pushed to go and eat country food more than anything else."*

Marlene mentioned that the moose, the deer and the caribou meat are very low in mercury. *“The thing with store bought food is there is good store bought food and bad store bought.”* She mentions that it is the choices people make that are the problem but some things are hidden. *“...the worst are the sugars. They don’t tell you about the sugars. They keep telling you about salt but they don’t tell you about the sugar and the fructose.... All that sugar messes up your metabolism...”* She emphasized that one “can be healthy on good bought food if one can afford it, which I know is another issue.”

JMRFN would like to get more work done with Diane Bronson with Food secure Canada. The Food Secure workshop in Edmonton a few years ago helped take perspective. *“The north is going to be more impacted than anywhere else and food crises will happen. That is why we are looking at that Food secure”*, said Chief Sanguetz.

Marlene shared a personal viewpoint on the subject. *“If you come into a community where people get a fair amount of their calorie intake from caribou for example, then all of a sudden, there is quota, there has to be some means for those people to get those calories through some other means. Someone in Lutsel K’e brought that up, how you needed something coordinated. If you are putting bans on things you have to do something to let those people get food in alternate way.”*

2.6 Mike Low, DFN ARROM technical advisor in collaboration with Dr. Brian Laird, University of Waterloo.

Mike travels to all the communities and works with the community monitors on all sorts of projects from water quality to collecting fish and everything in between. He presented an update on some of the programs conducted this summer and an update on the return to country food survey that started in 2012.

ENR, Lands and Water Division is developing a community based monitoring program across the NWT. Dehcho AAROM has an agreement to collect water quality and contaminant data with the involvement of Dehcho communities. Presently, the Dehcho is the only region collecting its own water data. In the rest of the NWT, ENR technicians and employees collect this data. Mike coordinates with ENR sending them the data and samples for analysis and reporting.

In 2014, AAROM hired an Aurora College summer student to assist Mike. They worked closely with the community monitors in most communities in the Dehcho. *“Community members really get to know the science in these programs and then they teach us about everything else.”*



Figure 5 " The Dehcho has really taken charge of their own resource monitoring programs. A good news story", reminded Mike Low. This is a regional success because everyone takes charge, even the very young.

Mike then presented the three pieces of equipment used and their individual purpose. PMD, DGTs and Sondes respectively measure PAHs, metals and basic parameters and are integral parts of AAROM's monitoring program, which has been designed with ENR and with community consultation. Sondes are left in the water all summer but are calibrated every 30 days. *"Usually I am visiting these sites every 30 days with community monitors. DGTs are only in the water for four days so usually the community monitors pull them out themselves."*

Mike emphasized the importance of collecting this data: *"This data is very critical in dealing with future global warming and climate change, and this is also very important when looking at fish stocks in the area of each community. It is very important that we collect this data so that we can continue to monitor the fish health."*

He then presented the community monitors and acknowledged their commitment to the success of the program. Mike also described the work done in each community, the type of data collected and the type of instrument set. In addition to water quality data collection, many communities do angler surveys to monitor recreational fishing that is booming in places, like Fort Providence. Details are on the slides 6 to 9 of this presentation. It can be found on AAROM's website.

He emphasized that ENR scientists are the ones that went to the communities and decided what equipment went where. They looked at community concerns and the past sampling and they decided where there were gaps and which equipment was where last year.

He then elaborated on the "Return to the Country Food Survey" that was developed after the first workshop here in Jean Marie in 2012. This was administered after the mercury advisory had been out for a couple years because there were concerns that mercury advisories may be swaying people against eating all types of fish, not just those that could have high levels of Hg. AAROM gathered information on the types of country foods that were being consumed

in the Dehcho, including fish and wild game. Ultimately, we wanted people to continue consuming traditional foods and fish.

Each Band (Liidlii Kue in Fort Simpson, Jean Marie First Nation, Deh Gah Gotie First Nation, K'a'Agee Tu First Nation and Sambaa K'e Dene Band) hired one or a few community members to administer the survey. The employees interviewed as many households as possible using a generic survey form prepared by Dehcho AAROM. Local surveyors in each community did a very good job. Each household received a \$50 gift certificate in the small communities and a \$25 certificate in the two large communities.

The survey included questions on wild meat that is eaten, whether or not they hunt, whether or not they garden, if they fish or if they don't fish, if the mercury advisories had affected them and their opinion on the municipal water supply. The survey was designed to show differences between summer and winter habits. The data was analyzed by AAROM with some technical assistance from Dr. Brian Laird.

Mike then summarized the survey results for each community. He presented the number of surveys completed, the commitment of households to hunting and trapping, the average number of country food consumed per week, and the species consumed. When asked an estimate of how many meals people consume each week, some people answered with a qualitative answer, they gave descriptions, some people answered with a quantitative answer, actual numbers. The data is being adjusted for the qualitative answers although the preliminary results in the presentation had not all been corrected. This adjustment was not possible in all communities. In Wrigley for example, everyone answered qualitatively and extrapolation is not possible there.

Mike noted that some of the species are not present in certain lakes, so results of zero does not mean people do not catch or consume, it simply means that the species is not present. In some communities, some species are not present but still eaten. They come from other communities.

Mike noted particularities: In some communities, like Trout Lake and Jean Marie River, people are very aware of the advisories and their limit of mercury intake. In Fort Simpson, the limiting factor for them eating fish was the availability of it or them going out to get it. A lot of people in Fort Simpson work 9 to 5 jobs for the Government and a lot of them said they were not able to go out and set a net themselves because they were always working. And other one said that if they weren't able to go out and set their own net, then they relied on other people to give them fish.

Dr. Laird assisted AAROM with the analysis of a few specific questions from the "Return to Country Foods Survey". In his presentation, Dr. Laird showed that:

- About 28 per cent of the households surveyed said that the fish advisories affected the number of fish their family eats.
- The vast majority of participants (80%) felt that they needed more information regarding the fish mercury levels.

- The majority also wanted to be better informed on the risks and benefits of traditional food consumption.
- Around 85% of the household gathered berries or other land-based foods while 30 % were involved in some type of gardening.
- On average, participants ate more fish in the summer (2.3 meals per week) than in the winter (1.5 meals per week).
- The most commonly eaten fish was whitefish. This is good news because whitefish have excellent levels of health fats (e.g. omega-3 fatty acids) and not much mercury. Other fish eaten quite regularly were lake trout, walleye, and jack

In some studies, people that eat a lot of fish eat different types of fish than people that eat small amounts of fish. Therefore, Dr. Laird compared survey results for people who ate fish frequently versus those that ate fish relatively infrequently. For both these groups, it was found that whitefish was the predominant source of fish that people were catching. But, for people that ate fish infrequently, whitefish was relatively more important in comparison to those that ate fish frequently.

Comments/Questions from participants

Carole Mills inquired about the methodology used for the survey. She pointed out the difficulty to assess whether or not the advisories had an impact on the amount of fish consumed, as the amount of meals consumed prior advisory is uncertain. She pointed out that data for comparison exists. Extensive dietary surveys from 1998 were broken down by community, the number/grams of fish eaten, and everything else. Even with this data, in her opinion, saying that was because of the advisories would be difficult.

Carole then acknowledged that there is a purpose for this “Return to country food” survey. *“If we do what the communities say and give more information and more about the benefits, the survey could be administered again in five years to see if it had increased fish consumption. But I am a little confused about how you are going to determine if this was a result of advisories.”*

George clarified that the survey was not designed to do that and he does not think it could. He explained that AAROM was getting a lot of information from different communities that some people were not eating fish at all because of the advisories. AAROM asked the question directly on the survey. *“There was one question that asked have you quit eating fish because of the advisory? I think that is the only direct answer you could get on that.”*

Dr. Brian Laird thanked Carole for the suggestion and mentioned that the challenge would be that the make-up of the participants (e.g. age, sex, etc) in the “Return to Country Food Survey” could be very different those that took part in the Center for Indigenous People Nutrition and Environment (CINE) studies all those years ago.

He confirmed that one cannot objectively see the before and after effect of contaminant advisories when you only survey people after the advisory has been released. *“But the fact that there were over 20 per cent of the respondents that said the advisories had affected the number of fish they had consumed, that does give an indication that these advisories are having some impact. The questions still need to be asked about the magnitude of the impact and who have been impacted the most.”*

Carole Mills gave a warning that dietary surveys need to be consistent across the north and also be consistent across Canada and that there might be some methodology imposed on how to collect the information for future funding for whoever will conduct a follow-up study to CINE’s work.

