Kitchenuhmaykoosib Inninuwug (KI) and Climate Change:

Co-Creating an Adaptation Strategy for the Big Trout Lake Watershed

Workshop Summary Report

April 11 and 12, 2013

Thunder Bay, ON, Canada

Prepared by Cheryl Chetkiewicz[1]

[1] Wildlife Conservation Society Canada, PO Box 10316, Thunder Bay, ON, P7B 6T8 cchetkiewicz@wcs.org

TABLE OF CONTENTS

SUMMARY

Indigenous people's 'low carbon' livelihoods have contributed little to the rise in global greenhouse gas (GHG) emissions and climate change, yet are disproportionally affected by its consequences. Indigenous peoples, particularly in northern systems, are being adversely affected by climate change because they depend on local biological diversity, ecosystem services, and cultural landscapes for sustenance, well-being, and cultural identity. Scientific analyses of current and forecasted consequences of climate change supports many Indigenous peoples' observations of climate change impacts (e.g., Krupnik and Jolly 2002). Yet, Indigenous peoples and their knowledge systems are marginalized in national and international discussions and decision-making about solutions and responses to climate change (e.g., adaptation and mitigation). The inclusion of indigenous peoples in national and international discussions about climate change, however, is about to change. The Arctic Climate Impact Assessment[2] as well as the Intergovernmental Panel on Climate Change (IPCC) Assessment Report (AR5 is due in 2014) both emphasized the need for greater inclusion of Indigenous peoples and their knowledge in global efforts to understand how climate change and adaptation and mitigation efforts impact Indigenous peoples and local communities as well as what barriers exist to their involvement in developing climate change solutions.

In northern Ontario, there has been little effort to engage with or understand how Indigenous peoples are experiencing and adapting to climate change. Government efforts have focused on generating downscaled climate change projections[3], regional vulnerability assessments[4], an adaptation plan for Ontario[5], and tools to address climate change adaptation (Gleeson et al. 2011). Various reports refer to the predicted changes in climate in northern Ontario including increased temperatures, decreased precipitation, permafrost melt, and a greater frequency of wildfire and flooding events compared to the last 30-50 years. These approaches have had little or no participation of First Nation communities and are not specifically included in Ontario's planning processes with First Nations in the Far North. More recently a number of researchers (e.g., Laurentian University, Lakehead, Hardess Planning Inc.) have begun to work with communities directly on climate change and adaptation planning.

Wildlife Conservation Society (WCS) Canada has been studying the impacts of climate change on lake trout since 2007 and hosted a climate change adaptation planning workshop on freshwater fish in the Far North in 2012. In 2013, we convened community members from Kitchenuhmaykoosib Inninuwug

[2] http://www.acia.uaf.edu/pages/scientific.html

[3] http://www.mnr.gov.on.ca/en/Business/ClimateChange/1ColumnSubPage/STDPROD_093198.html

[4] http://www.climateontario.ca/

[5] http://www.ene.gov.on.ca/environment/en/resources/STDPROD_081665.html

First Nation (KIFN), primarily staff of the KI Lands and Environment Unit[6], and invited Indigenous and non-Indigenous climate change experts from around the world to discuss the likely impacts of climate change on valued resources in the KI territory, and the Big Trout Lake Watershed within the larger Severn River watershed. The goal of the meeting was learn about the issues in the KI territory and to discuss ways that WCS could support KI in their land use documentation processes and recognition of their Water Declaration[7].

The meeting was a first step in creating a dialogue on protecting and restoring the ecosystems on which KI culture and jurisdiction depends, specifically the fish required to sustain KI's culture into the future given land use and climate change. Ultimately, we hope this report will inform future research co-created with KI to fill knowledge gaps and support future vulnerability assessments and planning efforts to identify and evaluate adaptation options for KI.

ACKNOWLEDGEMENTS

Thanks to the community members of KI who attended the meeting, and to Tero Mustonen (SnowChange, Finland) and Patricia Cochran (Alaska Native Science Commission, Alaska, USA) for coming such a long way to be with us. We are grateful to Molly Cross who endured flight delays and revised travel plans from Bozeman and to Erika Rowland for producing the climate change maps for the workshop. Special thanks to Allan Lissner for recording the presentations during the meeting and sharing his stunning image for the report. Many thanks to Gleb Raygorodetsky who helped develop the concept, worked with Allan and KIFN on the film and story, and took the photographs for this report. This workshop would not have been possible without financial support from The Kresge Foundation, The W. Garfield Weston Foundation, and The Schad Foundation to whom we extend our sincere thanks.

WORKSHOP PARTICIPANTS

KITCHENUHMAYKOOSIB INNINWUG FIRST NATION (KIFN)

KIFN is located 600 km north of Thunder Bay. In 2013, the registered band population for KI was 1,576 people with approximately 67% living on reserve[8]. Community members speak *Anishininiimowin* (Oji-Cree) and English. KIFN is a member of the Independent First Nations Alliance (IFNA) along with Lac Seul, Whitesand, Pikangikum, and Muskrat Dam First Nations. The reserve is approximately 300 sq. km. In 1924, the *Indian Lands Act* between the province of Ontario and the Government of Canada was

[6] http://kilands.org/ki-lands-and-environment-unit/

[7] Available at: http:/*mcco.ca/system/files/Ab_neighbours/**Water**%20**Declaration**.docx*

[8] http://pse5-esd5.ainc-inac.gc.ca/fnp/Main/Search/FNRegPopulation.aspx?BAND_NUMBER=209&lang=eng=

enforced which gave the governments' authority over minerals and game on and outside reserve land. The Act was enforced to stop the over-killing of beaver due to the fur trade, but Elders remember it as a time of hunger and fear. The enforcement of the *Indian Lands Act* and impacts of this and subsequent community hardship became the trigger for the Big Trout Lake Band to sign an Adhesion to Treaty No. 9[9].

In KI's view, the signatories of Treaty No. 9 did not surrender their aboriginal title and aboriginal rights in and to the natural resources, but signed a treaty of peace and friendship with Her Majesty and Her Subjects. KI people believe that they signed the document with the British Crown as affirmed by the Royal Proclamation on October 7, 1763. Elders understood that the commitments made to the people were to last, "as long as the sun shines, the grass grows, and the rivers flow." This is reflected in the colours of KI's flag. KI people have a special, spiritual relationship with the land, based on the fact that it provides for all their needs. The land sustains their culture and way of life. There is no aspect of KI people's lives that is untouched by the land or water. KI's jurisdiction over its homeland, including the waters and resources, subject to the rights, sovereignty, ownership, jurisdiction and collective Title of the Kitchenuhmaykoosib Inninuwug remains their main goal. KI manages their homeland in accordance with its laws, policies, customs and traditions. This is why there is a high priority on protecting the unspoiled character of the land to support future generations[10].

It is with this spirit and conviction that KI is currently addressing land use and occupancy across its acknowledged traditional territory. In addition, KI declared that 13,025 sq. km of this territory, including the lakes, rivers, forest, wetlands, and Big Trout Lake, will be protected by the community from any development under the *Kitchenuhmaykoosib Inninuwug* Water Declaration. By protecting the watershed and associated wetlands, the Declaration *de facto* addresses one of the priority climate change adaptation areas for First Nations across Canada, specifically, deteriorating or changing water quality and quantity. Through this process, KI will not only inform future generations of the value of their homelands, but non-Indigenous stakeholders as well.

KITCHENUHMAYKOOSIB INNINUWUG LANDS AND ENVIRONMENT UNIT

Jacob Ostaman and Steven Chapman, *KIFN Lands and Environment Unit*

The mission of the Kitchenuhmaykoosib Inninuwug Lands and Environment Unit is to preserve and protect the KI Homelands from environmentally destructive human activities through the following activities:

---

[9] Diane Heibert and Marj Hienrichs. We are one with the Land: The history of Kitchenumaykoosib Innninuwug.

[10] From: Kitchenumaykoosib Inninuwug First Nation Searching Together Report. 2009. Mamow Sha-way-gi-kay-win. North South Partnership for Children in Remote First Nations Communities

- promote the preservation and protection of the KI Homelands;
- promote the principles of KI indigenous land use and occupancy;
- support KI in the development of economic activity that is sustainable and in accordance with the principles of KI indigenous land use and occupancy;
- promote and sponsor KI in the defense and protection of the environment within KI Homelands;
- sponsor and encourage research and publication of educational materials with respect to fish, animals, forest, water, land and others within the KI Homelands, and the sustainable relationship between KI government and the natural environment;
- network with other organizations and enlist their support in pursuit of our purposes;
- work with appropriate levels of government in support of the protection of KI Homelands; and,
- raise funds to support the mission.

Jacob Ostaman (standing) describing the work of the KIFN Lands and Environment Unit with John Cutfeet (writing), and David Peerla , advisor to KIFN. © Gleb Raygorodetsky/WCS Canada.

WILDLIFE CONSERVATION SOCIETY CANADA

Wildlife Conservation Society (WCS) (www.wcs.org) is the oldest environmental non-governmental organization (NGO) in North America, founded in 1897 as the New York Zoological Society. WCS Canada (www.wcscanada.org) was incorporated as an independent, Canadian NGO in 2004. In Ontario's Far North, WCS Canada has focused on scientific research (applied and field-based) on caribou, wolverine, and impacts of development and climate change on freshwater fish with applications to policy, legislation, species management and recovery planning, community-based and regional land use planning, and environmental assessment. In 2009, we became more active in addressing cumulative effects, environmental assessment, understanding the impacts of new infrastructure within intact

landscapes, and working with First Nations to support their needs for science and tools for planning. As part of a broader interest in addressing vulnerability to climate change and adaptation options in the Far North, WCS Canada along with WCS' North America Program scientists hosted a science-based workshop on freshwater fish in December 2012[11].

WCS Canada recognizes that in northern Ontario, freshwater fish as well as other wildlife and the ecological systems are inseparable from First Nation social systems. WCS Canada is committed to supporting First Nations communities caring for their lands, values, and the traditional knowledge that forms the basis of their livelihoods and rights. WCS Canada recognizes that the only way to better understand the effects of climate change and develop viable adaptation and mitigation programs is to work with local communities in an equitable and mutually agreed upon respectful process that meets the priorities of local communities.

Dr. Cheryl Chetkiewicz is an Associate Conservation Scientist with WCS Canada. Cheryl grew up in Zambia, England and Canada. Since 2009, Cheryl has worked for Wildlife Conservation Society Canada developing broad-scale conservation approaches to support land- use planning, environmental assessment, and conservation in Ontario's northern boreal.

Dr. Jenni McDermid is the Fish Conservation Research Scientist with WCS Canada. Her research focuses on impacts of climate change and resource development on freshwater fish.

Dr. Molly Cross is the Climate Change Adaptation Coordinator for the North America Program of WCS. Her work brings together experts in the fields of climate change, ecology, conservation planning and natural resource management to translate broad-brush adaptation strategies into tangible conservation actions.

[11] http://www.wcscanada.org/AboutUs/Publications.aspx

Cheryl Chetkiewicz describes the history and work of WCS and WCS Canada. © Gleb Raygorodetsky/WCS Canada

SNOWCHANGE COOPERATIVE

SnowChange (http://www.snowchange.org/) was started in late 2000 to document and work with local and Indigenous communities of the Northern regions. The organization is devoted to the advancement of tradition and culture and holds traditional knowledge, stories, handicrafts, fishing and hunting and other elements of their cultures sacred. Snowchange Cooperative is a network of local and Indigenous cultures around the world – their partners include the Saami, Chukchi, Yukaghir, Inuit, Inuvialuit, Inupiaq, Gwitchin, Icelandic, Maori, Australian Aboriginal and many other local and Indigenous peoples and communities. Finally, SnowChange Cooperative is also a powerful scientific organization. They work with the Arctic Council, Intergovernmental Panel on Climate Change, Indigenous Peoples Climate Change Assessment, National Science Foundation of the USA, several universities and partners on questions of biodiversity, climate change and local communities. SnowChange has created books, photo albums, international conferences, and political change. SnowChange represents the positive change the North needs. In the past 10 years, SnowChange has developed into a major force in international climate and indigenous policy and research. In 2002, SnowChange won the prestigious Worldwide Fund for Nature 2002 'Panda Prize' for best national ecological project.