Mike Low confirmed that they realized that something more comprehensive had to be done if the results were going to be used for something as a foundation or something. George points out that they *“did not have any kind of a control where you would revisit some of those communities and use a different method to get the same data then compare the two to see how they match up. So it wasn’t a really well designed survey in that sense. We wanted to get a general idea of what was going on. Brian and Rhona will later present the biomonitoring study and give their insights into a potential dietary survey that would be representative and consistent with other surveys that have been in the past.”*

Chief Sanguéz reminds the crowd of the problems they had when the advisory was posted and the importance of the data collected by AAROM’s survey: *“...it is important to understand where communities are coming from because, of course, when fish advisory came out we keep putting up signs at the lake and somebody kept knocking it down because no one wanted to see that damn sign. We put the grader blades on it! That data is important to see how we could forge ahead. What we are doing now could affect the movement of the mercury movement.”*

2.7 Dr. André Corriveau, Chief Public Health Officer, GNWT Department of Health and Social Services

Dr. Corriveau acknowledged the fact that the information that has been presented so far has been very helpful to him and will help us to continue his work. He then presented basic information on the origin of mercury. He pointed out that even though there are more emissions that are coming through the atmosphere from coal burning, climate change is a major factor in the transformation of that mercury into a form that enters the food chain. As the water in our lakes increases, the transformation of mercury by microorganisms is accelerated and gets into the food chain more quickly.

He also talked about the local incidences, and particularly of fires. This year, millions of acres of land have been burned and that will create a pulse of mercury into the water as trees are good stores of mercury. *“If it goes into a lake, where the water is more still, than in a river where it can be flushed out, it will bio accumulate. So those are all important factors that we need to take into account.”*

The reason DHSS care about mercury is that at high levels mercury is toxic and can have very significant health impacts, especially on the neurological system, so the brain, and most importantly, in developing brains. Unborn children and young children are more susceptible as their brain is maturing. *“That is why many of the monitoring programs in the past have targeted pregnant women. Looking at their exposure, we could have a sense of what impacts or the risks the children born from these women might be exposed to.”*

Dr. Corriveau reassured the crowd, the levels of mercury that cause health impacts are expected in the Dehcho.

He discussed the process of bioaccumulation through the food chain. *“The top level predators are the fish that we have to be most concerned with or where we are most likely to find that those higher levels of mercury.”*



Figure 6. Food is key to the Return to country food workshop. Jean Marie River chefs created meals that met the recommendations of the Canadian food guide.

He presented a list of the fish that are commonly eaten across the Northwest Territories and reiterated the importance of fish for human health. *“It contains elements that protect our heart, that promote brain growth, that stimulate our immune system, so it is really an essential food. To be healthy is to eat fish.”* This fact is recognized in the Canadian and NWT Food guides, regular consumption of fish is recommended.

The advisories are not meant to end up causing a decrease in the consumption of fish. Losing the health benefits that are associated with that type of food is not an option. It is very important to everyone that DHSS advisories are provided in a way that is easy to understand and won't scare people from a source of food that is very important, not just from a cultural perspective but in terms of generating good health in the community.

Dr. Corriveau explained how advisories are produced. Health Canada sets the guidelines DHSS uses to provide the assessments. *“At this point there are guidelines that are set for certain frozen or canned fish, and the ones that are provided for retail that were caught commercially. (...) Then there are complicated formulas to assess the exposure level so once we know which fish people are eating and how much of it and how much mercury is in the fish, we can figure out what the average exposure is and provide specific advice on the health risk that may be associated.”*

All advisories are available on the DHSS web site. They are also shared with the communities that are immediately affected by them. He presented all the lakes for which advisories were provided over the past few years. It was noticed that the Dehcho was over represented and the reason for this is that the Dehcho region is very active in monitoring its fish. DHSS rely on scientists' studies for data and the Dehcho produces a lot of data. It is not a reflection on the Dehcho being worse than the Akaitcho region.

Then Dr. Corriveau emphasized the difference between a hazard and a risk. *“A hazard is something that by itself is a problem. Mercury can be called a health hazard. But it becomes a risk to you only if you are exposed to it. The hazard is one thing in theory, so in a medical book you could say metal mercury is a health hazard, but it is only a risk if you are exposed to it, and a certain level of exposure”.*

He then explained the concept of risk assessment: *“A risk assessment will focus on something we know is a hazard but may not be a risk to you if you are not exposed to it or if the level of exposure is above a certain threshold. The first step when doing a risk assessment is to identify the hazards in our environment. What are the things that might be a cause of problem? Then you categorize that hazard in terms of where is it. You map where the hazard is and then you see if there are houses there, are there places where children play? Then you can do an exposure assessment and then an assessment of what the actual risk is and the advisory is one way to manage the risk and give some advice on what you can do to limit your exposure to the risk and the hazard that might be there.*

So in this case, part of the hazard characterization are the studies the researchers are conducting on fish. Information is gathered on which fish, where have which level of mercury. With this information, a risk assessment can be done and a risk management advice, in terms of what you might do in terms of limiting fish, deciding which lakes are safer than others, or what you might have to do internationally, can be provided. This is what was

done with the POPs, or the inorganic contaminants where aboriginal groups went to the United Nations and went to the forums and lobbied for certain types of chemicals to be stopped and to not be released in the environment. That was a risk management strategy in that we want to reduce the risk of exposures that people have and depending on the source of the hazards the strategies might be different. Sometimes it might be lobbying internationally; sometimes it might be doing things at home. As we know from mercury, a lot of it is coming from coal burning, so part of the solution, for the long term, will be to find ways to convince China to move away from burning coal and move to a more renewable source of energy. That is a long process but often there are international forums where these discussions can take place. In the meantime we will continue our work here with George and others to monitor what is going on and find ways to mitigate our risk.”

Dr. Corriveau then suggested guidance to develop a biomonitoring program: mercury targets the nervous system, the cardiovascular systems and the kidneys, which are the organs which try to eliminate the mercury that is in your body. Those that are in development are the ones that are most sensitive so the fetus and children during their first five years of life, when the brain is still in development. A monitoring program would want to make sure that we target, among others, pregnant women because that would be the first group where it would have an impact on their children. Early signs of toxicity would have to be detected by a physician or a nurse practitioner. There would be things like tremors or loss of vision, slurred speech and coordination of muscles and in severe cases infants being born blind or with mental retardation. Those types of outcomes are usually seen where there has been industrial contamination of a local area, such as in Minamata, Japan where they had plants producing and releasing a lot of mercury in the local bay while people were using seafood from that area. The levels there were hundreds of times higher than we would even expect to see in the worst cases here. It is not something we need to worry about. It is only to inform of the range of health impacts.

He then commented on the factors that influence possible toxic effects and emphasized the most toxic form of mercury, methyl mercury, which goes up in the food chain, beginning with the small microorganisms in lake water.

He then presented the guidelines that DHSS use as a baseline (0.2 ug/kg body weight for pregnant women and children) and 0.47 ug/kg body weight for the general population) and explained the type of sampling that can be done and results that can be obtained. *“Mercury measured in blood would give your level of exposure over the recent past, like the last couple of weeks. From hair, it is accumulated depending on the length, and it would give us an estimate of exposure over time, a year or two. You need both to get a good measure of the total exposure. The combination of those two results would be the best tool. And of course, getting blood samples is a lot more complicated than just getting hair samples. With blood it is more intricate and requires more of a complex process, to get consent, to transport the samples to a lab and have them sent back.”* Once we do the blood tests on people we would compare them to the safety guidelines produced by Health Canada. There are other countries that have their own guidelines.

He then talked about the biomonitoring studies done from the middle to the late 90s and concluded that it would be time to take another look at people exposure to mercury. *The highest levels at the time were in the Eastern Arctic and that is where a lot of the work has*

continued because that was a major area of concern at the time while over here, the levels were much lower. We know for a fact that mercury levels have gone up in fish, at least to a certain extent. It would be good time, 15 years later, to see if there are any changes from the studies done around 1996 to 1998.

The data derived from previous studies showed that the intake of fish drive the intake of mercury. There is some mercury in every fish. The guidelines set by Health Canada would take that into account and allow people to eat the regular amount of fish every week. Canadian data shows that 96 per cent of people have levels that are below 4.5 in blood. The majority of the Canadian public across Canada are well below the safety limit which is around 8. So most people across Canada, even though there is mercury in fish, the way they eat fish provides us some reassurance that it is not a major public health problem across Canada but having more local data would certainly be good for us to have.

As for clearance, it takes 200 days to clear a meal that has mercury in it. Mercury in the body goes up, and then it is cleared gradually over a period. Some of the mercury ingested is incorporated in tissues, so it is not measured in the blood. There is equilibrium and then, it is released. It might be trapped and be absorbed in bones, and other organs, deposited in hair. It take a while for it to be cleared completely. It goes down slowly because of the way it is processed in the body. Although it is processed by the kidney, it is not a very efficient system.”

Dr. Corriveau continued on the potential to reach toxic mercury levels and factors that may counteract the harmful impact of mercury. “There are some fish, like tuna, that can have more mercury. So if you ate mercury every day you could get a toxic level over time because of how slowly it is cleared from your body. But if you eat fish with very low levels of mercury, you would never reach a level where there is a health problem because our body has some ability to clear it. There are also other things that might be in country foods, like selenium, that might have a counter affect to mercury. If your food is high in selenium, it can counteract the harmful effects of mercury. It seems to protect the body from the harm of mercury.

He then continued about other considerations taken into account in doing a health risk assessment. “*we also think about the benefits of the food and as I mentioned before, fish is also viewed as a very important preventative factor against heart disease and also in maternal health for the development of brain. In addition to the omega-3 fatty acids - we heard that whitefish is very high in some of those compounds – fish may contain selenium which counteracts the effects of mercury. In children, and pregnant women it is an important source of food that will maximize the buildup of architecture of our brain. So we certainly want to avoid the situation where people are not eating fish at all because they are worried about some contaminants that might be in it. Then there might be more harm than good from our advisories.*”

Dr. Corriveau emphasized the need to communicate this information in a way that doesn't make people concerned about an important healthy food. The assessment of exposure through biomonitoring is certainly a way to confirm people are safe and DHSS will be very supportive of such initiatives: “*We are very supportive of doing work in biomonitoring. We are very concerned about what is going on in the environment but in the end we want to be*

sure that our people are safe. Until we have data on people we don't know for sure. A lot of the assessments, based on environmental data, are based on theories or models that are imprecise. They provide us with estimates but they are not as accurate as having real data from people. So we will be very supportive of any efforts that are being made in this region and one of the things I can do as the chief public health officer is write a letter of support for research proposal, or to endorse the community effort in this regard so that you have a better chance to get funded."

Comments/Questions from participants

Someone asked if one were to stop eating fish, would you get to zero mercury in your body again? Dr. Corriveau confirmed that there are probably other pathways of exposure, for example through other types of food.

Chief Sanguéz mentioned that from studies on climate changed and from the work with Nick Larder, the regional biologist, the community knows that the food will be impacted. Study on caribou and moose showed that caribou and moose, up in the mountains, have elevated cadmium levels. There are advisories not to eat the livers and the kidneys from the moose.

The Chief expressed his concern about the way fish will be disposed of. *"When left on the land, something else consumes it? Maybe somebody else will be impacted, like the birds. So how you dispose of the kidney and the liver? Do you just throw them in the fire and burn them so that no one else would get it?"* These are question that have not yet received an answer and that elders would like answered. Sheep have not been looked at and need to be. They are part of the traditional harvest. *"..Our communities used to harvest sheep from the mountains". Chief Sanguéz reminded everyone "Everything is interconnected in some way" and asked for the support of scientists. "Anyone that could help us to help everybody understand and do more of the monitoring (is needed). He then shared about this position on the biomonitoring study: "Even me, I would like to get blood and hair samples to see if I did get exposed. As kids we were raised with a lot of fish, how would we know that we weren't exposed to mercury all along until we finally found out?"* Finally, he reiterated that there are changes that have not been documented: *"...in the last few years some changes were happening, the elders were telling us so within the last few years. We finally got a study done and found out there is mercury and there is cadmium, and there are other things that are happening."*

Dr. Corriveau reminded that because mercury is naturally occurring, we have always been exposed to it. He also explained the difference between climate change and past industrial practices. *"Climate change speeds up the process where inorganic mercury is transferred into an organic form and it is transferred, into the food chain. We were aware of mercury even before that. Up until the late 70s the pulp and paper mills were using processes to bleach the paper that were high producers of mercury into the rivers. Until that practice was stopped it was an important source in Canada of high mercury levels. When it was stopped, the levels went down quickly because most times it was rivers that were impacted, and the water was flowing. So it didn't really bio accumulate and we didn't really have the same impact of climate change back then. So this process of climate change is speeding up the impact of mercury on our environment and our food systems."*

He then put an interesting perspective on the cadmium issues: *“With regard to cadmium, in the eastern Arctic, we found that the highest cadmium levels were in smokers. When they grow tobacco, they spray with fungal agents to prevent rot on the tobacco leaf, and some of those pesticides have high cadmium levels in them. And the tobacco leaf, because of the way it is produced has cadmium as a contaminant. So we found that people who did not smoke did not have high cadmium levels in their blood like smokers. Smoking was the main source of cadmium in people, even in areas where it is a main concern in kidney meat. As I mentioned, some of those metals, it is the target organ to get rid of them, even in animals. So that is where you would expect to find higher levels of cadmium, whether it is in people or in moose, it is in their kidneys.”*

Marlene specifies that advisories do not necessarily mean that you cannot eat it at all. These organs (liver and kidney) have other essential nutrients that your body needs.

Dr. Corriveau confirmed. It is something you would want as a delicacy, once a month, not every day. Organ meats provide a lot of iron or essential nutrients that the body needs. But it is not something you would want to eat every day, like the muscle meat. It is a lot safer to throw out your package of cigarettes, yes.

Carol Mills shared that from the studies conducted 10 or 15 years ago, it turned out that if you smoked 2 cigarettes less a day, you could eat all the kidneys you wanted. That is how much cadmium is in cigarettes versus your meat.

Bruce had mixed responses on the new “smoking moose” button. He explained that people don’t see it has a cigarette in its mouth and commented on the organs. *“If you eat the mountain moose and the valley moose, there is actually no risk. So it is a healthy choice. But then if you smoke cigarettes, you blow it all away. So if you have someone doing a biopsy on a moose trying to decide whether or not to give the kidney away, think smoking.”*

Bald Bruce Townsend asked about the possibility to participate in the study...he was wondering if any hair is acceptable. Carole confirmed that any hair is acceptable and specified that hair grow, on average, half inch per year so the longer the hair the better the assessment of long term exposure.

2.8 Dr. Brian Laird, Research Scientist, University of Waterloo

After acknowledging the many people acting as guiding forces for this work, Dr. Laird shared his guiding principle and his philosophy as a risk assessor: “finding ways that we can encourage people to help people feel confident in the safety of their traditional foods, such that they can get the most bang for the bucks in terms of the most nutrients and least contaminants.”



Figure 7. Participants were very attentive. Along the wooden wall, Dr. Brian Laird, Meagan Ann O'Hare, Dr. Rhona Hanning and David Menacho.

He then reviewed some of the health benefits of the nutrients in country foods. *“Omega-3s are really healthy fats. They can protect against heart disease and promote good brain development therefore they are especially important for children and pregnant women. They can protect against inflammation on a chronic basis. These are really important to have as part of your diet and it just so happens that a lot of the traditional foods within the Dehcho have high levels of some of these omega-3. Most people get most of their omega-3s from fish and shellfish, and in Inuit country, they get them from marine mammals. In the south, there are a bunch of products called functional foods so there are eggs in the supermarkets that are supplemented with omega-3s. Realistically though, the best source of omega-3’s is from fish and shellfish. Within the Dehcho, it would be from fish like Lake trout and Whitefish.”*

Selenium has a role in protecting the body against metal toxicity. *“Over time the evidence has gotten stronger and stronger that, if you have high levels of selenium in your body, the risks of effects from mercury could be a lot lower than if you aren’t getting enough selenium. The reason why it is so important is that selenium forms a really important part in some antioxidant enzymes that circulate in the body. Selenium is also needed for the thyroid to work properly. Meat and seafood are good sources of selenium. Nuts, like cashews, also have very high levels of selenium.”*

Brian then briefly discussed the forms of mercury and their impact on human health. *“Out of the different types of mercury in the environment, the type of mercury in fish and seafood that we are*

most often talking about as toxicologists and as risk assessors is methyl mercury. This is what can build up and bioaccumulate and biomagnify in the food web. It is the type of mercury that you find in Walleye, Northern pike and Lake trout. Inorganic mercury can also be present in the diet, it is just substantially less available and less toxic than the type of mercury found in fish muscle.

From a risk perspective, the inorganic mercury from wild game liver and kidneys, is often less of a concern than the types of mercury that is present in seafood. As Dr. Corriveau mentioned, the kidney is responsible for the elimination toxic metals from the body and for that reason the kidney will naturally build up things like cadmium and mercury. This is why for some of these metals, exposure can result in kidney problems if you're exposed a high enough level.

With methylmercury, you are not really thinking about the kidney so much, you are thinking about problems with the central nervous system, with brain development and the cardiovascular system.

It is really important to remember that the risk is going to be defined by the exposure level. And so if you are not exposed to enough of these toxicants, methyl mercury or inorganic mercury or cadmium, the risk can be very low.

In terms of mercury cycle in the environment, the thing to remember is that the bigger, older fish, are the ones that can accumulate higher levels of methylmercury and if one eats a lot of these big, old fish, it can lead to problems in terms of health risks. But, generally, you have to eat a lot of the fish in order to get to that exposure level." The studies conducted in the Dehcho allowed DHSS to quantify the recommended levels of consumption of each fish species. All the advisories that have been put out about mercury in the Dehcho have all revolved around mercury levels in Lake trout, Walleye and Northern pike.