Dr. Tero Mustonen, a passionate defender of traditional worldview and cosmology of his people, is a Finn and the head of village of Selkie in North Karelia, Finland. He is the traditional knowledge coordinator for Eurasia for the Arctic Biodiversity Assessment. Tero is the Director of SnowChange and a

well-known scholar of the Arctic biodiversity, climate change and Indigenous issues. He lives in the middle of the last old-growth forest in Selkie with his wife, Kaisu, 2 goats and 10 chicken without running water. He is a winter seiner. Mustonen has won several human rights and environmental awards for the work with Snowchange and Indigenous peoples of the Arctic. He is also an adopted full status member of the Kwakwakwala First Nation based in British Columbia, Canada.

ALASKA NATIVE SCIENCE COMMISSION

The Alaska Native Science Commission (ANSC) (www.nativescience.org & www.nativeknowledge.org) is a 501 (c) (3) non-profit organization with a mission to endorse and support scientific research that enhances and perpetuates Alaska Native cultures and ensures the protection of Indigenous cultures and intellectual property. ANSC was established in 1994 through a grassroots resolution from the Alaska Federation of Natives Annual Convention. ANSC has an all-Native Board of Commissioners representing the state geographically and culturally. ANSC maintains close relationships among local, regional and statewide organizations and agencies, and Alaska Native communities through its informational and research initiatives.

One of the major goals of ANSC is to provide information to the target audience of Alaska Native communities regarding science and research that impacts their health, life, culture, and environment. The ANSC functions as a clearinghouse for research, an information base for ongoing and past research, and as an archive for significant information involving the Native community. ANSC provides a means of creating partnerships for circumpolar indigenous peoples, local communities, researchers, government and private agencies, and educational institutions. The networking system includes Alaska Native communities, tribes, councils, service and health organizations, profit and non-profit organizations, state and federal agencies, researchers, universities, and international organizations.

The organization's funding has primarily come from the National Science Foundation. Additional funding support has come from federal, Native, and private sources. The Commission has administered and collaborated on projects funded through agencies such as the Northwest Arctic Borough, U.S. Environmental Protection Agency, the Alaska Humanities Forum, Copper River Native Association, Alaska Science and Technology Foundation, U.S. Census Bureau, and the National Oceanic and Atmospheric Administration. Over the past eighteen years, ANSC has conducted statewide regional meetings with Alaska Native communities to identify and address science-related issues and concerns. ANSC conducted meetings in seven regions – Northwest, Arctic, Interior, Western, Yukon-Kuskokwim, Southcentral and Southeast Alaska. Reports from these regional meetings are distributed to communities and listed on ANSC websites (www.nativescience.org & www.nativeknowledge.org).

As an advocate for Native Science, ANSC provides leadership and vision to assist communities in development and sustainability by providing training and technical assistance and facilitating a climate for developing partnerships between researchers and communities. At the international level, ANSC is collaborating with indigenous communities to bring together scientists, Native leaders and others, to share information and experience in the development of opportunities for continuing collaborations.

Ms. Patricia Cochran serves as Executive Director of the ANSC and has served as Chair of the 2009 Indigenous Peoples' Global Summit on Climate Change and is Co-Chair of the Indigenous Peoples' Global Network on Climate Change. She is the past Chair of the Inuit Circumpolar Council and former Chair of the Indigenous Peoples' Secretariat to the 8 nation, Arctic Council. Ms. Cochran has served as Principal and Co-Principal Investigator on numerous research projects throughout the Arctic, including the Survey of Living Conditions, Traditional Knowledge and Contaminants Project, Indigenous Knowledge Systems Colloquium and Bering Sea Sub Network.

CONVERSATIONS WITH THE EARTH

Conversations with the Earth (CWE) (http://www.conversationsearth.org) was founded in 2009 by an international indigenous-led advocacy and education organization for the rights of indigenous peoples, Land Is Life, renowned experts in participatory video, InsightShare, and award-winning photographer and expert in sustaining oral traditions, Nicolas Villaume, founder of *Conversations du Monde*. CWE also draws on contributions from a range of writers and editorial sources.

Conversations with the Earth is a growing network of indigenous groups and communities living in critical ecosystems around the world, from the Atlantic Rainforest to Central Asia, from the Philippines to the Andes, from the Arctic to Ethiopia. As part of CWE, the indigenous communities are able to share their local stories of climate change – both impacts and response. By supporting the creation of sustainable autonomous indigenous media around the world, and by keeping in contact with communities that have participated in the creation of CWE photostories, CWE fosters long-term relationships with communities, based on principles of Free, Prior and Informed Consent (FPIC), local control and support for indigenous media capacity.

Indigenous voices have important knowledge and wisdom to contribute to the global discourse on climate change, which will determine global choices in shaping our collective future. From Manus islanders in Papua New Guinea working together to save their Oceanside homes, to Maasai villagers in Kenya responding to a cattle-killing drought in the open plains, Conversations with the Earth works to enable local indigenous communities to create first-hand accounts of their experience of climate change.

Dr. Gleb Raygorodetsky is an Adjunct Research Fellow with the UNU Institute for Advanced Sciences (UNU-IAS) on the Traditional Knowledge Initiative, contributing to the traditional knowledge and climate change program. Gleb is a conservation biologist with expertise in resource co-management and traditional knowledge systems. As part of UNU–IAS Gleb has continued to work in the field of biocultural diversity with a focus on participatory research and communication, indigenous rights, climate change mitigation and adaptation, and sacred natural sites. Prior to joining UNU-IAS, Gleb led the development of an innovative global grant-making strategy for the Christensen Fund on biocultural diversity and resilience. Gleb co-chairs the Ethics Program for the International Society of Ethnobiology (ISE) and is an active member of the IUCN Specialist Group on Cultural and Spiritual Values of Protected Areas (CSVPA).

ALLAN LISSNER, PRAXIS PICTURES

Allan Lissner is an award-winning photographer and filmmaker who was raised in Ethiopia, Liberia, USA, Nepal, Lithuania, Denmark, Jordan, Bangladesh and Canada.

For the past six years Allan has been working on collaborative multimedia projects with remote indigenous communities, documenting their efforts to protect their territories and preserve their ways of life. This ongoing work includes projects with over a dozen communities in the Philippines, Guatemala, Tanzania, Papua New Guinnea, Australia, Chile and Canada -- including Kitchenuhmaykoosib Inninwug and Neskantaga First Nations.

Some of the organizations Allan has done work with include Amnesty International, GlobalAware, the Indigenous Environmental Network, KAIROS, Oxfam, Make Poverty History, the Norwegian Church Aid, the Ontario Council for International Cooperation, the United Nations Development Program, and the United Nations Women's Association in Bangladesh. For more information, visit http://allan.lissner.net/

WHAT WE SHARED

KIFN LANDS AND ENVIRONMENT UNIT

Jacob Ostaman and Steven Chapman, *KIFN Lands and Environment Unit*

LAND DOCUMENTATION

Working with Terry Tobias and on behalf of KI, Steven and staff have interviewed 100 people and mapped some 16,000 features representing 62 different kinds of use-and-occupancy sites (44 harvesting-site and 18 fixed-cultural site categories). The map survey produced much material containing raw data: hundreds of individual biography maps and hundreds of hours of audio recordings. Raw data were also captured in interview record forms. KI has a set of thematic maps (each of which displays a subset of the 16,000 features) and a hodgepodge map that displays all 16,000 features (see figure below). Five Elders' field trips also provided opportunities to document oral history with videos and photos of various places in the Homelands and verify information collected in the interviews. Jacob highlighted a number of other projects they wanted to do including place name research, identifying travel routes, and conducting a harvest study to determine how much traditional foods are consumed. This documentation process supports KI land claims activities. The overall goal of this project is to show that land and the fish and wildlife on it have always been used and valued by KI. Jacob indicated that KIFN were no longer engaged with Ontario's Ministry of Natural Resources (MNR) community-based land-use planning process under the *Far North Act, 2010*.

Jacob and Steven explained that KI left the MNR planning process because of differences in understanding of jurisdiction and key aspects of the Far North Act with which KI did not agree including: 1) the power of Cabinet to override a land use plan where economic development was deemed to be in

the social and economic interest of Ontario; and 2) the unilateral creation of the legislation without free, prior, informed consent of KI, which they deem unconstitutional. By exiting this process, KIFN has no recourse to Ontario's land use planning funding.

WATER DECLARATION

KI Elders have repeatedly said that KI needs to protect the watershed and directed the development of the KI Water Declaration as a protection tool for future generations, fulfilling part of the vision of *Kanawayandan D'aaki*. A community-led process created the Declaration that includes 13,025 sq. km of lakes, rivers, wetlands, and Kitchenuhmaykoosib (Big Trout Lake). Jacob indicated the community is currently looking for a companion legal process (e.g., international) to gain protection for this land and water. Jacob also noted that protection means continuing their traditional uses such as hunting, fishing, trapping and gathering.

KI CONSULTATION PROTOCOLS

KI consultation protocols are a community-led process that have been approved. The protocols outline the laws that govern terms of entry for government, industry, etc. They declare that KI takes ownership of its resources, including the deposit, extraction, processing, and production of minerals.

In addition to assessing areas that need protection, next steps for the unit include assessment of potential development and a resource inventory (e.g., energy, roads, transmission/infrastructure) in addition to areas that need protection, and mapping and maintaining this information. In addition to these efforts, Steve described a number of challenges with research, scientists, and MNR over the years, including a legacy of some researchers coming in and doing work without their knowledge, consent, or returning the information. He indicated that his dream was to have the KI Homeland maps in syllabics and bring back the place names for their territory. The discussion around KI's presentation included the following:

- In order to prevent scientists from conducting research without community consent the Alaska Native Science Commission, for example, has developed a number of protocols for researchers coming to their communities that could be used as guidelines. These have helped communities redefine the researcher-community relationship.
- The research relationships with communities is more clear with University researchers where project funding that involves Indigenous peoples (e.g., NSERC, SSHRC, CIHR) has protocols, standards and review processes. For NGOs, like WCS Canada, these guidelines are not standard approaches, but represent best practises that NGOs should strive to implement. WCS Global has created an Internal Review Board to support ethical reviews of work that affects people to comply with US funding rules (e.g., USAID).

- KIFN is trying to get historic information from previous LUP processes such the Draft West Patricia Land Use Plan in the 1980s and maps created on land use and occupancy during the Royal Commission on the Northern Environment. This information has been recently located and is being digitized and repatriated to the community. Some of this information may be useful for current KI planning efforts.
- KIFN are hosting twenty-five ordinary people during June 17-23, 2013 to learn about the community, the people that live here, and the way things are. This event coincides with national Aboriginal week.

Steven Chapman illustrates some of the 16,000 features collected in their land-use-and-occupancy work ("hodgepodge map"). © Gleb Raygorodetsky/WCS Canada.

"THE BREATHING LANDS" FILM

Allan Lissner and KIFN

The First Nations community members (e.g., Elders, active hunters and fishermen) that still go out on the land see changes that need to be documented and shared with both community members (e.g., youth and other non-Aboriginal stakeholders and researchers studying climate change). KI wanted to tell their story about the importance of water and their watershed in their own territory in their own

way and share their observations of climate change impacting their territory to provide a foundation for discussing what and how KI could address these changes in their land use work.

During 2012, KIFN with Allan Lissner produced a film entitled, "The Breathing Lands". The film focused on changes across KIFN territory. Material for the film was collected through a combination of interviews with Elders and community leaders in the KI community (see guiding questions in Appendix 1) and a two-week canoe trip with eight community members. The goal of the video was to document and share information about KI's efforts to protect their water for future generations[12]. During the workshop, we screened a draft version of the film for the first time with participants from KI.