All of these advisories have taken great efforts to note that country foods are also very important sources of nutrients. It was suggested that people not cut back on the intake of fish in general, but instead take exposure mitigation measures, such as eating more smaller fish and eat more fish that are lower down in the food chain, like whitefish."

Dr. Laird presented his last year's study on the risks and benefits of mercury and nutrients in traditional foods. The work was done in collaboration with Dr. Heidi Swanson and George Low. He looked at the levels of mercury and nutrients that are in the fish that are being harvested in the Dehcho.

His main question is: What are the nutrient levels in the fish being harvested and which of those fish have the most nutrients and the least mercury? Therefore, mercury and nutrients (e.g. omega-3 fatty acids, and selenium), were measured in fish that were collected by Heidi last year in Kelly Lake, in Trout Lake, and Sanguex Lake (see presentation page 13). This allowed us to get an idea of both the risks and benefits of eating the fish from different lakes in the Dehcho.

He then presented results on mercury and the omega-3 fatty acids as the selenium data will be available later in the fall. *"Whitefish and cisco had very high levels of omega-3s and not much mercury in them. Whereas other species had lower levels of omega 3 fatty acids but had higher levels of mercury. This means that when you are thinking about a trade-off between mercury risk and nutrient benefits, whitefish and ciscos are different than other species."*

He expressed his hope to work with Heidi over the next year, trying to Analyze the risks and benefits from fish harvested from other lakes.

Dr. Laird then explained how risks and benefits can be brought together to form a more comprehensive look at how we can promote country foods such that we can maximize nutrition intake while lowering mercury exposure. *“The guiding principle is that you really want to be able to promote country foods so that we can get the most nutrients and the least contaminants and the most benefit and the least risk. To be able to do that well, we need to know the mercury levels in the fish. This has been going on for a couple decades now in the Dehcho. We also need to know the nutrient level in these fish, which we have been doing over the past year in the Dehcho. We might be able to add to our nutrient dataset from other sources. We also know a decent amount about which fish are being eaten by the work being done by CINE in the mid-90s. Then we got some other really valuable information from the “Return to country foods” survey, which provided us with more up-to-date information on some really important questions about country food consumption, (e.g. like how often are people eating fish, how much fish is being eaten, and by whom). The main piece of lacking information is “What are the current mercury exposure levels of people in the Dehcho region?” This is question Dr. Laird’s team is hoping answer through the use of a biomonitoring study. The reason why they want to measure the level of human exposure is because that level of exposure is what will determine whether a person is at risk or not. It can also help identify the people that are most at risk so that we can make sure that the messages regarding the risks and benefits of country foods are making it to the people who need it the most.*

Dr. Laird re-explained the different ways exposure can be measured: *“we can take a look at the mercury levels in fish, in the environment and combine that together with the amount of fish eaten and arrive at a dose that we can compare to guideline. But, the gold standard for being able to understand levels of exposure and risk is through the use of biomonitoring where levels of metals like mercury (or other contaminants) are measured in hair, blood or urine. For mercury, what would be most relevant to measure is hair and blood. Measuring mercury in both hair and blood is useful because they help us answer different questions that are both really important. With mercury measurements in blood we can get a snapshot of what the current trends are right now. With hair we can look at exposure over a longer period of time. From a risk perspective, we want to be able to know both these things.*

In the “Return to country food” survey, a very important question was asked: Do you want a member of your family to, or yourself to be tested for mercury? A sizeable number of people, about 40 per cent, said they wanted to be tested and the people who ate fish the most, tended to want to be tested more often than the people that ate fish more rarely.” Dr. Laird explained that it is normal for some people to want to be tested and for some people to not want to be tested. He clarified that in any biomonitoring study, only the people who want to participate would take part.

Dr. Laird presented a fact sheet about what such a biomonitoring program could look like (see website), a draft outline for discussion during the weekend. He also suggested establishing a community-based steering committee that can help guide the project in terms of making sure that the project is addressing the things that community members want addressed in the ways that community members want them addressed.

He then suggested some next steps: *“The next thing we want to do is hire and train local research coordinators to help put on this survey. We would ask participants to provide some basic information like their age and sex, and then we would ask them to take part in a pretty detailed dietary survey about the types of food they have eaten over the past 24 hours. Then we would also ask participants to describe the types of foods they have eaten over the course of the past year. I think that what would be really useful is if we ask that participants either provide us with a hair sample and a blood sample for metal analysis. One thing important to note here is, if a person doesn’t want to provide a hair or blood sample, they should still be able to participate. Participants would be able to take part in any portion of the survey that they wanted to. This is important from a consent perspective.*

And then, so once we have done that work, we could do the analysis in the lab and return the results back to the communities in the ways that was decided upon by the community-based steering committee. In terms of the benefits of the study, I think this would help us make sure that mercury advisories are lining up with current exposure levels. We want to definitely make sure that there isn’t an over inflation of risks in people’s perceptions. If the exposures are nowhere near the levels that are going to cause effects, then I think that would be a piece of information that most people would want to have. It would also provide us with a snapshot in time that would be able to allow us to see, in the future, if levels have gone down or gone up or stayed about the same. After things like the Minamata Convention on mercury, procedures are put into place to reduce people’s exposure to mercury. Doing a biomonitoring study now will help us know how well those policies put in place through Minamata Convention are working. Also, this proposed biomonitoring study would provide local training opportunities, and help us decide which of those foods are providing the most nutrients and the least contaminants”.

Dr. Laird proposed to NCP to do some pilot work in the Dehcho this fall, to help go forward with building a really culturally relevant and robust dietary survey. *“What we would like to do is move the dietary questionnaires onto tablets (e.g. iPads) so that we can analyze the results more quickly. Once that pilot survey is underway, a proposal for the full biomonitoring study could be submitted for NCP funding under the human health blueprint for January 2015.*

So what the pilot study would involve would be the design and development of a dietary survey that we could use to be part of a biomonitoring study in subsequent years. The benefit of using tablets is that it would help us get the results back sooner. One of the big time and labour costs in this type of work, doing dietary surveys, is typing peoples’ answers from a paper-based survey into a spreadsheet on a computer so we can see what is going on.

Once we have got a survey that is designed and developed and has all the food that is part of that survey, we need to hire some local research coordinators in a couple of communities and conduct focus groups to make sure it is complete and culturally relevant, and makes sense.”

2.9 Rhona Hanning, professor School of Public Health and Health Systems, University of Waterloo.

Rhona level of expertise is dietary assessment. She added to Brian’s explanation about the development of the survey: *“The idea is not to repeat AAROM’s survey but rather to build on that foundation and that background, to draw on what other people have done, and to use some*

of the local traditional knowledge to build some instruments to collect information that will be the most useful and relevant.”

Then Dr. Hanning talked about her background and some of the things that might help inform her involvement in the process. She first focused on the development of a dietary survey, giving examples from her work with First Nations in James Bay: *“ I have been working with the First Nations on the west side of the James Bay coast. Remote fly-in communities. Traditional or country foods are also fairly important because of their nutrition and also food security in the region. Goose is probably one of the most common foods that are consumed but certainly you see whitefish drying and harvested on the Port Albany at a camp with the youth, last summer.*

Collecting dietary information is not an exact science. We collect very different things from day to day. And getting a really good sense of what people eat is a very difficult or tricky thing to do. One of the tools people use are food frequency questionnaires. We looked at the whole range of species that people consume but really we wanted to know how people consume it. For example, what parts of the fish are people eating? Are they eating the skins or are they just eating the fillets. What parts of the fish are they consuming? How is that fish being prepared? Certainly with respect to the nutrient level something like omega-3 fats...if you are grilling it as opposed to frying it, it can have implications for the nutrient levels in the foods as they are being consumed. So getting some detailed information on that across seasons because as you saw summer consumption tended to be higher than at other times of the year. Not surprising. Many people do eat things differently across the seasons these foods are available. Get a sense of when people consume them but also how much they may be eating.

While we know some things that might be consumed at a household level, particularly there is an interest in women of childbearing age, kids themselves as they belong to a particular group when it comes to consumption of mercury, a target groups that can benefit from the nutritional benefits of fish.

Then you want to look at not only what is being consumed by the household but a little bit of an idea about who is consuming what within the household.”

Dr. Hanning discussed her past finding: “In the 90s we studied contaminant levels in cord and maternal blood, in the Mushkegowuk territory of Northern Ontario, Canada; mercury didn’t come out as being a problem. The interesting thing we found is that in the moms who had the highest intakes of traditional food, there were higher blood levels of lead, and this was associated with high cord blood levels in a small percentage of infants. At the time, lead was being used in shots and since goose was a traditional source of food being used in these communities, we suspected that this was the source of contamination. And so this has been one of the pieces of information that has led to the policy of using steel shots instead of lead shot in those communities.