The film highlighted the following:

- Many things are changing - the stars and the moon are in different places, the trees are changing earlier in the fall, waterfowl and birds are arriving at different times of the year, some species are declining, and the weather is less predictable.
- *Kitchenuhmaykoosib* (Big Trout Lake) is a living system that reaches far beyond its shores. It provides clean drinking water for all life, habitat for the fish and water life, food and travel ways for people, and moisture for the air. Water is a sacred and needs to be looked after and protected.
- KIFN has had and continues to struggle with Ontario and industry processes that affect KI homeland. This includes: Platinex Ltd. in 2006 which resulted in the jailing of KI leadership, God's Lake Resources in 2011, and the unilateral withdrawal of 23, 181 sq. km. of land on *Kitchenuhmaykoosib Aaki* (KI homeland) by Ontario.
- The significance of *Kanawayandan D'aaki* which means "Looking after the Land" or "Keep my Land". KI people strive to be leaders of *Kanawayandan D'aaki* - the sacred instructions given to KI people by their Grandfathers and Grandmothers to pass to the next generation to look after the land. It is the spiritual mandate of KI to preserve and protect Kitchenuhmaykoosib Aaki (KI homeland). *Kanawayandan D'aaki* governs and binds KI to fulfill the sacred duty of looking after the homeland and the ultimate responsibility for protecting its resources for future generations.

In discussing the film, KI community members present decided that:

- This version of the film needs to be screened in the community and by leadership. Steve and Jacob would be responsible for making sure this happened. Allan would make necessary edits for KI based on community and leadership comments and wishes.
- Decisions about public distribution of the film and use would be determined by the community and leadership and communicated to WCS Canada, funders, or others that may interested in showing or sharing the film. Steve and Jacob would be responsible for this.

[12] http://www.canadiangeographic.ca/magazine/jun13/fawn_severn_watershed.asp

- There are actually many hours of video and recordings from other trips and activities in KI that could complement this film to make a bigger impact. There are clearly other films and stories that could be made to support KI goals and objectives.
- There are other platforms (e.g., web, exhibits, articles) for bringing the KI story to a bigger audience. Gleb discussed using the CWE platform as an option for sharing and distributing KI's message about climate change and land rights.

HOW ARE PEOPLE IN THE CIRCUMPOLAR NORTH ADDRESSING CLIMATE CHANGE?

Dr. Tero Mustonen, Director, *SnowChange Cooperative*

Tero shared the stories of two very different salmon rivers in Finland where both land-locked Atlantic salmon and Barents' Sea Atlantic salmon are an important cultural and natural resource.

The Jukajoki River Watershed

- Located in North Karelia, Finland, the Jukajoki River Watershed is 9,000 ha and has sustained many human impacts over the years but most severely beginning in the 1950s. Both hydro-development and peat farming have destroyed soils, wetlands, and dramatically changed rivers and hydrological cycles. There was a discharge accident from the peat plant resulting in highly acidic water systems and massive fish die-offs. Local fishermen and other community users have been aware of these damages, but government authorities did not act. Communities decided restore the watershed themselves, and eventually the peat company/peat production was discontinued and the damaged site was turned into the largest man-made wetland area in eastern Finland (120 ha). Climate change is increasingly a threat. In 2010, summer temperatures reached + 37°C causing major heat stress for fish, especially in shallower systems.
- The Jukajoki Restoration Plan beginning in 2011 is focused on: the creation of man-made wetland units; the use of traditional knowledge and fisheries to monitor fish health; oral histories as baseline for restoration; a science-based monitoring program; developing a process for collaborative management; and mapping of spawning and other crucial sites to restore them where necessary. Two peer-reviewed science papers have now been released as the basis for the restoration plan.

The Näätämö/Neiden Watershed

- The Neiden River flows from Finland to Norway and contains an internationally significant population of Atlantic salmon.
- The project included the Skolt Sámi and other Eastern Sámi communities, the Saa'mi Nu'ett cultural organization, and the Snowchange Cooperative. The Skolt Sámi, the majority of which live in Sevettijärvi, Finland, are Indigenous peoples living in present day Norway, Finland, and Russia. Together, they developed a community-based climate change adaptation plan for the

Ponoi and Näätämö Collaborative Management Plan after identifying their customary salmon fishery as a significant concern[13].

- The work in this part of the world has focused on documenting and restoring place names - in 4 languages - and documenting use and harvest sites, both historic and current. The work is being used to support the development of a co-management plan[14] including a complete reform of licenses for fishing. As part of the plan, the ecological restoration of salmon spawning sites includes addressing the impacts of climate change. Some of the options they are considering include physical restoration and increased harvest of predatory fish on salmon. They have also developed a digital database for this information based on a model created for Australian Aboriginal Traditional Knowledge Revitalization Pathways Project.
- Tero emphasized that unlike Canada, Indigenous peoples in his homeland have no land or water rights. For example, Finland has not ratified Sámi rights to lands or waters despite its international commitments. The co-management plan for the Näätämö/Neiden Watershed is the first of its kind in Finland and in the region and includes wide-reaching reforms to the management and harvest of salmon. It also includes the Kven and other local people living in the watershed in an unprecedented way.

[13] http://ourworld.unu.edu/en/the-skolt-sami-path-to-climate-change-resilience/

[14] http://www.snowchange.org/2013/04/a-new-collaborative-management-plan-for-the-naatamoneiden-watershed/

Tero Mustonen describes the project in the Jukajoki river watershed. © Gleb Raygorodetsky/WCS Canada

HOW ARE INDIGENOUS PEOPLE IN ALASKA ADDRESSING CLIMATE CHANGE?

Dr. Patricia Cochran, Executive Director, *Alaska Native Science Commission*

Patricia presented an overview of the Community Partnership for Self Reliance and Sustainability (CPSS) Project.

- The CPSS Project is a partnership between the ANSC, the University of Alaska Fairbanks (UAF), and Alaska villages by which communities identify their vision of self-reliance and work with the ANSC and UAF to refine that vision and implement it.
- Why? Rural Alaskan communities will face major challenges in the coming years from rising fuel costs, climate change and its negative impacts on fish/wildlife/habitat/and waters, increasing state population, decrease in government funds, and other changes that provide serious challenges to rural Alaska communities. At the same time, there is a high likelihood of declining resources provided to rural communities by state and federal agencies. If rural communities are to survive, they must become more self-reliant.
- Becoming self-reliant requires a holistic vision and processes to foster community resilience and self-reliance rather than emphasis on a single project. It also requires actions that are self-

empowering, solution-oriented, and focused on the long-term future of the community including:

- Developing practical strategies to meet the sustainability needs of Alaskan Indigenous communities by enhancing their capacity to solve problems on their own.
- Supporting and enhancing their self-reliance, despite the challenges of rising costs of energy and food, changing climate, and constraints on their capacity to maintain traditional cultural values in a modern world.
- Engaging communities to understand and collaborate to implement *their* concept of community self-reliance in the context of the modern world.
- Acknowledging that Alaskan indigenous communities have had to be self-reliant for thousands of years.

While CPSS cannot hope to enable the community to *achieve* their vision for self-reliance, it can collaborate with them on the initial steps along this path. Patricia described the process, which took two years to develop. Because the ANSC is an old and established institution, it was already a trusted and respected partner and leader for Native community research.

- They solicited interest from communities based on four questions about community perceptions of self-reliance.
- They identified 11 communities that were off the road network, had no access to AK oil revenues, had a reputation for community cohesion and innovation, had indicators of community well-being and sent letters of invitation to submit proposals to participate.
- Selected four communities and developed a Partnership Agreement and hired a liaison.
- They then held a series of community meetings that followed a traditional format (talking circles) focused on a number of assessments and evaluations to develop three priorities and actions to focus on, identify resources, and initiate an action plan. They also created follow-up processes and evaluation approaches.

The work with communities culminated in CPSS meeting in Fairbanks as a way of sharing with each other before development of final reports to each community. All four communities felt that the CPSS partnership had been a valuable experience, and each community hoped that the collaboration would continue by carrying out specific projects. According to comments from community leaders, it was important that the project began by having people from ANSC and UAF come to the communities and listen to what the communities had to say. They said that this was done in a respectful and culturally sensitive way. Perhaps the greatest benefit to communities was the chance for leaders to back away from immediate day-to-day problems and think about the big things that needed to happen in order for the community to move toward self-reliance. It was a chance to bounce ideas off people from outside the community who were concerned about their issues. The specific project benefits that each community received from the partnership differed among communities and were designed to meet the specific requests and goals of each community.

ANSC and UAF participants benefited enormously from this partnership. They gained a huge respect for the skills, knowledge, ingenuity, dedication, and good humor of the leaders in each community. They learned a great deal about the problems facing rural communities and ways in which communities had tackled and sometimes solved these problems. Perhaps most important, it challenged the way in which many university researchers have previously communicated with communities and made them think more carefully about how to communicate respectfully and effectively and how to make their research more useful and accessible to communities. The graduate students, in particular, came away with a much deeper understanding of the issues and opportunities in rural Alaska. This understanding will help them do their thesis research and in many cases has influenced their long-term professional goals.

Other outcomes from the CPSS included:

- Approaches that communities frequently mentioned as ways to increase their capacity for self-reliance included (1) the formation by Village Councils of both for-profit and nonprofit corporations to raise money and do projects, (2) purchase of equipment by for-profit corporations that could later be used for other projects, (3) training of community members to be employed on projects done within the communities, and (4**)** learning about projects or funding from other communities.
- Each community had at least one issue that differed from issues faced by the other three communities, was critical to community self-reliance, and was not addressed by any government program. This included funding for village relocation in Newtok, acceptance of Koyukuk's strategy of adapting to flooding by protecting infrastructure in place, secure rights to pure water in Igiugig, and rights to fish for salmon in Nikolai. Finding solutions to these problems was complicated because they were influenced by regulations and agencies that were not flexible enough to meet the needs of these communities.
- The high cost of energy, energy-inefficient housing, and challenges in developing renewable energy were major barriers to self-reliance emphasized by all communities. Each community had found *different* ways to address this problem. The ideas for how best to tackle the problems came from many sources, including ideas that arose within the communities, projects that they learned about from neighboring communities, ideas that had been described or demonstrated in regional or statewide energy or environmental workshops, and statewide or regional programs (e.g., weatherization).
- In general, the projects that community leaders were most enthusiastic about came from ideas that originated with the community rather than from top-down statewide programs. The capacity of the communities to write grant applications, which was often limited by time or by number of people with grant-writing experience, was important in making progress toward reducing energy costs. In spite of these innovations, energy costs are still the biggest economic problem faced by most communities and are an important opportunity for further progress.
- A second general problem emphasized by all communities was the increasing difficulty of harvesting enough food from the land and sea to meet community needs. The challenges differed among communities but included climate-induced changes in animal availability, legal

restrictions on hunting and fishing, increased cost of fuel to go hunting and fishing, and competition for harvest with people from other places. Many of these challenges require solutions that differ from one place to another and may require improved communication between communities and fish and wildlife managers. Alaska Department of Fish & Game (ADF&G) has recently moved the responsibility for responding to community requests from the Alaska Board of Game to ADF&G, which may improve the responsiveness to community requests.

In all cases new friendships and professional collaborations were formed because of CPSS that are likely to continue. Some general suggestions for next steps included (1) a website or small workshops to share community strategies and agency funding sources that can promote self-reliance, (2) training of community members in grant-writing skills, (3) degree programs at UAF (such as the rural development masters or the indigenous studies PhD) that are offered by distance delivery and cultivate community leadership. These initial suggestions required additional thought and discussion with leaders from these and other communities

Patricia Cochran describes the CPSS project developed in partnership with ANSC. © Gleb Raygorodetsky/WCS Canada

HOW ARE OTHER INDIGENOUS PEOPLES' ADDRESSING CLIMATE CHANGE AND COMMUNICATING THESE IMPACTS TO THE WORLD?

Dr. Gleb Raygorodetsky, Adjunct Fellow, *UNU-IAS Traditional Knowledge Initiative*

Allan Lissner, with help from Gleb, drafted a story for CWE and produced a photo panel based on the film. The draft photo panel was displayed alongside other CWE stories during the workshop for review. If of interest to KI, their story could become part of the multimedia and multi-platform CWE project (e.g., web, exhibit, films, DVD). A copy of the exhibit was given to KI for review and approval by the KI community and leadership.

In discussing the use of the KI story in CWE, KI community members decided that:

- The KI panel needs to go back to community and leadership for review of material (e.g., errors) and approval. Steve and Jacob would be responsible for this.
- KI would get a copy of the entire exhibit for use in the community to support their education and publicity needs and interests. Noah and Steve would be responsible for getting the exhibit to KI community and sharing with leadership, etc.
- Decisions about public distribution of the KI exhibit in CWE would be determined by the community and leadership and communicated with WCS Canada and Gleb. Steve and Jacob would be responsible for this.