She then presented a few papers on traditional food consumption in school children and highlighted the findings: *“The intake of traditional foods in the kids is lower than the adults, probably not totally surprising, but yet it contributes positively and significantly to their nutrient intakes. It is a really important component of what they eat.”*

Dr. Hanning explained that another important approach to dietary inquiry is focus groups/sharing circles as they bring much insight and reveal important keys to initiate change: *“The other thing we had discussion groups with the kids to try and understand some of those barriers to eating traditional foods. A couple of the things that came out that might be interesting were that some of that traditional aboriginal knowledge had been lost. Some of them just didn’t have the skills in terms of helping to harvest or prepare foods and some of those foods weren’t often prepared within their communities. So returning some of that traditional knowledge has been a real focus in some of the school programs like it is in some of your communities.*

The other thing that came out was they had heard the concerns about environmental contaminants. It worried them and that was one of the reasons why they didn’t eat more traditional food. In fact, often times, the concerns were unfounded. For the foods they were eating and for the levels they were eating, it is not something they should be concerned about.”

Dr. Hanning shared some background on an electronic tool that could be used in the Dehcho: *“We have developed and validated a web-based food intake, food assessment questionnaire. We have interviewed over 600 First Nations school kids, across the years, using this tool. We used it to inform programs and evaluate programs within the communities. We made sure that the tool captured the foods that were being consumed in the communities, both the store bought foods and the traditional foods, and then we included images for portion estimations. Local people helped us take those pictures.”*

She emphasized the importance of developing tools and approaches for research that are relevant to community members to yield results that are significant for people: *“What we really want to do is get a lot of community input to make sure we have got it right. To make sure that we have represented the range of foods that is being consumed and prepared. That the kinds of tools we develop and the kind of methods that will be used in the research are ones that work well for people within the communities.*

We found that if we want to get input from a range of people, and not just the people on the advisory committees, who often are representatives from education and health that it is useful to have healthy community feasts where the families come and participate. We have an enjoyable celebration together where we can give back the results of the studies that we have done. But it is also a nice opportunity to gather information - one of the things that we have found worked well.
”

She concluded with a quotation from Celine Sutherland, one of the nurses from Attawapiskat who participated in their research and was actually involved in some of the studies and published a paper. What she comments on here is that one of the lessons I have learned from community research is that: *“First Nations communities are unique and diverse. Nevertheless the process and the lessons described can be a starting point for health care workers who want to begin the process of gathering community input for health community programming.” The point from that is that clearly the five Ontario first nations communities we work with are very diverse. There is a whole level of magnitude of difference, when one moves from Ontario to the NWT. But hopefully some of the things that we have learned and developed over the past 20 years might be useful to your communities as you look to some of these new studies that might be helpful to people here.”*

Comments/Questions from participants

Chief Sanguéz informed that he will share about the biomonitoring study at the next Dehcho leadership meeting. He asked the researchers to prepare an information package. *“I think that it is long overdue that our people need to contribute to the science of living on country food in the north. It has changed a lot with climate change. That is why I would really like to contribute to it to make sure that whatever is happening to our people’s bodies that are consuming these things, we need to get that message out.”* He also wants to relate the information to Nick Larder, the regional biologist, to make sure that the caribou-working group is aware of what is happening here with the movement of mercury. There will be Dehcho wildlife workshop in October.

He reminded people: *“Our people, we do consume a lot of fish and a lot of country foods here, I think contributing to getting some of these samples to find out where the conditions of our people are (is important). Hopefully by next year, we will know what is happening here.”*

Dr. Brian Laird showed much appreciation for the interest and support of Chief Sanguéz and committed to preparing a package of information for the Leadership, which would include the background information needed to develop an understanding of mercury and what is needed for the next steps by the end of the week. Chief Sanguéz committed to send the information by the end of the week to the executive director or the assistant to the Grand Chief to be circulated before our next leadership meeting.

Chief Sanguéz reminded: *“We did the fish study, it woke up everybody. Having a study done on hair and blood samples would even help more and that would tell the government people that is what happening here.”*

Carole Mills encourage the scientist and communities to use a methodology that will allow for comparisons with existing data. *“I see this all the time in science. We can’t compare to that study because we did it a little bit differently; we use dry weight versus wet weight, moles versus grams, whatever. Methodologies were too different so we can’t compare.”*

We have good data from the late 90s on dietary information and we have really good data on mercury levels on blood as well as milk from the late 90s, from these communities, from this region. So we would want to make sure that whatever we collect now we can compare it and we won’t be saying, we can’t compare to that data because we changed too much.

Science changes, for sure, how you measure things changes, detection changes but that is what I would encourage. Those studies were done by the Dene Nation so it was your organization that did all this work. So use your own work and promote using a similar methodology if we can and not change it too much.”

She also shared that NCP did a lot of work on the nutrients and benefits in food in the late 90s. CINE, a university organization created by Dene Nation, the Inuit and the Metis because people didn’t always trust government also looked at a lot of nutrients in the food and preparation techniques because that would change contaminant levels. It is always hard to find old data but it is there.

Facilitator Bruce Townsend evidenced the wonderful partnerships that were being created at the end of this first day. And concluded on Brazil nuts: *“When I first graduated in the 1970s, my first assignment was mercury. At the end of the decade we were exploring selenium too. One of the things I do with the kids is to help them make healthy choices. We notice that the kids in this region really like Brazil nuts. And they are high in selenium.”*

2.10 Bruce Townsend, BEAT Environmental (Day 2)

Bruce gave a brief update on the science youth camp program. *“This year’s camp was the most challenging but also the best so far. It was an incredible blend of science and Dene values. We were right into the elements, paddling into a north wind against a driving rain and major smoke from the forest fires! I’ve never experienced anything like it! Clouds rolled in, the sun faded out and then became a big orange ball, and then... it started raining ash. It was very spooky but the kids did very well! What was planned as a four-hour paddle turned into a nine-hour adventure! We finally had to cut it short and drag the canoes back to camp using boats.”*

He then shared his personal learning experience and acknowledged the mentoring he received from the Dene elders. *“Sam really mentored me. He helped me modify some of the language I was using; he showed me how it was colonial and imperialistic and how perhaps I should say it in a different way. This really helped me out.”*



Figure 8. Bruce Townsend captivated many with his education update.

Bruce then recognized the work of the two really big drivers of this year's camp effort, Lois Phillip from the Fort Providence School and Dahti Tsetso from the Dehcho First Nations *"I have the deepest respect for both of these ladies."*

He then shared about combining science and the Dene culture and knowledge and also his concern for the students: *"Stan had counseled me last year to make sure that I layered the science on top of traditional knowledge, not the other way around. So one of the things I was able to find out during the camp, through lots of coaching, was that the two systems do fit together. The Dene science is more inclusive, you have grandfather rocks and grandmother rocks, whereas the western science approach is a lot narrower. So to be able to introduce science and cradle it within a traditional knowledge framework is actually quite easy. Two hands, one cradled within the other, two ways of knowing, strong like two people."*



Figure 9. Roxanna Thompson (front, left), journalist for the Dehcho Drum, interviews Dr. Heidi Swanson and Dr. Marlene Evans confers with Jessica Jumbo (back, right)

However a big lesson for me, is that although western science can be cradled within the Dene science model, I was struck as to how important it was to reconnect the kids to Dene values and traditions, the land, and that sense of place, and how so much healing can take place there. When this happens, I think that the “western science system”, which is a lot sharper, can be effectively embedded within the Dene value system. “Like a sharp stick in the TK bundle”.

In the last five years, I have been teaching the fisheries and the marine science program at Aurora College in Fort Smith. I have seen a lot of Dene students come in, they are enthusiastic but they don't make it through first semester, especially the young women. It really concerns me as to how we are going to continue to engage these students, promote science education and better prepare them for diploma and degree programs.”

Bruce shared the encouraging successes and impacts the youth program has had on individual students: “On the positive side, a Jean Marie River student recently told me that: “*You know I took the experiential science course in fresh water systems, and the information I learned during the youth camps really helped me out with the course.”*

So introducing science material during youth camps can provide our junior and senior high kids a “head start” so when they bump into this curriculum during school, they know a little bit more about it.

Bruce then shared about his approach and the content of his teachings: “*I used a more holistic approach this year to better harmonize with Dene values and traditions. I called it “We are Stardust”. Using Lego blocks we looked at atoms and how they are formed by stars and how they occur on earth and become part of our food sources. Some of them are essential nutrients such as zinc, iron for strong blood, and calcium for strong bones. However some of them like mercury and cadmium aren't so nice.*

So we have to figure out ways to get the message out to the elders. So before I came up here I tried my ideas out on my next door neighbor (she's 83) and what she said to me was: hey so you got this moose kidney problem with cadmium...cook it, won't it go away? And last year the elders were saying, can't we just dry the fish and the mercury will disappear? So once you understand atoms and how they work and why they are not going to be broken down, then you can reduce fear, promote healthy choices and continue eating fish.