Steve Chapman takes a break with the CWE exhibit and panel in the background. © Gleb Raygorodetsky/WCS Canada

CLIMATE CHANGE AND FRESHWATER FISH

KI community members asked for some information about what is causing climate change and why it is a problem. We watched a short movie[15] ("Fever") to provide an overview of the processes driving climate change around the globe and the implications for Indigenous peoples in particular.

WCS Canada staff presented information on the organization, the work we have been doing on climate change impacts on freshwater fish as well as planning for climate change adaptation. A series of climate change maps produced by WCS were reviewed by attendees, as were the scientific data for fish distribution in the Severn Watershed.

HOW DOES WCS ADDRESS CLIMATE CHANGE IN NORTH AMERICA?

Molly Cross, Climate Change Adaptation Coordinator, *Wildlife Conservation Society - North America Program*

Key points from this presentation included an introduction to key concepts and terminology as well as what WCS has been doing to address climate change adaptation in the places we work or have been invited.

- Adaptation is defined as adjustments in ecological, social, and/or economic systems in response to observed or expected changes in climate to alleviate adverse impacts or take advantage of new opportunities.
- Vulnerability of a species or ecosystem to climate change is a function of the amount of *exposure* to changes in climate conditions, the level of *sensitivity* to those changes in climate, and the *adaptive capacity* of the species or ecosystem to cope with that exposure and sensitivity.
- 'Adaptation strategies' are actions aimed at reducing vulnerabilities and/or taking advantage of opportunities related to climate change.
- In North America, WCS is working on climate change in a number of ways, including: 1) Understanding consequences of climate change (e.g., field research, modeling, syntheses of information); 2) Planning for those consequences with multiple groups and different decision-makers; and, 3) Implementing priority climate-informed actions with partners and allies.
- As an example of WCS's work on understanding climate change, Molly discussed a climate change vulnerability assessment for breeding birds in Alaska that was led by WCS.
- Planning processes led by WCS follow the Adaptation for Conservation Targets (ACT) Framework which includes several steps: 1) selecting key species, processes, or systems to focus on; 2) identifying the key climate- and non-climate-related drivers influencing a target species or

[15] http://www.lifemosaic.net/en/home.php

system; 3) developing and applying future climate scenarios to estimate future vulnerabilities and responses, and 4) developing potential adaptation options[16]. WCS has led climate change planning efforts in a number of landscapes across North America, on a number of species (e.g., grizzly bear, cutthroat trout), ecological processes (e.g., watershed hydrology, wildfire), and ecosystems (e.g., lowland boreal wetlands, Yellowstone River). The WCS Canada-led Freshwater Fish workshop held in December in Peterborough is an example of how we have applied this approach in Northern Ontario (described below).

Molly Cross highlighting some of the ways WCS understands the consequences of climate change © Gleb Raygorodetsky for WCS Canada

WCS CANADA'S FRESHWATER FISH PROGRAM

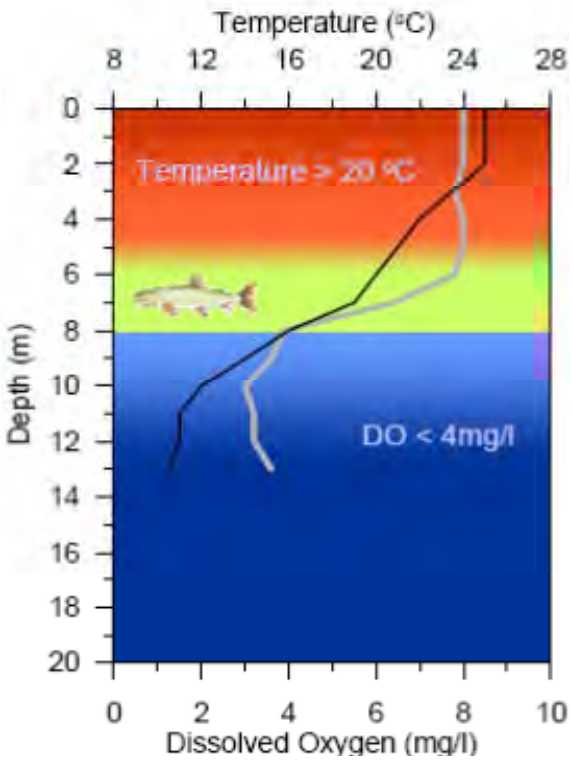
Jenni McDermid, Fish Conservation Research Scientist, *Wildlife Conservation Society Canada*

WCS Canada's Freshwater Fish Program established in 2007 grew out of the recommendations and research priorities identified in the WCS Canada Conservation Report by David Browne[17] that described what scientists knew about fish in northern Ontario, the potential impacts of development in northern

[16] http://link.springer.com/content/pdf/10.1007%2Fs00267-012-9893-7.pdf

[17] http://wcscanada.org/Publications.aspx#publications_ontario

Ontario and lessons learned from southern Ontario. There are three main areas of focus in the program: 1) Baseline monitoring and research for land-use planning; 2) Assessing the impact of human activities; and, 3) Impacts and mitigation of climate change on freshwater fish. There are a number of projects and activities for each of these. For the purpose of this workshop and the report, the activities around climate change are highlighted.



- Jenni described the evidence for stress or recruitment failure among lake trout populations. In Myrt Lake (south of the Far North), Jenni has been using hydro-acoustics and standardized netting to assess lake trout abundance. She has found that the lake trout are restricted to a tight band of water between 6 and 8 m deep.
- Upon full body sampling, she discovered that a large number of individuals had asymmetry in their gonads with a number of fish possessing only a single gonad that was occasionally malformed. There are few published studies in which asymmetry of gonads in fish has previously been reported and is associated with stress in fish. This type of asymmetry could have serious fitness consequences.
- Jenni also noted very few juvenile lake trout in their catches. Aging showed that fish are mature by 3 years of age whereas 6 years and older is more common for other lake trout populations in the area. Their diets had also changed dramatically from other lake populations.
- Jenni is also working with a number of students and the fish and eggs in this system to better understand the physiological response of coldwater species (brook trout and lake trout) to warming water temperatures.

OVERVIEW OF WCS CANADA CLIMATE CHANGE PLANNING WORKSHOP

Jenni described the planning workshop hosted by WCS Canada in December 2012 that brought 33 First Nations, academic researchers, and Ontario scientists together to look at freshwater fish and climate change in three watersheds - Attawapiskat, Ekwan, and Winusk - in northern Ontario.

- Freshwater fish were selected because there has been a warming of 1.8°C over the last 150 years and these warming impacts have had significant impacts on freshwater systems. Fish are

so sensitive to water temperature that they are typically within one of three guilds associated with temperature including:
    - Warm-water fish (e.g., smallmouth bass, sunfish) - prefer temperatures greater than 25°C
    - Cool-water (e.g. pike, walleye, yellow perch) - prefer temperatures of 15-25°C
    - Cold-water (e.g. brook trout, lake whitefish, lake trout) - prefer temperatures below 15°C.
- The approach included developing a conceptual model for impacts to freshwater fish (Figure 1) and reviewing a series of climate change maps based on climate data and models for the region (Figure 2).
- Outcomes from our workshop include potential impacts on fish due to climate stressors such as:
    - Climate change will: extend the range of warm-water fish, decrease the range of cold water, and will have variable effects on various cool-water fish.
    - Vulnerability is higher in shallow lakes and rivers and those with systems with limited groundwater.
    - All thermal guilds may be vulnerable to salt incursion along the coast, increased mobilization of sediment, and the loss of flow and droughts.
    - The Ekwan watershed may be most vulnerable to climate change.
    - Watersheds may be appropriate scales for conservation and planning for freshwater fish.
- Outcomes from our workshop include potential impacts on fish due to non-climate stressors such as:
    - Land uses exacerbate climate change impacts on freshwater fish.
    - Need to set goals/visions/objectives for the desired conditions in watersheds.
    - Each land use has its own direct, indirect and cumulative impacts on the aquatic ecosystems.
    - Attawapiskat watershed may be the most affected by land use changes given proposed projects in the Ring of Fire and existing De Beers Victor Diamond Mine.
- Climate change intervention points for action included:
    - Identify climate refuges, or places where suitable climate/habitat conditions for a given species, ecosystem, or process will be found in the future.
    - Climate change mitigation such as reducing GHGs and conserving "sink" habitats like peatlands.
    - Local level stewardship.
- Non-climate change interventions points for action included:
    - Planning by First Nations to improve infrastructure given population growth (e.g., eliminating diesel).
    - Industrial development including infrastructure will exacerbate impacts on freshwater fish due to climate change.
    - Need for scientific research to support community science in land use planning, environmental assessment, and dealing with various Ontario processes and regulations.

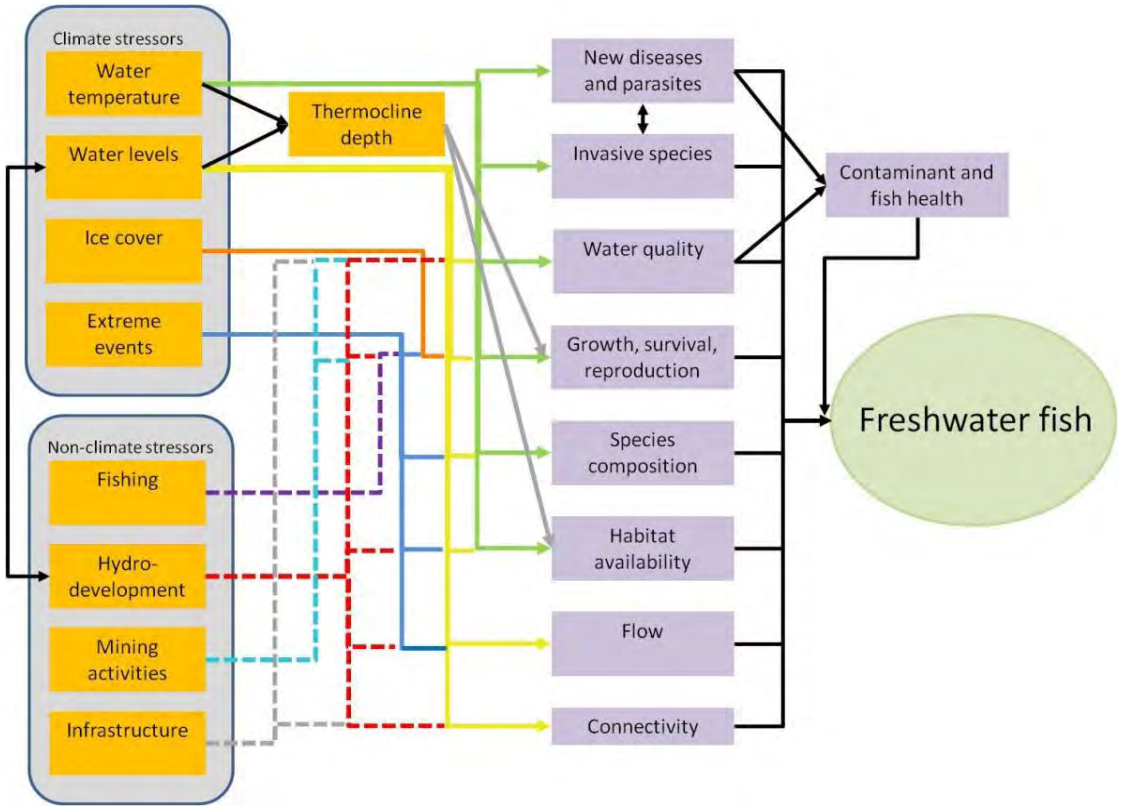


Figure 1. Conceptual model for climate and non-climate stressors on freshwater fish.