Roxanna, the journalist, was telling me that she interviewed Joshua, one of the students from Nahanni Butte, and he tried to explain to her about cadmium and he pretty much had it right...there's still a little bit more work to do but he knows about atoms and he knows that atoms make molecules and how they relate to water and how they become part of the food chain.”

Bruce also included activities that reconnect elders and children. “*So what I am hoping is that these kids will reconnect with their elders and grandparents and explain the science side of things.”* We also introduced other activities on healthy choices: “*We talked about where the good fish lakes are, ones with low mercury and the species they can eat. So they got that. Then we talked about cadmium and about the mountain moose and the valley moose, and how they could make good choices and how they could eat the meat in either location. The meat in either location is totally OK but in mountain moose, the kidneys can be a problem. That is when I*

introduced the button with the smoking moose and asked the kids ‘why worry about eating kidneys if you have a cigarette dangling from your mouth’?! (Smoking has been shown to double daily cadmium intake!) I have to watch myself in the community because everyone is huffing and puffing, but it is a message that was worth telling. It also showed the same kind of thing we are trying to accomplish with respect to fish and mercury – healthy choices.”

Bruce talked about the different approaches for the various age groups: *“We used the idea called SMART because the kids are so smart...Science, Memory/Music (which is the oral tradition) and Art. When we interact with the younger kids the paints fly, lots of finger painting, they love it. However the older kids aren’t as interested! They’ll draw corporate logos but they’re not really interested in drawing fish. So what we tried to do this year was reengage the older students using iPads. George bought six iPads in waterproof cases and we played with applications that showed, for instance, how to measure metals in water. They built atoms, and from atoms they built molecules, hands on interactive stuff. We still have a long way to go but it works. It engages them.”*

He recognized however that he had reactions from elders: *“...ooh...iPads...in the bush...no!! But one of the components that we tried to introduce was language! The kids were asked to interview an elder. Say, hey I have this idea, and intend to present it, but how can I say it in Slavey. So that promoted positive interaction with the elders, introduced science but also recognized the need to include language within the teachings, to bridge both world views and to cement a sense of place.”*

He talked about other applications that were used: *“...an app where you could point the iPad up at the sky and you could tap a star and the iPad would tell you what the star is burning. So we reviewed elements again and introduced spectroscopy. We also added elements into the camp fire so we could see what color they made when they burned ... and when we were done ... the northern lights came out.”*

Thank you for listening....

2.11 Megan Ann O’Hare, Master Student, University of Ottawa (Day 2)

Megan is from northern Ontario originally, from Manitoulin Island in Lake Heron. Since 2013, she is involved in a masters of arts in human kinetics, which focuses on food security and food sovereignty in Fort Providence. She has spent five months and a half over a period of a little over a year. Her research is a qualitative analysis into the lived experiences of issues challenging food security and food sovereignty in Fort Providence. She is in the early stages of her work, therefore no result to present yet.

Megan described what her project is all about: *“Food security is defined as all people at all times having access to sufficient, safe and healthy food to maintain active and healthy lifestyles. And so the programs I work with focused on that but even more so at food sovereignty. Health Canada define food sovereignty as the right of people to healthy and culturally appropriate food produced through ecologically sound and sustainable methods and the right to define their own food and agricultural systems.”*

She then explained how she got involved with Fort Providence, especially at Deh Gah elementary and secondary school: *“Lois, the principal, contacted my supervisor at the University of Ottawa, who heads the indigenous research group. They work in food security a lot in northern Ontario but they are definitely open to working with some communities in the NWT. Lois expressed some concern with issues in food security in their school; a lot of their students were coming to school having not eaten dinner the night before or breakfast that morning. The school, beyond curriculum had to provide meals. Lois wanted to get some programs together and that is where I came in. I came to help as an extra set of hands to help run these programs.”*

In spring 2013 and 2014, Meagan spent time in Fort Providence and worked at a spring cultural camp. Every day a different grade from the school and their teachers came out to the winter crossing, which is just down the river toward Great Slave Lake, the mouth of the river. We set nets, emptied the nets and cleaned the fish to produce a whole bunch of dried fish. Every day we would have different fish and different country foods for lunch. And then people in the community would bring us a lot of ducks, swans, Canada geese and we would fix that and would have that for lunch as well. Anything that was left we would bring back to the school at the end of the week and would vacuum seal and freeze it. They are actually using all of that country food as snacks throughout the year instead of having to import snacks. It is more of locally procured snacks.

It give students a big opportunity to help food procurement, and a lot of the students would not have a chance to do this because their family doesn't fish anymore. Their parents are busy working so they don't go hunting. So they (the kids) don't have the time or the ability to learn these skills, so the school actually implements this into their curriculum. They are learning the skills of how to fix fish for themselves and they can learn those skills and teach their family later on.

So the kindergarten kids would help scale the fish with a spoon, the older kids would get knives and help cut it up. We had elders working with us, different hunters, it was great.”

So what my research involves looking at these types of programs, everything that is happening, at the Deh Gah schools. They are working toward having food sovereignty and then I am going to look at the impact these kinds of programs have. Hopefully it will be useful to other schools to be able to follow suit and do these programs as well. It is a program to connect the elders to the community members, to the students and really open the circle of communication in learning a whole bunch of new skills.

In the fall 2014, we will do another fish camp. With the success of the two camps, the school has suggested that we invite parents to camp too. So it will be at “Telemia”, which is just a few minutes by boat down the river. Every week a different grade is going to go out and the parents are invited to come so they get to be involved in this transmission of knowledge.

Meagan hoped that in a year she would have a lot of results to share.

Comments/Questions from participants

George Low supports this program fully. *“I think that is an excellent program. Getting the kids out and making dry fish and traditional foods, I am really glad to see that. And I hope we see it right across the Dehcho.”*

2.12 Dr. Brian Laird, Research scientist, University of Waterloo (Day 2)

The group had the night to think about the biomonitoring program and had the opportunity to ask question on Day 2.

Dr. Laird summarized all the elements described on Day 1 to start a biomonitoring study, including two pilot projects, the development of an electronic survey specific for the Dehcho and the actual pilot study to two communities to test-run the biomonitoring protocol for further implementation at the territorial level. The community of Jean Marie River volunteered to be part of the pilot project. Kakisa was to be approached to be the second community. Funding from NCP is available for the pilot work.

Dr. Laird then asked about community priorities and concerns. *“In the handout, presented on day 1, questions like: What are the questions you would want such a biomonitoring study to answer? What groups and individuals would you want as part of the committee to guide the project to make sure we are answering the questions in the right way? Then more specific things like: What are the specific things we would want to measure and with whom? Do we want to make sure we want children and elders and everyone in between? Or do we want to be more specific about the people we want to ask? These are the questions that shape what the biomonitoring would look like. I can provide some thoughts on but I see this as a project that has to be asking the questions that the Dehcho want answered.”*

George Low asked about the extra benefits of doing the blood samples as well as hair samples? Dr. Laird answered: *“The extra benefit of blood samples, and this is just for mercury, is that it will give us a clearer snapshot of what people’s exposure is at the time of the study. Hair reveals the past exposure. So if you have both, you can see what you have right now as well as what it was before. Both of those are useful. Also, if you take a blood sample, it only takes a little amount to measure mercury, but you can also measure things like cadmium or other things you are concerned about. I think it is even more important is to look at the nutrients in people’s blood. Then we would be able to link back to the people who are eating a lot of traditional foods. We would hopefully be able to see people who have higher levels of selenium and omega-3 fatty acids so we can come back to people and say relying on traditional foods is giving you benefits because we have been able to see these really important nutrients in your bodies.”*

Chief Sanguet considers this study very important but agrees that convincing people may be difficult at time. Communicating in a way that will convince them is essential. *“Country foods are changing our way of life. (...) we have to let the communities and leadership know that this is toward understanding the health of our people through hair and blood samples.”* He also warned Dr. Laird *“... we really need to be careful about how we portray this thing. I really want to let our community members know why we are doing this. It is important to know what is happening to our people with country food. (...) Then again, when we tell them about it we tell*

them as much as we can but just say don't eat so much. Maybe get 2 or 3 portions a week but if you eat days a week that is too much. But at the same time, I do. Traditionally we feed a lot of fish to our dogs too. Are we killing our dogs too with that amount of fish?"

He also shared on the parts that need to be studied and the origin of the fish eaten in his community: *"I don't eat too much store bought meat...I eat a lot of fish. Not so much the fish, over the three years study that I have participated in. I like the sucker heads, but when it comes to fish guts, I love them! (...) Because we know the mercury is high in the pickerel and the jackfish a lot of our communities go and get some whitefish out of the Mackenzie River. A lot of it comes from our cousins from Fort Providence. A lot of time in the winter our people go and buy whitefish from the fishermen from Great Slave."* Chief Sanguéz questioned the quality of the fish guts he is eating. *"... That is where most of the stuff lies is in the fish guts. So maybe I am exposing myself to mercury but I don't eat it every day. In the Mackenzie, I don't know how high or low... I do take a lot of jackfish gut that I eat."*

He also shared about the use of fish remains and particularly guts: *"A lot I feed the eagles but in the last while, we are trying to keep some of the meat to start producing our own bait for trapping."* Chief Sanguéz shared that he wanted to set a net at Sanguéz Lake but realizes that it would be better to wait and do it scientifically to gain more understanding about the reduction of mercury by fishing out big fish. He insisted with Carole Mills that this is a pilot project the community is interested in.