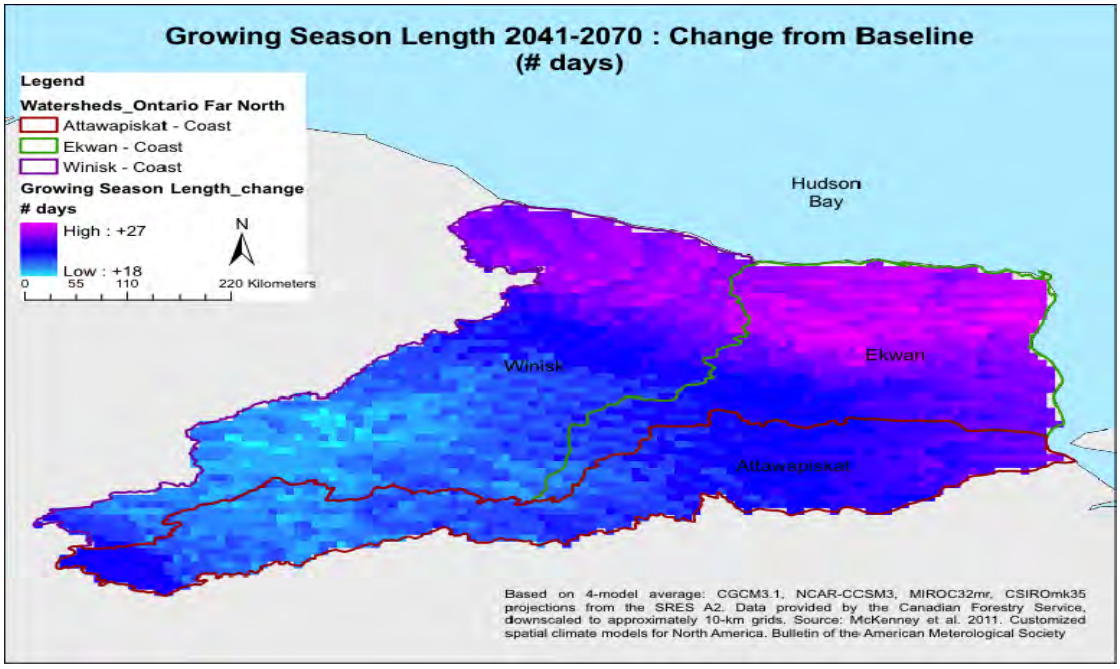


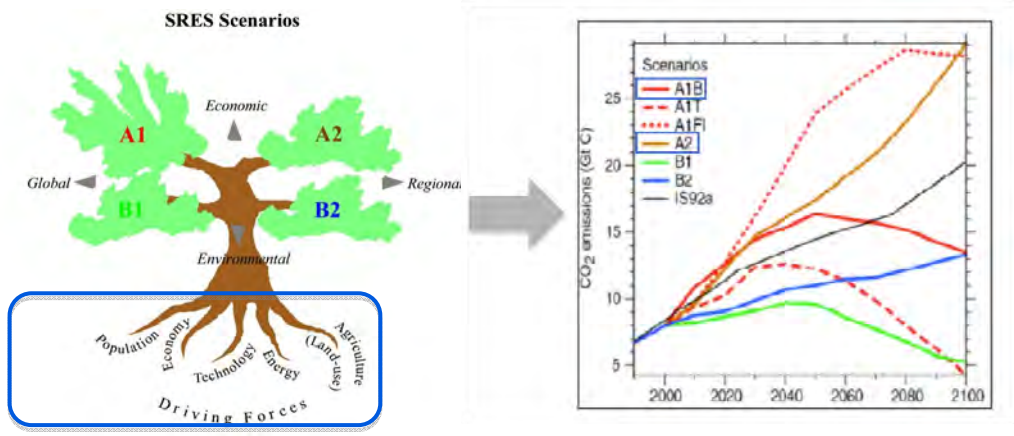
Figure 2. Growing season changes projected using climate models for the Attawapiskat, Ekwan and Winisk Watersheds.

CLIMATE SCENARIOS FOR FRESHWATER FISH IN THE SEVERN WATERSHED

Molly Cross, Climate Change Adaptation Coordinator, *Wildlife Conservation Society - North America Program*

Climate models represent one tool scientists use for thinking about the effects of changing climate. To build these models, scientists consider factors such as global population, land use, technology, and economy, and develop a set of assumptions about what the future will look like in terms of greenhouse gas output given certain changes in population growth, land use patterns, economical conditions, and technological advances. These are called greenhouse gas emission "scenario families".

Each scenario family explores how variations in these drivers effect future GHG emissions (Figure 3). For example, the A2 scenario assumes high population growth and consequently high changes in land use with increases in energy use. The anticipated amounts of future green house gas are entered into global climate models to produce outputs that we care about such as future temperatures and amounts of rain and snow. These outputs are typically mapped as grid cells at different resolutions.



IPCC 200,
Nakicenovic et al.

Figure 3. How scenarios based on different futures of population, energy use and land use are translated into GHG emissions models.

The models considered during the December workshop and for the purposes of our presentation were developed by Drs. Erika Rowland and Molly Cross with data from Natural Resources Canada, Canadian Forest Service (McKenney et al. 2011). The climatic and bioclimatic variables considered were based on projections from four general circulation models (GCMs) generated using the high A2 emissions scenario - which has already been surpassed in reality - and downscaled to 10 km resolution.

Variables examined for freshwater fish included annual temperature, annual precipitation, seasonal temperature and precipitation, maximum summer temperature, and growing season length for both the

historical baseline (1961-1990) and future (2041-2070) time periods. A plausible scenario reflecting projected changes for these variables across the Severn River watershed were: +3.4^{o}C in summer maximum temperature, a 6-11% increase in total annual precipitation, and an additional 20 days in growing season length. We examined the outputs of these future changes as maps (Figure 4-7).

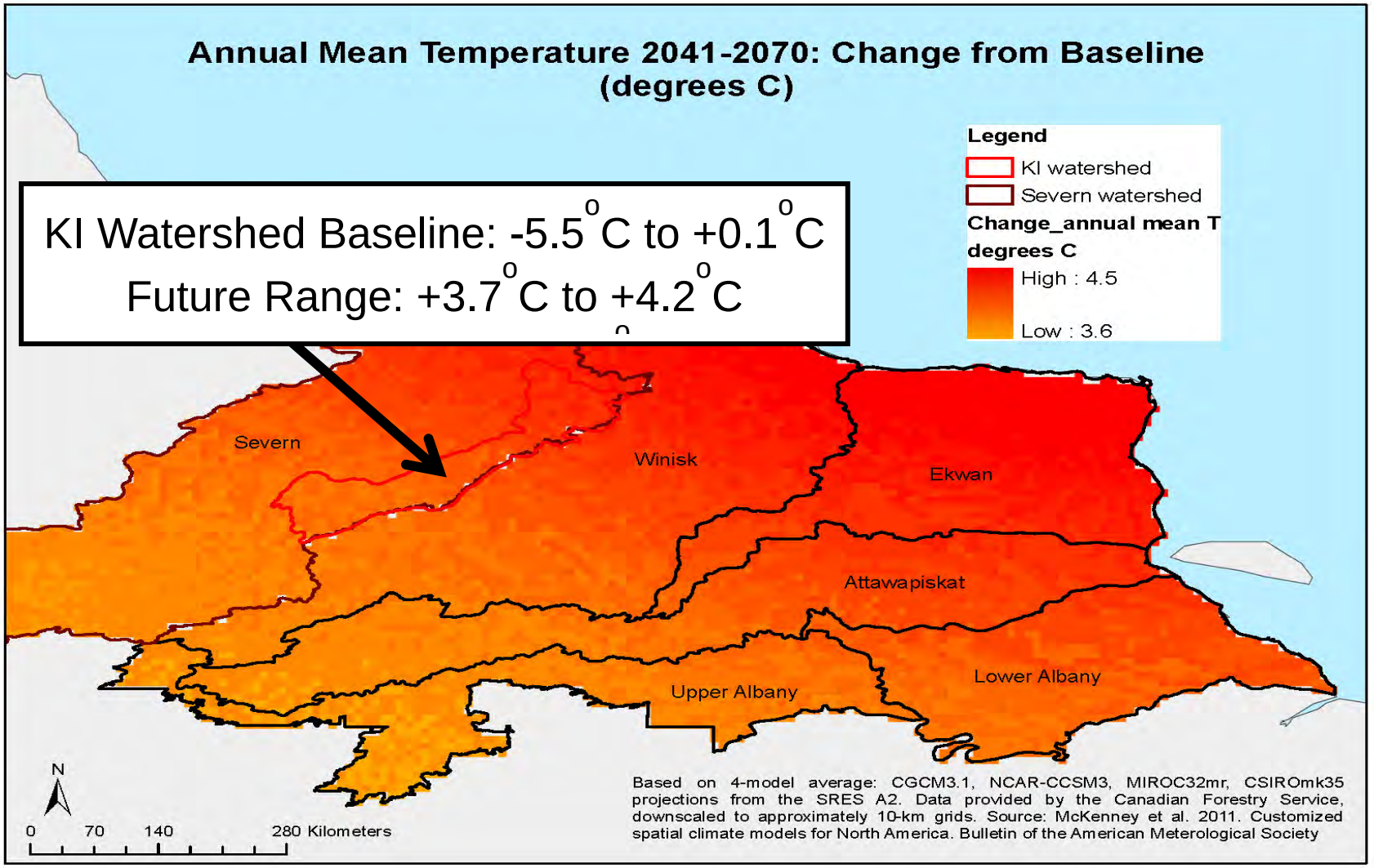


Figure 4. Map depicting the spatial heterogeneity across the Severn Watershed, including the Big Trout Lake watershed, of the change in annual mean temperature between the baseline (1961-1990) and future (2041-2070). The model predicts an increase of 4° C in the average annual temperature (-5.5° to 0.1°).

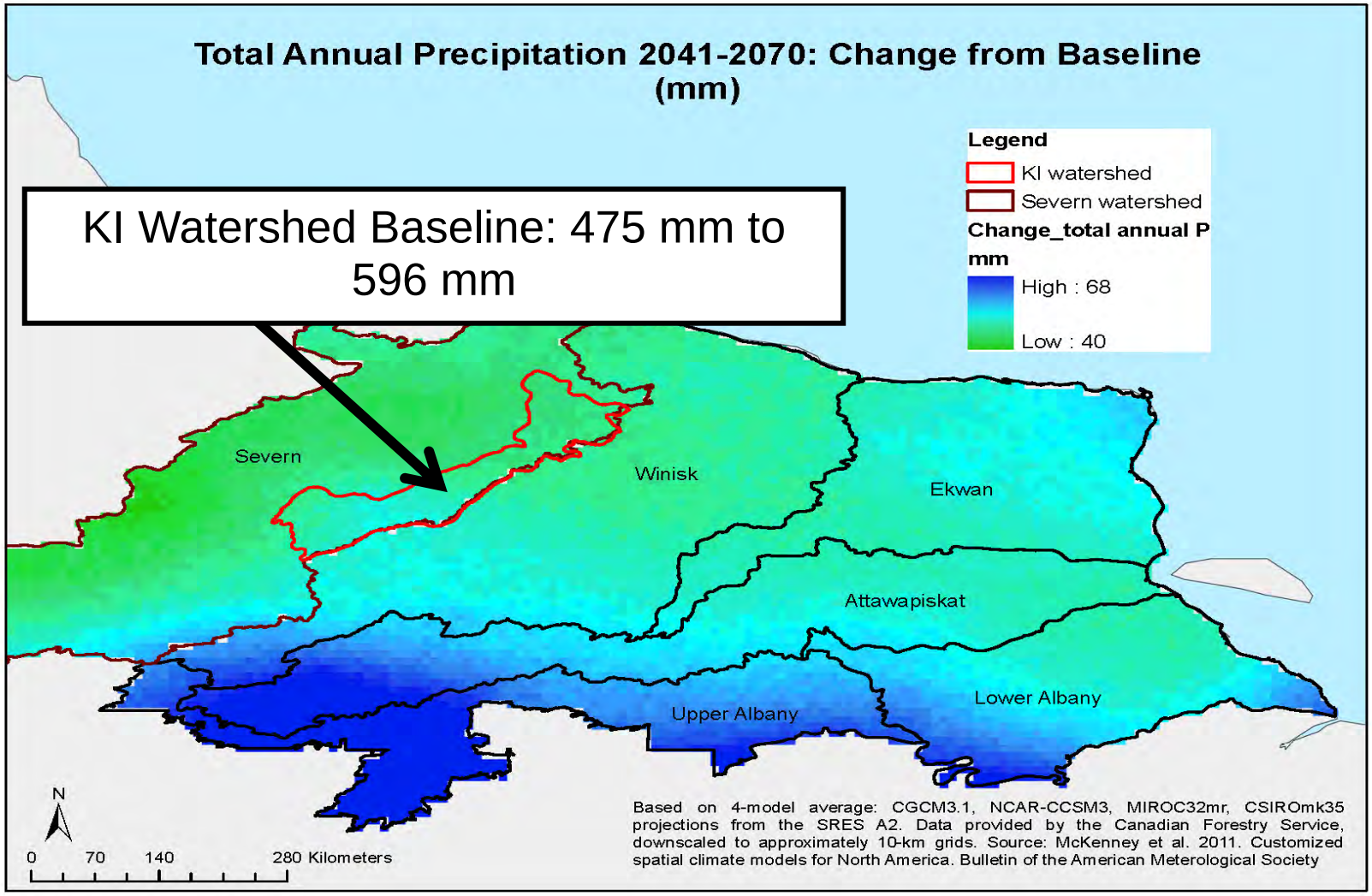


Figure 5. Map depicting the spatial heterogeneity across the Severn Watershed, including the Big Trout Lake watershed, of the change in annual total precipitation (e.g., rain, snow) between the baseline (1961-1990) and future (2041-2070). The model predicts an increase of 8% over current annual precipitation levels.