Bruce affirmed that Chief Sanguéz asked the question about fish guts last year and inquired again to get an answer. Heidi answered: *"Mercury is one of those tricky contaminants that actually that is mostly stored in muscle. So while some organism might be high in mercury but if you just ate the stomach and the guts that would be pretty low."*

George Low announced that a source of funding maybe available for the fish-down pilot project and may start that sooner than later. *"We are going to look into that and see if we can get it going next summer or winter."*

Dr. Hanning also sees the importance of gathering information on what exactly people eat: *"David Menacho was telling me that when they dry the fish in his family they include the skin along with the fillets. Knowing that can help us collect samples for nutrient analysis to be better able to balance those benefits with the risks."*

She followed up on the safety of the information and the way researchers collect it. It is an important point that everyone has to agree on at the beginning of the project. There are many aspects to consider:

"I think before anyone volunteered, - and from AAROM's survey it sounded like 40 per cent of the people said they were interested in having some information collected about them which might include blood or hair sampling - they would have to know what was done with that information and feel good about it. The whole study would have to be something that your group would feel good about how it was going to be conducted, the university would have very rigorous procedures."

Certainly, based on the studies that I have done in the past, an individual would get their own information with also some interpretation with what that meant so that they would be able to

understand if there was, or was not, a concern. How that information would be shared beyond that would be up to the individual.

For example, it is good to have decided ahead of time, if we have someone with high levels that may be concerned, if we share it with the Health authorities, or not. That is something that has to be decided ahead of time because the individual has to know.

Normally the data is given back to the communities of course but presented in a way that individuals are not identified in any way. Certainly, when the researchers want to put forward reports or presentations, or so on, usually there is an agreement with the community. Communities get to know about those things ahead of time, and participate in the process. That data is just on groups. So again, no individual can be indented in that way. It is something that we, as researchers, care about a lot. And that before you even start you have to be sure that everyone is comfortable with how the information will be collected, presented, and then shared back.”

Dr. Laird’ experience revealed that it is important to allow individual the choice of whether they want to take part in the whole study or just part of it. *“To do the dietary survey and give hair, but not give blood, that is okay. But, if we’re measuring blood samples, it is important that we collect an adequate number of blood samples to allow significant conclusions to be drawn”. Dr Laird also noted that those conclusions would be decided on in consultation with community members, for example through the Community-Based Steering Committee.. “It puts the onus on us, as researchers, to explain why we want that particular sample from the individuals who want to participate. The onus is on us to explain why the study is important and how it could be in their interest.” Dr. Laird then mentioned that, at the end of the day, every person would have the right to decide if they wanted to give a blood sample. If they preferred, they could participate and note give the blood sample.*

Chief Sanguex needs the results of the biomonitoring study to convince government of what mercury is doing to his people, and continue to gather information on how country food is impacted. The climate change workshop held in his community a few years back really scared him as a chief. It did. It is going to impact the kids that are coming up. *“We as chiefs are trying to do our best to try, and do anything and everything, to get the word out. If people don’t participate then we are lacking the information that we need to forge ahead until government knows this is what is happening.”*

Chief Sanguex sees the importance of contacting Diane Bronson from Food Secure Canada to inform her on what is happening with the mercury movement in the Dehcho. *“Periodically I get a hold of her and say: “What is Food Secure doing since the last movement in Edmonton? One of the most disturbing things that we hear is that the conservative government doesn’t really care. What is happening with food security is not just in the north it is everywhere. We are not just targeting native people, we are talking about the whole human race, around the world and government doesn’t really care.”*

The media are also a good way to make sure the messages are heard. The Dehcho Drum and CBC. *“I always talk to Peter Hope from CBC radio in our own language and explain to our people why we have to do this and I will do this after we are done here.”*

He concluded by reaffirming that this sampling needs to be done. Getting an understanding of what is happening is key as members are submitted to impacts that are beyond their control. *“Now we have an understanding of where the mercury is and our people understand it is from the air, it is from pollutants around the world, coal burning, those are the contributing factors. The elders had told us that they knew that it wasn’t our fault, we as aboriginal people never did anything. We knew that industry had got some okay from other areas to do some certain development that would impact us. (...) I got to tell my mom what is happening and she is 89, she still loves fish. I tell them about the mercury. She says she knows that if she doesn’t eat too much she will be okay.”*

Dr. Swanson wants to keep in mind that this biomonitoring study can help move the environmental work forward. *“ ... Sometimes we forget that we are part of the human environment. So we have been testing fish flesh but let’s say that Brian and Rhona find out that we should be testing guts, or flesh with more skin on, or more liver. Then in three years we can come back to this workshop and give you different results in all of the foods you are eating... but we don’t know what to test until we find out exactly what you are eating. So it will take us forward. It is important that these projects can really link into each other. And add value.”*

Bruce commented: *“I remember as a young biologist I would come to my supervisor research scientist with new ideas and he would look at me and say, so what? So I think this is an example of so what. We are starting to make the link.”*

Priscilla Canadian inquired about the ways people can detoxify their body from cadmium and mercury. Dr. Laird explained: *“It all depends on the level the person has been exposed to. As to whether or not the detox treatments that actually work whether they should be used. For people that are exposed to very high levels, there are treatments available through chelators. However, those chelators can have serious side effects that can create other health problems. They can hurt the kidney and liver for example. The only time a health professional will recommend using that kind of treatment is when the exposure is extremely high. The exposure levels where those type of chelators are prescribed are much higher than what we would expect to find in the Dehcho. There are less risky detox programs that are out there, but generally they just don’t work. There are people out there that try to make a buck harvesting people’s fears on expensive treatments that don’t work. What I tell my students in the undergrad class is be really wary of people taking advantage of your fear about mercury and selling you things that don’t work. Those people are out there.”*



Figure 10. Priscilla Canadien inquires about the way people can detoxify their body of mercury.

Bruce shared a period of history to make everyone smile: *“So like what happened when there was a radio isotope fear in California and they were black marketing iodine. The price of standard iodine pills went up 1000 times. This is what you warn the students about!”*

Jermaine inquired about any natural type of substance that could detoxify, to help the kidney in their 200 days natural filtration task on mercury. Dr. Laird has been looking at different traditional foods that might be able to help get mercury out of the body or stop it from being absorbed but the things he is working on are in really early stages. He does not know yet if they work or not. *“There is some thought out there that selenium supplements might help against mercury toxicity but one thing that is really important about selenium is that there are different types of selenium, just like there are different types of mercury. Toxicologists don’t have a good idea of the types that are protective and those that aren’t. And like other substances, too much selenium can be as bad as not enough. I don’t recommend anyone to buy those pills. Dr. Laird then explained that he thought it was best, when you are eating traditional foods, that whenever possible, you pick foods that are rich in selenium and other nutrients and relatively low in mercury.*

Bruce told a story to exemplified what he is trying to do with the kids: *“One of the things I used to do in a past life is deliver a diving program. I did it with aboriginal people in the north. I remember one time after going through this extensive training program, this Inuit from Resolute Bay looked at me just before we were about to put the regulators in our mouths and he said, “Should we be suspicious?” And I said, yes, be suspicious. That is what we try to show the kids. We were trying to help them understand about the building blocks, essential nutrients, nutrition and healthy choices so they are not going to be involved with the latest fad. I think we said it during the first workshop how do you know whether the food you are eating or the supplements you are taking are going to help. Well you would ask an elder, if the elder recognizes it as food that was number one and number two was if it is advertised on TV, it is not good. There is a lot*

of money being made with people's misunderstanding of essential diet and what the body really requires. The food you guys eat with respect to moose, and fish from the right lakes, boy that is good meals, healthy meals. Stay away from cigarettes."

Joe Tambour, the translator, shared about traditional detox treatments with the scientists: *"What I know maybe will help you and what you know could help me. One of the things I know is that years ago, when elders knew we had eaten something bad, they would have something for it. If I go down south for a week, I eat fast foods, when I get home what do I use to toxin it out? We use spruce gum juice. I use that to flush all the toxins out of me for fast food and it helps I will tell you.*

Everything fresh from a tree is our medicine. When we were young when we went out to the hospital or where we are being treated, they fill us with junk, medicines, and fluids. When we get back the elders get together and say, we know why you have a problem. Because you are no longer Dene, you are just full of fluids. One of the most important things is that they bath us in spruce. Rough.

Years ago, there was no sickness in our people because when we lived in the bush the smoke from the fire protected us. The spruce bough we sleep on protects us from sickness.