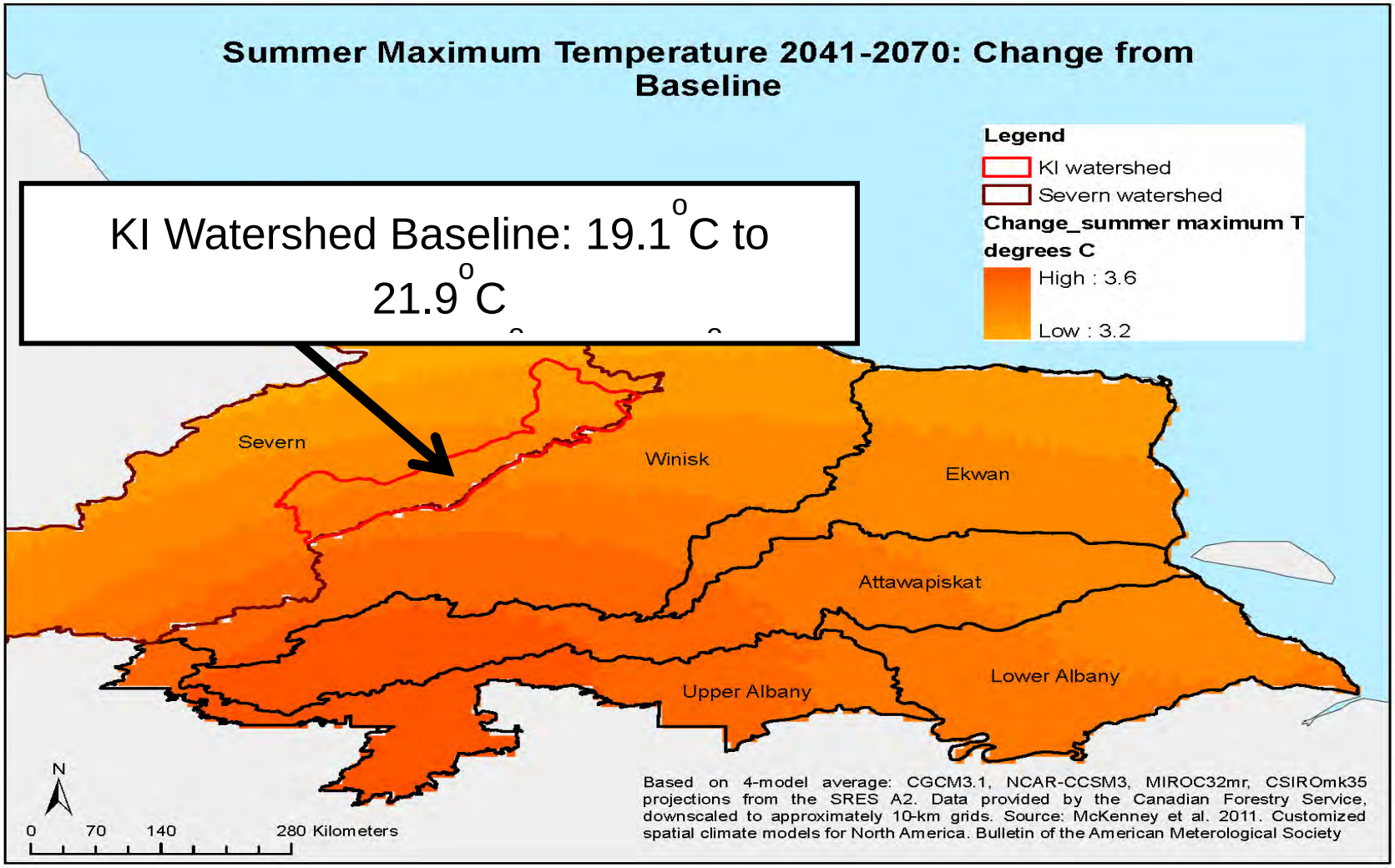


Figure 6. Map depicting the spatial heterogeneity across the Severn Watershed, including the Big Trout Lake watershed, of the change in average summer maximum temperature between the baseline (1961-1990) and future (2041-2070). The model predicts an increase of 3.4°C over current maximums of 19.1° to 21.9°.

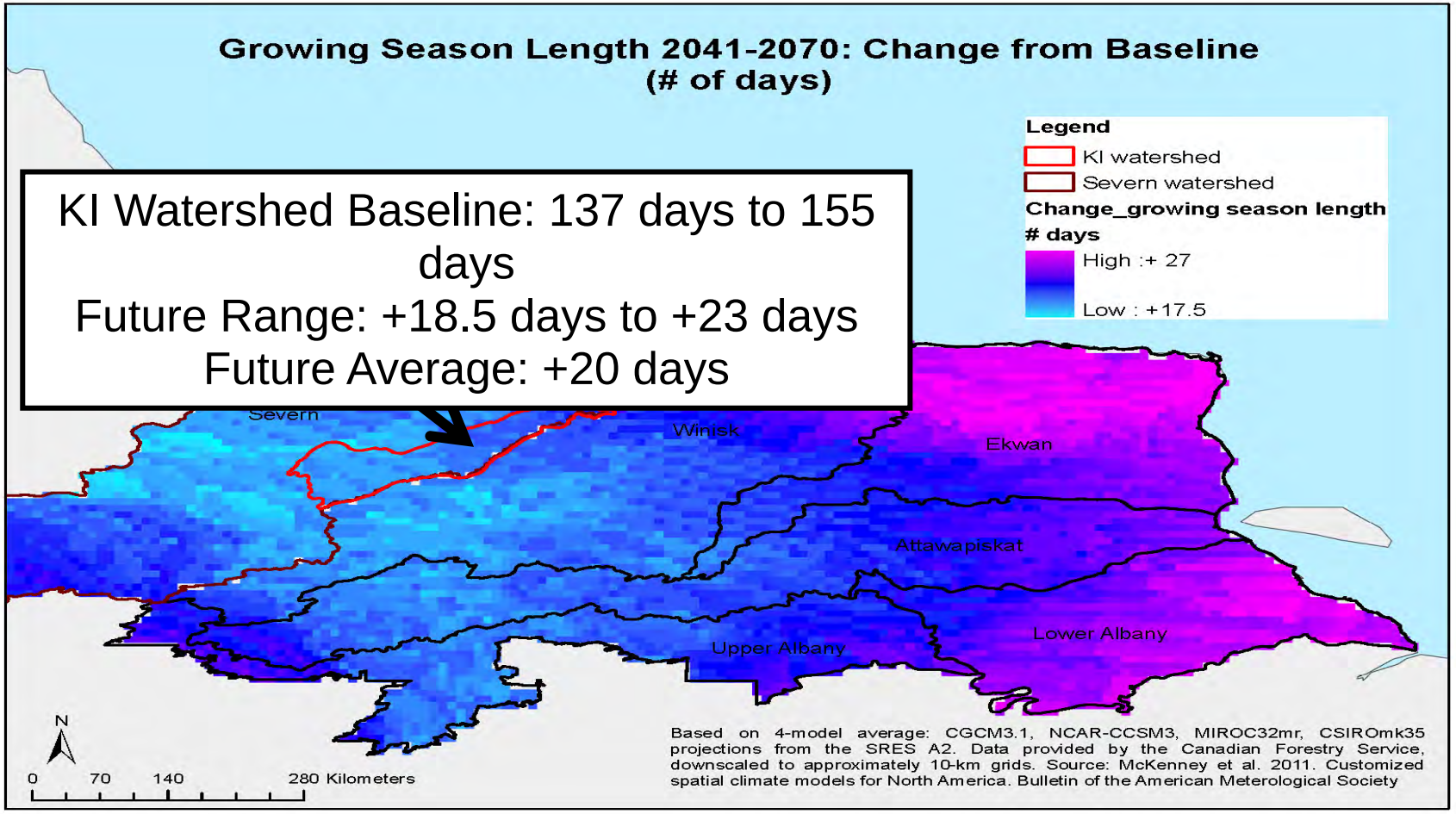
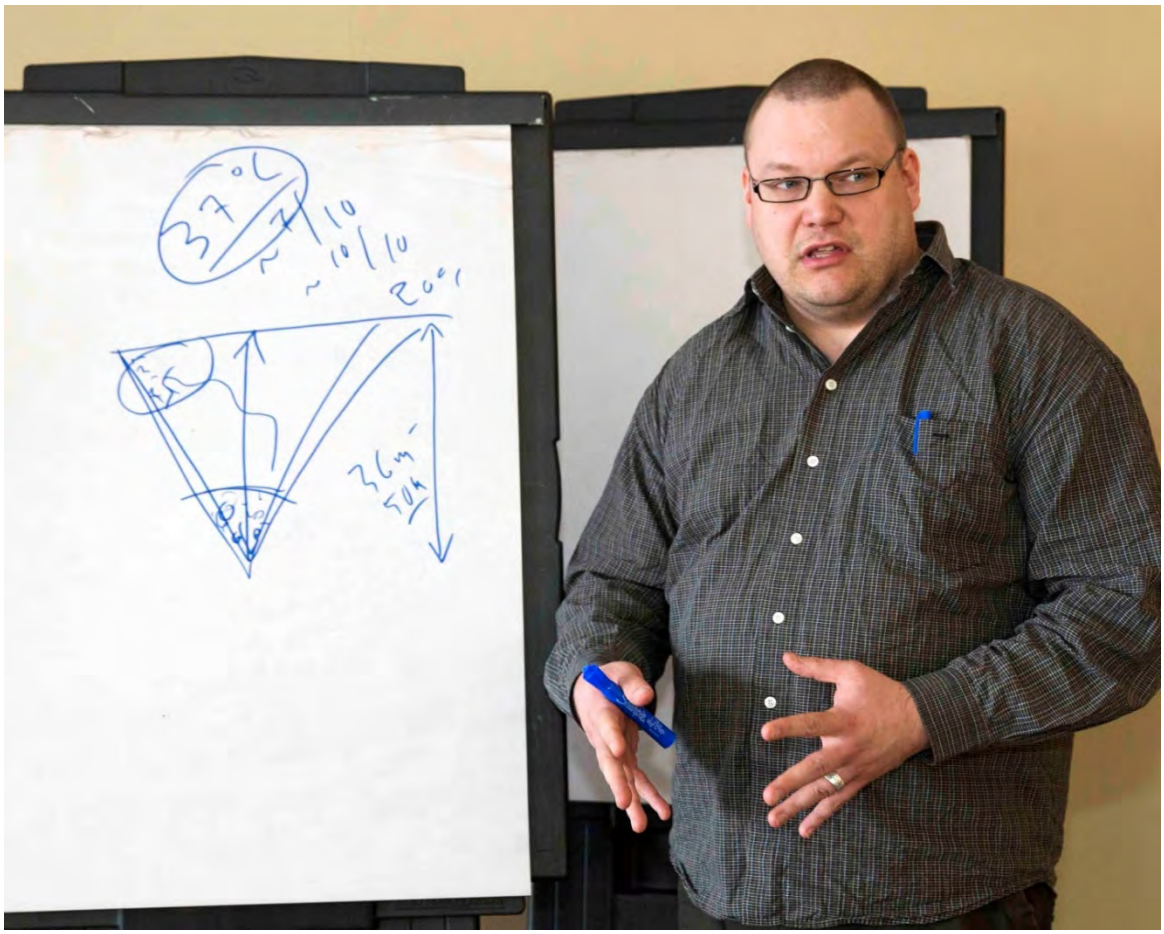