We don't go see doctors nowadays because I know what we can use that is more powerful than their medicine. So if you are really sick and you want a cure, healing, go in the bush for a couple days, sleep there. How did you guys feel when you slept over there? Big difference, eh? That is part of it. Instead of always four walls you sleep on the land. It heals you. I do a workshop on these things called TK, we call it nowadays that is our culture. I help people.

Talking to the elders, I tell him how come today we can't live as long as you. They are 96, two uncles. And they said because when we were young we didn't have a choice.

I know the water is polluted; I go in the bush. I will dig a whole put spruce bough in there and drink. Why? Spruce bough, it purifies toxins from the ground water and makes it pure. It is like our holy water. Something for you to think about.

Today when you get an animals you have to cut it fast, take it back before it spoils. I say why? This is a question I asked one of the scientists...they said today the rain is not as pure as it used to be. There are chemicals in that rain that goes in the food of the animals and affects them. And so we are studying the animals but don't know where that stuff is coming from...it is coming from the atmosphere, it is changing. The world is changing. Even the rain comes down and has chemicals in it because of the smoke stacks down south. Creating all this, and bringing it here. It is not our fault. It is because we created it and we didn't know that. What good we think might be for the people is bad for us up north.

See this beautiful place, the 5 lakes we have to protect them. Whatever goes up must come down. It is true. So whatever we eat has to be wasted someplace if we want to be healthy. Just a little thought I thought I would help you with. Mashi."

Jessica Jumbo from Trout Lake concluded with her experience: *"At home, we use a lot of natural remedies from the bush when people are feeling sick. I know what he means when he*

talks about using tree bark to detox. And we try to teach the younger kids that. We try to move more toward not taking pills.”

3.0 Sharing circle: what participants take home.

Each participant was asked to share one thing they thought was most important, or not even covered in the workshop that maybe is really important to their community or themselves.

Dr. Heidi Swanson: *“I just wanted to reiterate that it has been a privilege to be here and it has been a privilege to work in the Dehcho region and this is why I do what I do. One thing that I took from Stan that gave me something to think about and which I had not thought about before was considering some of the other effects of wildlife like beavers on the system and how it might be playing into the whole picture and how it might be tying into the whole security issue. It opened my eyes to a broader perspective.”*

Jessica Jumbo: *“It was really nice to see some results and am really interested in seeing any results in selenium, which foods are high in it and which we would be encouraged to eat more. I am really interested in doing this bio monitoring and would take the information back to my community and see if they would be interested in doing that too. Thank you”*

Chief Sanguéz: *“...we were kind of shooting in the dark where we were going to go with this, the contributing factors in this mercury are so overwhelming for our elders. They said the same thing, they wanted to know what we wanted to do from here on. I think we hit it on the third year, about doing the bio monitoring system. By next year we will know what will be the outcome for our people when it comes to country foods.*

I would like to know, with Bill Quinton study at Scotty creek, about the thawing contributing to the mercury increase. We asked that question in Kakisa but they didn't give us that answer...we don't know ...we want to do more studies and that is what he indicated with Kakisa.

But whoever participated in this workshop, please be mindful to let the communities know what is of concern at this country food workshop, the mercury, the selenium ...and help us.”

Chief Sanguéz reiterated his intention to share Dr. Laird information with the Leadership so they be empowered to work with governments: *“I want to make that available to the leadership and say, hey, there is a flag here ...the leadership needs to work with government and scientists and tell them ...I have to know if that is the factor,... what do we do if it is contaminated? How do you do that?”*

He also shared about the possibility to investigate and use traditional medicine: *“I know that there are answers around it (contamination) by using traditional medicines that our translator was talking about and Jessica...there are traditional medicines out there that may be contributing to the solution. One of things I have found out over the years is that rat root was a medicine. But rat root was never studied. That is one that maybe we can get a study done on, rat root. Mashi.”*

Carol Mills: *“I certainly appreciated the opportunity to come here. I found it a very informative workshop. I am glad to see so many things going on in the lakes here continuing on from the*

work that were done in the late 90s looking at the fish and the mercury. It is nice to see that Heidi is continuing the food web work. George has been working with us continuing some of the trend monitoring. I am glad that the water chemistry studies are being done too. Hopefully we can get a fuller picture of how these lakes are functioning. Why the mercury varies between fish and the lakes from year to year? And the new studies on the omega fats in the fish sounds quite exciting too because it helps weight in the pros and cons of eating some of the certain fish species. And I like to learn about people's concerns. So this has been very worthwhile, thank you."

Meagan: "I too am very excited to have been invited to this. I have taken away a lot from this workshop, especially considering that my studies are more on the socio-cultural side of food. It is really beneficial to understand a little bit more of the science side of it. And it was presented in a way that even me, being not "sciencey" really, I could understand and took a lot away from it. I appreciate that, thank you very much."

Dr. Brian Laird: "The one thing for me is how striking it has been to be here and receive your thoughts and your feedback on what we are talking about doing as the next step, building on this very large body of work that has been done within the Dehcho for many years now and moving on. Like Stan, I was particularly struck by Joe's comments about the way traditional knowledge might be integrated into any follow-up that happened within individuals that came back as exceeding Biomonitoring guidelines. And I am sure we can find a way to build that into part of the process in this project."

Dr. Rhona Hanning: "I am very grateful for having the opportunity to be here and I guess what has impressed me the most is the workshop itself and the process of the workshop because I think it is just wonderful opportunity from people from different perspective to share and I personally have learned so much and certainly am very impressed with all that has been going on and continues to go on. I am very excited about the possibility of returning and being able to contribute in what other way. Thanks"

David Menacho: "I am very thankful for being here. I would like to thank Brian for inviting me. It is my first time in another settlement in the Dehcho. I was always in the Sahtu. It is very exciting for me to finding out how things work in other regions. And I know we do it a little different in the Sahtu. I have been taking notes and can take back what I learned and what everyone talked about. We did a study on mercury in 2012. I asked Dr. Carole Mills if there was a follow-up we could do because we only studied the trout, not the whitefish. So that is one of the things I would like to go back to my members and say we do another study on other fish. Other than that, I like to thank everybody."

John McLeod: "This is the first time for me. But I did catch on to most of what you guys said. So I know more now than I did yesterday."

Sonya Frise: "This is my first time as well in Jean Marie River. I enjoyed my stay and all the food. The information and the studies, I can take back to my community and take it from there."

Pricilla Canadien: "This is my third time being here and I would like to thank George for the invitation to bring two fellow employees with me. It was a great experience to sleep in the bush."

Joe Tambour in his translation cubicle: *“I am going to say this from behind the bullet proof glass here! I want to say thank you and would love to share more information before I leave this world. I enjoyed my drumming here and would like to thank the Chief for allowing me to come and say a prayer to his elders that have passed on. I knew them all.”*

Nicolas de Pelham: *“A few years back I did some samples and stuff from Sibbeston Lake and Tetso Lake and wondered where that information was for Sibbeston Lake because that is where I go hunting and trapping and get fish from. I think it was Fisheries and Oceans that did that.”*

Edward Chico: *“I do river monitoring with Nick and other work later on. But what Stan said about the levels of mercury being there hundreds and thousands of years I have been to this meeting before and started to think about and try to explain it to an elder in Simpson what the meeting was about and it is hard to translate that to an elder and he wanted to know why it was like that. I told him that big fish, 10 to 12 year olds eating little fish, that contains mercury and it contains in the big fish and he looked at me and said, what did he eat before that, rabbit stew? He said when the creator made the world the bigger fish was always eating the little fish so I don't know why they just started when they started studying the fish, Mashi.”*

George Low: *“I enjoyed the workshop and camping out here. One night getting a sore back and going to Lucy's! Good crowd, good presentations. For the new study I think they have a sense of where they are going. The community knows what scientists are trying to do so that is the most important thing. So thank you everybody and have a safe trip back.*

I wanted to thank Stan for the lovely job he did of hosting this gathering and always speaking up for the land, water and fish. And I want to thank all his staff for putting on such a good workshop. ”

Bruce Townsend: *“It has been a meaningful meeting for me and meaningful visit last week as well. I really felt that I connected a lot better. Lots of room to go, but still very much appreciated the invitation. Always feel welcome in the community. I always found George receptive and generous. I thank him for the program he has put together here. The real energy lies in the commitment in this room and what the communities decide to do with it. Certainly the science side, university side and ARROM side is here to help. Glad to hear Stan is taking it to the leadership as well.”*

Chief Sanguéz: *“Because of the complexity of the proposals, I need everyone to help George put a good proposal in. Just go for three years George! Everyone will have to contribute to putting a good one together. I was hoping that it (the biomonitoring research) would be in another small community somewhere. Trout Lake! I want to just go boating ...”* He noted that information on climate change, mercury, fish study was. It was helpful that we went there.

Appendix 1: Contact Information of Resource People

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