Figure 7. Map depicting the spatial heterogeneity across the Severn Watershed, including the Big Trout Lake watershed, of the change in growing season length between the baseline (1961-1990) and future (2041-2070). The model predicts an increase of 20 days over current baselines. Note: growing season for this map starts when the mean daily temperature is greater than or equal to 5°C for 5 consecutive days beginning in March. It ends when the average minimum temperature is less than -2 °C beginning on August 1. These rules are aimed more towards defining a growing season for tree species than fish as they are more clearly related to a frost free period. Further information can be found at: http://cfs.nrcan.gc.ca/projects/3/9

Workshop participants discussed the presentations and climate change data. The following points were made during the discussion:

- **People in KI are intimately connected to the lake and lake trout.** Jacob explained that in their language, the description of who they are as a people is people of the lake and lake trout - *Kitchenumaykoosib Inninuwug*. What happens to the lake and the lake trout happens to the people of KI. If the lake trout disappear, what will happen to the people of KI? This is their identity and it is linked to the Creator and the land. Elders have told them to take care of and protect the lake and the fish in it. Jacob and other community members acknowledged that they were missing the counsel and guidance of their Elders at this workshop.
- **The people of KI live and relate to their territory and orient their lives around six seasons** - winter, spring, mid-spring, summer, fall, mid-fall. Molly explained that climate maps, currently presented as annual averages, could be created based on these seasons to make them more relevant to the community in thinking about climate change adaptation and impacts.
- **Changes in the climate are changing fish distribution and behaviour and consequently fisherman on *Kitchenumaykoosib* must also change.** For example, fishing patterns on the lake, particularly distribution and success rates, have changed. Fish are now harder to find and move to "deeper" pockets in the lake making them more difficult to catch.
- **Climate change effects may interact with past environmental impacts from development to create more (cumulative) impacts than anticipated.** In KI, there have been a number of environmental hazards such as contaminants associated with a weather station and raw sewage had affected fishing in *Kitchenumaykoosib*.
- **Science and research can be useful for understanding what is happening to freshwater systems and the fish in them as the climate changes effects become more dramatic, especially in northern regions.** For example, Tero described how the extremely warm summer affected the distribution of whitefish in his lake. Whitefish moved to colder and deeper waters. When they were caught in the nets in the winter, fishermen found green eggs inside and they did not know what this meant as they had never seen it before. Only with the help of scientists, were they able to discover that the eggs were actually being resorbed by the fish due to climate stress and had changed colour as a result.



Tero Mustonen © Gleb Raygorodetsky/WCS Canada

Tero illustrates the whitefish lake dynamics near his village where fish were forced to respond to a significant summer warming event.

Stanley Bluecoat © Gleb Raygorodetsky/WCS Canada

Stanley Bluecoat, a councilor for KIFN and a net fisherman in KI, describes how the fishing in *Kitchenumaykoosib* has been changing since he has been fishing there.

Noah Chapman © Gleb Raygorodetsky/WCS Canada

Noah Chapman from KI, a rod fisherman, describes how the fishing in *Kitchenumaykoosib* has changed agreeing with Stanley on how fish are moving around and no longer where they used to be.

Steve Chapman © Gleb Raygorodetsky/WCS Canada

Steve Chapman describes a number of environmental hazards such as a weather station and raw sewage and the impacts on fish in *Kitchenumaykoosib*.

Patricia Cochran with (from left) Steve Chapman, Noah Chapman, and Stanley Bluecoat. © Gleb Raygorodetsky/WCS Canada

Patricia discusses various protocols developed by ANSC regarding climate change research and communities that may be useful for KI to consider going forward.

WHAT'S NEXT?

Overall, there was interest expressed among participants in moving forward on a community-based process for research that would support the goals and objectives of the Lands and Environment Unit and WCS Canada's efforts to support climate change adaptation planning and research on freshwater fish. This would also include potential funding and partnership opportunities.

Specific next steps included:

- WCS Canada and KI agreed to begin a research protocol/agreement process.
- CWE exhibit and story to return to KI for review, editing, and approval by leadership and community before further distribution and use. The exhibit is for the community to keep.
- Film to return to KI for review, editing, and approval by leadership and community before further distribution.

APPENDIX 1. QUESTIONS TO SUPPORT INTERVIEWS FOR THE FILM

Local Knowledge of Climate Change in KI

Main themes to guide the questions: 1) weather; 2) seasons; 3) fish, animals and plants; 4) water, including snow and ice; and 5) fire.

These questions are meant as a guide to help the discussion to cover the most important topics. The questions can be changed/omitted/new ones added depending on the nature and pace of the interviewer/interview interaction. In each group of questions, please provide as detailed answer/description of your observations as possible. The main issues to try and cover are:

- What changes are being observed? and,
- What impact are they having on the quality of life for people in KI and across the KI territory.

Weather/weather events

- Is the weather different from when you were growing up e.g., wind, rain/snow, heat/cold?
- Are you seeing any weather events that you haven't seen before e.g., thunder and lightning, rain in winter, tornadoes?

Seasons

- Are the spring, summer, fall and winter seasons coming at different times/months now than it did when you were young?
- Is the there more or less snow or rain?
- Have you noticed any changes in spring break-up or freeze-up?
- Have you noticed any changes in the river flow, lake sizes, and are you seeing places drying up because water is disappearing?

Fish, animals & plants

- Have you noticed any changes in the numbers and locations of different fish and wildlife compared to when you were young?
- Fish (trout, sturgeon, herring, etc.)
- Geese and ducks
- Moose and Caribou
- Beaver, marten, lynx
- Other animals
- Medicinal plants & Berries
- Insects
- Have you observed any new and or unusual species of fish, birds, wildlife, insects, and plants?

Water, Ice, and Snow

- Have you noticed changes in river and lake ice conditions compared to when you were young?
- Have you found any “drunken forests” or sinking lands i.e., leaning or fallen trees where permafrost has melted?
- Have any lakes or streams disappeared?
- Are these changes happening everywhere on KI territory or only in some places?

Fire

- Have you noticed more or less fires compared to when you were young?
- Have the fires gotten bigger or smaller in size?

Community’s well-being

- What do you think is causing all these changes?
- How are they impacting your life:
- Ability to hunt and fish?
- Ability to travel on the land?
- Road conditions?
- Safety on the land?
- How have you been trying to deal with these challenges?
- What would help you and the future generations of KI people deal with these challenges in the future?

APPENDIX 2. DRAFT AGENDA

DRAFT Agenda

Kitchenuhmaykoosib Inninuwug (KI) and Climate Change:

Co-Creating an Adaptation Strategy for the Big Trout Lake Watershed

April 11 and 12, 2013

Boardroom 2, Valhalla Inn

Thunder Bay, Ontario

Workshop Goal:

To facilitate a discussion about the projected impacts of climate change in Northern Ontario and local impacts on KI territory in order to support KI in their land use planning and documentation processes and Water Declaration for the Big Trout Lake Watershed.

Workshop Objectives:

Objective 1. Discuss key climate change vulnerabilities for Big Trout Lake Watershed based on KI collective traditional knowledge and most recent climate science, particularly for freshwater fish.

Objective 2. Discuss a set of KI priorities in developing a community-based climate change adaptation plan within and beyond the Big Trout Lake Watershed.

Objective 3. Establish a framework for a community-led research plan on climate change adaptation.

Thursday April 11

8:00—9:00 Continental Breakfast *(provided)*

9:00–9:15 Blessing and Opening Ceremony by KI Elder

9:15—9:45 Welcome and Introductions (Cheryl Chetkiewicz, Wildlife Conservation Society-Canada)

9:45 – 10:30 Screening of "The Breathing Lands" Film (with Allan Lissner)

10:30 -10:45 Break

10:45-12:00 Discussion led by Jacob Ostaman and Steven Chapman, *Lands and Environment Unit, KI*

- Water declaration
- Mining and development
- Land Use planning and documentation
- Climate Change

12:00–1:00 Lunch *(provided)*

1:00—2:00 Tale of Two Salmon Rivers - Climate Change, Traditional Knowledge and Ecological Restoration - Cases of Jukajoki and Näätämö in Finland –*Tero Mustonen, SnowChange*

Presentation and Discussion

2:00 – 3:00 The Community Partnership for Self Reliance & Sustainability– *Patricia Cochran, Executive Director, Alaska Native Science Commission*

Presentation and discussion

3:00-3:30 Break

3:30-4:30 Conversations with the Earth: Indigenous Voices on Climate Change - *Gleb Raygorodetsky, UNU-IAS Traditional Knowledge Initiative*

Presentation and discussion

CWE panel on KI

4:30 – 5:00 Bringing the day back to KI – Jacob, Steve, and others

Evening Dinner on your own (optional gathering at restaurant tbd ~ 630 pm)

Friday April 12

8:00—9:00 Continental Breakfast *(provided)*

9:00– 9:30 Introduction to WCS and Climate Change Adaptation Planning - Cheryl Chetkiewicz, Wi *Wildlife Conservation Society Canada* and Molly Cross, *Wildlife Conservation Society—North America Program*

9:30 – 10:00 WCS Freshwater Fish Program and Summary of Climate Change Workshop in December- Jenni McDermid, *Wildlife Conservation Society Canada*

10:00-10:30 Break

10:30-11:00 Big Trout Lake Watershed – Jenni McDermid and Molly Cross, *Wildlife Conservation Society*

- Introduce conceptual model for Freshwater Fish
- Introduce climate change models
- Provide hardcopy maps for Big Trout Lake Watershed

11:00-12:00 Discussion - Cheryl Chetkiewicz, *Wildlife Conservation Society-Canada*

12:00–1:00 Lunch *(provided)*

1:00—2:00 Discussion of key priorities in developing a climate change adaptation plan for KI watershed and homeland

2:00 – 3:00 Discussion of key research needs and opportunities (WCS, SnowChange, CWE, KI, etc.)

3:00 – 3:30 Break

3:30 – 4:30 Next steps and discussion

4:30 – 5:00 Closing ceremony and prayer, KI Elder

Evening Dinner on your own

APPENDIX 3. SCIENTIFIC OVERVIEW OF CLIMATE CHANGE IMPACTS ON FRESHWATER FISH[18]

A number of scientific studies have been conducted to assess and predict the consequences of climate change on freshwater habitats (lakes, rivers, streams, and wetlands) and the fish that depend on them. Climate change is predicted to affect freshwater ecosystems and fish in a variety of complex ways, particularly in northern hemispheres where a warming of 1.8°C has taken place over the last 150 years (Magnuson et al. 2000).

CLIMATE CHANGE IMPACTS ON FRESHWATER ENVIRONMENTS

Climate change influences: 1) ice cover; 2) water temperature profiles; 3) total water volumes; and 4) water quality of freshwater bodies (Schindler et al. 1990, Lofgren 2002). Climate change is predicted to increase surface water temperatures with increasing air temperature (Lofgren 2002); however the magnitude of response in freshwater ecosystems depends on characteristics of the waterbody, such as area, depth, latitude, and stratification (Gerten & Adrian 2001,Lofgren 2002). In the northern hemisphere, particularly boreal forests, lakes and rivers now freeze later, break-up earlier, and experience shorter ice cover periods (Magnuson et al. 2000, Benson et al. 2001).

Lakes in milder climates (e.g., temperate) generally undergo a process called thermal stratification as summer approaches. As air temperature increases, the surface waters warm whereas the bottom layer of water remains relatively cool. These two layers are separated by the thermocline — the transition layer between the mixed water layer near the surface and the deeper, colder water layer. During the summer, surface waters reach their maximum depth and stratification remains throughout the summer. Climate change may result in changes in length of seasonal stratification of lakes and the depth of thermoclines (i.e. the thickness of the surface water layer), both of which interact with a number of climate variables. For example, shallower thermocline depths result from rapid onset of spring stratification (Robertson and Ragotzkic 1990, Snucins and Gunn 2000), whereas deepening of thermoclines may be a consequence of warmer water and longer ice-free seasons (Schindler 2001).

Total water volumes are also predicted to change with climate. Warming is predicted to cause greater evaporation, which is expected to exceed anticipated increases in precipitation (Schindler 2001, Lofgren 2002). Mortsch et al. (2000) estimated that evaporation effects on watersheds would create an approximately 1 m drop in water levels. Consequently, a disappearance of wetland surface area (Schindler 2001), decreases in river flow (Schindler 2001), and ultimately decreased connectivity among aquatic habitats can occur. Decreases in nutrient input and increases in water transparency are also expected to accompany climate change (Schindler et al. 1990). Changes in productivity and nutrient

[18] From McDermid in Browne 2007.

inputs in northern lakes are likely to lead to lower phytoplankton abundances (Lofgren 2002), which can have cascading effects throughout the food web with consequences for fisheries.

HOW DO CHANGES IN THE FRESHWATER ENVIRONMENT AFFECT FRESHWATER FISH IN NORTHERN BOREAL LAKES?

IMPACTS ON FISH

Fish are directly influenced by the temperature of their environment, as it plays a role in the regulation of all physiological processes (Fry 1971). Freshwater fish can be grouped into three thermal guilds: 1) warm-water (e.g., smallmouth bass, sunfish); 2) cool-water (e.g. pike, walleye, yellow perch); and 3) cold-water (e.g. brook trout, whitefish, lake trout), with responses to climate change differing among them. Climate change can impact freshwater fish in two ways: 1) impacts on fish at specific locations, such as changes in productivity or health; and 2) impacts on the spatial distribution of fish populations, such as northward migrations (Shuter et al. 1998). Changes in ice cover patterns results in a lengthening of growing seasons and is generally predicted to increase growth and productivity of all guilds if suitable thermal habitat and nutrients are available. For example, Shuter et al. (2002) predicted an increase in yield and productivity of walleye north of 51° latitude as air temperature increases. However, increases in air temperature accompanied by decreasing water levels can result in declines in water quality that would negatively impact many fish species, especially at the egg and fry stages (Hunter et al. 1979, Williamson et al. 1997, Huff et al. 2004).

IMPACTS ON FISH HABITAT

Changes in water temperature profiles will alter the availability of habitat at or near the optimal or preferred temperature profiles for each fish species. Warm-water fish prefer temperatures greater than 25°C, cool-water fish prefer temperatures of 15-25°C, and cold-water fish prefer temperatures below 15°C. Thus as climate warms, the amount of thermal habitat available for warm-water species will increase, whereas we anticipate thermal habitat will decrease for cold-water species. For cool-water fish the response is more difficult to predict. Magnuson et al. (1990) suggested that climate change may expand thermal habitat for cool-water fish by extending the growing season. Casselman (2002) found that cool-water species were more negatively affected by colder than warmer temperatures. Cold-water fish, such as lake trout and brook trout, will be most adversely affected by climate change, and unable to inhabit lakes in the southern part of their current range, resulting in a reduced distribution as water temperatures increase (Snucins and Gunn 1995, Meisner 1990, Shuter et al. 2002). In addition, with increased evaporation and decreases in thermocline depth, subthermocline habitat available for cold-water species will decrease (Schindler 2001), leading to an overall decrease in productivity in lakes where cold-water species persist. Finally, unstratified and shallow northern lakes may warm beyond optimum temperatures for cold-water species (Schindler 2001).

IMPACTS ON FISH COMMUNITIES

Climate warming may accelerate the rate of spread of non-native species that flourish in warmer waters. A number of species are currently at the northern limit of their zoogeographic range south of 51° latitude, such as smallmouth bass, rockbass, fathead minnow, river and Iowa darters, and various *Notropis* species. These species have the potential for range expansion with climate warming and their abundance is predicted to increase as water temperatures increase and extend the growing season (Shuter et al. 2002). Smallmouth bass are currently held at their northern zoogeographic limit (south of 51° latitude) by climate (Shuter and Post 1990). It is, however, predicted that the northern limit for this species will advance 120 km north for every degree Celsius of air warming that occurs (Shuter and Post 1990, Sharma et al. 2009). Both cool and cold-water species are adversely affected by increases in both native and non-native warm-water species, through competition for resources (Shuter and Meisner 1992, Vander Zanden et al. 1999). Furthermore, this range expansion could also lead to the extirpation of over 20,000 cyprinid populations in Ontario (Jackson and Mandrak 2002).

INTERACTIONS WITH OTHER HUMAN ACTIVITIES AND LAND USE

Climate change impacts may also be exacerbated by overfishing (e.g., commercial, recreational, subsistence), and other land uses such as dams and mining that destroy habitat and fragment aquatic systems, as well as introduce non-native species, either deliberately through bait activities and stocking programs or as climate change creates new thermal habitat displacing native species (summarized in Browne 2007, Schindler 2001).

REFERENCES

Benson, B. J., J. J. Magnuson, R. L. Jacobs, and S. L. Fuenger. 2001. Response of lake ice breakup in the Northern Hemisphere to the 1976 interdecadal shift in the North Pacific. Verhandlungen International Verein Limnologie **27**:2770-2774.

Browne, D. R. 2007. Freshwater fish in Ontario's boreal: Status, conservation and potential impacts of development. No. 2, Wildlife Conservation Society Canada, Toronto. Available for download at: http://www.wcscanada.org/AboutUs/Publications.aspx

Casselman, J. M. 2002. Effects of temperature, global extremes, and climate change on year-class production of warmwater, coolwater, and coldwater fishes in the Great Lakes Basin. Pages 39-59 *in* N. A. McGuinn, editor. Fisheries in a Changing Climate. American Fisheries Society 32, Bethesda, Maryland.

Cross, M. S., E. S. Zavaleta, D. Bachelet, M. L. Brooks, C. A. F. Enquist, E. Fleishman, L. Graumlich, C. R. Groves, L. Hannah, L. Hansen, G. Hayward, M. Koopman, L. L. Lawler, J. R. Malcolm, J. Nordgren, B. Petersen, E. L. Rowland, D. Scott, S. L. Shafer, M. R. Shaw, and G. M. Tabor. 2012. The Adaptation for Conservation Targets (ACT) framework: A tool for incorporating climate change into natural resource management. Environmental Management **50**:341-351.

Fry, F. E. J. 1971. The effect of environmental factors on the physiology of fish. Pages 1-89 *in* W. S. Hoar and D. J. Randall, editors. Fish Physiology, 6. Academic Press, New York.

Gerten, D. and R. Adrian. 2001. Differences in the persistency of the North Atlantic Oscillation signal among lakes. Limnology and Oceanography **46**:448-455.

Gleeson, J., P. Gray, A. Douglas, C. J. Lemieux, and G. Nielsen. 2011. Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems. Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR), Sudbury.

Huff, D. D., G. G. Grad, and C. E. Williamson. 2004. Environmental constraints on spawning depth of yellow perch: the roles of low temperature and high solar ultraviolet radiation. Transactions of the American Fisheries Society **133**:718-726.

Hunter, J. R., J. H. Taylor, and H. G. Moser. 1979. Effect of ultraviolet irradiation on eggs and larvae of the northern anchovy, *Engraulis mordax*, and the pacific mackerel, *Scomber japonicus*, during the embryonic stage. Photochemistry and Photobiology **29**:325-338.

Jackson, D. A. and N. E. Mandrak. 2002. Changing fish biodiversity: predicting the loss of cyprinid biodiversity due to global climate change. Pages 89-98 *in* N. A. McGinn, editor. Fisheries in a Changing Climate. American Fisheries Society 32, Bethesda, Maryland.

Krupnik, I. and D. Jolly, editors. 2002. The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change. Arctic Research Consortium of the United States, Fairbanks, AK.

Lofgren, B. M. 2002. Global warming influences on water levels, ice, and chemical and biological cycles in lakes: some examples. Pages 15-21 *in* N. A. McGinn, editor. Fisheries in a Changing Climate. American Fisheries Society 32, Bethesda, Maryland.

Magnuson, J. J., J. D. Meisner, and D. K. Hill. 1990. Potential changes in the thermal habitat of Great Lakes fish after global climate warming. Transactions of the American Fisheries Society **119**:254-264.

Magnuson, J. J., D. M. Robertson, B. J. Benson, R. L. Wynne, D. M. Livingstone, T. Arai, R. A. Assel, R. G. Barry, V. Card, E. Kuusisto, N. G. Granin, T. D. Prowse, K. M. Stewart, and V. S. Vuglinski. 2000. Historical trends in lake and river ice cover in the Northern Hemisphere. Science **289**:1743-1746.

McKenney, D., M. F. Hutchinson, P. Papadopol, K. Lawrence, J. Pedlar, K. Campbell, E. Milewska, F. F. Hopkinson, D. Price, and T. Owen. 2011. Customized spatial climate models for North America. Bulletin of the American Meteorological Society **92**:1612-1622.

Meisner, J. D. 1990. Effects of climatic warming on the southern margin of the native brook trout, *Salvelinus fontinalis*. Canadian Journal of Fisheries and Aquatic Sciences **47**:1065-1070.

Mortsch, L., H. Hengeveld, M. Lister, B. Lofgren, F. Quinn, M. Slivitzky, and L. Wenger. 2000. Climate change impact on the hydrology of the Great Lakes-St. Lawrence System. Canadian Water Resources Journal **25**:153-179.

Robertson, D. M. and R. A. Ragotzkie. 1990. Changes in the thermal structure of moderate to large sized lakes in response to changes in air temperature. Canadian Journal of Fisheries and Aquatic Sciences **52**:360-380.

Schindler, D. W. 2001. The cumulative effects of climate warming and other human stressors on Canadian freshwaters. Canadian Journal of Fisheries and Aquatic Sciences **58**:18-29.

Schindler, D. W., K. G. Beaty, E. J. Fee, D. R. Cruikshank, E. R. Debruyn, D. L. Findlay, G. A. Linsey, J. A. Shearer, M. P. Stainton, and M. A. Turner. 1990. Effects of climatic warming on lakes of the central boreal forest. Science **250**:967-970.

Sharma, S., D. A. Jackson, and C. K. Minns. 2009. Quantifying the effects of climate change and invasive species on native species. Ecography **32**:517-525.

Shuter, B. J. and J. D. Meisner. 1992. Tools for assessing the impact if climate change on freshwater fish populations. Geojournal **28**:7-20.

Shuter, B. J., C. K. Minns, and N. P. Lester. 2002. Climate change, freshwater fish, and fisheries: case studies from Ontario and their use in assessing potential impacts. Pages 77-87 *in* N. A. McGinn, editor. Fisheries in a Changing Climate. American Fisheries Society 32, Bethesda, Maryland.

Shuter, B. J., C. K. Minns, H. A. Regier, and J. D. Reist. 1998. Canada Country Study: climate impacts and adaptation, fishery sector. Pages 219–256 *in* G. Koshida and W. Avis, editors. Responding to Global Climate Change: National Sectoral Issue, Canada Country Study: Climate Impacts and Adaptation. Environment Canada.

Shuter, B. J. and J. R. Post. 1990. Climate, population viability and the zoogeography of temperate fishes. Transaction of the American Fisheries Society **119**:314-336.

Snucins, E. and J. Gunn. 2000. Interannual variation in the thermal structure of clear and colored lakes. Limnology and Oceanography **45**:1639-1646.

Snucins, E. and G. J. 1995. Coping with a warm environments: behavioral thermoregulation by lake trout. Transactions of the American Fisheries Society **124**:118-123.

Vander Zanden, M. J., J. M. Casselman, and J. B. Rasmussen. 1999. Stable isotope evidence for the food web consequences of species invasions in lakes. Nature **401**:464-467.

Williamson, C. E., S. L. Metzgar, P. A. Lovera, and R. E. Moeller. 1997. Solar ultraviolet radiation and the spawning habitat of yellow perch, Perca flavescens. Ecological Applications **7**:1017-1023.