

## 2.7 Climate impacts on the sentinel species Arctic char (*Salvelinus alpinus*) in northern Canada

### Summary

#### Project Leader(s)

Power, Michael  
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This project will have four interlinked components nested within the overall ArcticNet Integrated Regional Impact Studies (IRIS) framework of climate change in the Canadian Arctic. The first component will address practical issues of Arctic char management of specific interest to Inuit participants in Nunavik as they pertain to the construction and dissemination of an Arctic char management database useful for planning and co-ordinating local stream and stock enhancement initiatives. Coupled with database construction will be a detailed follow-up study on the environmental effects of introducing Arctic char to suitable river and lake systems where they were not previously found. This portion of the study will examine the ecological effects of an Inuit initiative to introduce and manage an Arctic char population in a river system previously unused by Arctic char. Data from the study will help the Inuit of Nunavik understand the full implications of pro-active management to increase available Arctic char resources in the territory and provide a critical information base for future introduction decisions. Samples obtained from the impact effects study will further be used to improve the scientific database for complementary ArcticNet funded studies of climate induced change in the biological characteristics of Arctic char populations and the consequences of climate-change for possible changes in the rates of mercury (Hg) accumulation in fish. A final component of the study will match studies being conducted in Nunavik with a detailed analysis of climate-related changes in the biological characteristics of an Arctic char resource fishery in the Inuvialuit land claims region, thereby enhancing scientific understanding of the spatial trends and the rates of change occurring in the biology of Arctic char as a result of changing northern conditions. Essentially the research will help equip Inuit organizations with the tools to address key questions of concern and begin to address those questions. [1] In the face of climate change will Arctic char populations continue to exist at abundance levels suitable for local exploitation? [2] Can existing Arctic char populations be enhanced by local communities as an adaptive management strategy in an environmentally sound way? And, [3] will the resulting fish be safe to eat?

### People

#### Network Investigators

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#### Collaborators & Research Associates

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Doidge, Bill (Nunavik Research Center)  
Reist, Jim (University of Waterloo)

#### PhD Students

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#### Masters Students

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#### Technical Staff

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### **Project Staff**

Koeck, Guenter (Institute of Zoology and Limnology, University of Innsbruck)  
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## **Partners**

A.D. Latornell Endowment Fund  
Environment Canada - Canada Centre for Inland Waters  
Fisheries and Oceans Canada - Science Branch Newfoundland  
Fisheries and Oceans Canada - Freshwater Institute  
University of Waterloo  
Nayumivik Landholding Corporation  
Makivik Corporation  
Environment Canada  
Natural Resources Canada - Polar Continental Shelf Project  
Nunavik Research Center  
Indian and Northern Affairs Canada - Northern Contaminants Program  
Environment Canada - Northern Ecosystem Initiative  
Fisheries Joint Management Committee (FJMC)

## **Publications**

### **Articles Published in Refereed Publications**

Gantner, N., Muir, D., Power, M., Psenner, R. and Solomon, K., 2006, Effects of Climate Change on Mercury Concentrations in Landlocked Arctic Char (*Salvelinus alpinus*) in the Canadian High Arctic, In Tabane, S., Takeoka, H., Isobe, T., and Nishibe, Y. (eds) Chemical Pollution and Environmental Changes, Proceedings of the International Symposium 2006 on Pioneering Studies of Young Scientists on Chemical Pollution and Environmental Changes, 2006, Matsuyama, Japan, Frontiers Science Series, No. 48, 17-19, Published

Reist, J. D., M. Power, and J. B. Dempson., 2006, Biodiversity of arctic chars – key integrators and monitors of ecosystem change., 59th Canadian Conference for Fisheries Research. Calgary, AB, Jan 5-7 2006., 1, Published

Storm-Suke, A., Dempson, J. B., Caron, F. and Power, M., 2007, Effects of formalin and ethanol preservation on otolith  $\delta^{18}O$  stable isotope signatures, Rapid Communications in Mass Spectrometry, Volume 21 pages 503-508, Published

Storm-Suke, A., Dempson, J. B., Reist, J. D. and Power, M., 2007, Oxygen isotope fractionation in the otoliths of young-of-the-year Arctic charr (*Salvelinus alpinus*, (Linnaeus)) and brook charr (*Salvelinus fontinalis*, (Mitchill)), Rapid Communications in Mass Spectrometry. v.21, no.24, 47-50, Published

Michaud, W. K., Power, M. and Kinnison, M. T. , 2008, Trophically mediated divergence of Arctic charr (*Salvelinus alpinus* L.) populations in contemporary time, Evolutionary Ecology Research, 1, Submitted

Power, M., Reist, J. D. and Dempson, J. B. , 2008, Fish in High Latitude Arctic Lakes, In Vincent W. F. and Laybourn-Parry, J. (eds) (2008) Polar Lakes and Rivers – Limnology of Arctic and Antarctic Aquatic Ecosystems, 1, Submitted

Gantner N., Köck, G., Babaluk J., Reist J., Lockhart W.L., Solomon K. and Muir, D.C.G., 2008, Temporal trends of mercury, cesium, potassium, selenium, and thallium in Arctic Char (*Salvelinus alpinus*) from Lake

Hazen (Nunavut): Effects of trophic position, size and age, Environmental Toxicology & Chemistry, 1, Submitted

Storm-Suke, A., Dempson, J. B. and Power, M., 2008, Otolith  $\delta^{18}O$  derived and in-situ water temperature measures: determining the influence of habitat selection on thermal reconstructions using young-of-the-year Arctic char, Ecology of Freshwater Fishes, 1, Submitted

### **Other Refereed Contributions**

Johnson, J. D. Reist, J. D. and Power, M., 2006, Understanding the Trophic Structure of the Beaufort Sea Ecosystem, Arctic Change and Coastal Communities Conference, Tuktoyaktuk, Northwest Territories, 1, Accepted

### **Non-Refereed Contributions**

Muir, D.C.G., Köck, G. and Gantner, K. , 2006, Temporal trends of Persistent Organic Pollutants and Mercury in Landlocked char in the High Arctic, In: Synopsis of research conducted under the 2005-2006, Northern Contaminants Program, , pp. 155-161., Accepted

Power, M. Dempson, J. B. and Reist, J. D., 2006, Climate change implication for key fish species in the Canadian North., 2006 Canada/Norway Bilateral Northern Dialogue, Ottawa, May 10-11, 2006. , 1, Published

Reist, J. D., Power, M. and Dempson, J. B. , 2006, Biodiversity of arctic chars – key integrators and monitors of ecosystem change., Arctic Research Consortium of the United States Annual Meeting. Washington, D. C. May 2006., 1, Published

Gantner, N., Muir, D.C., Koeck, G., Power, M. and Solomon, K. R., 2006, Investigating Dietary Effects on Mercury Concentrations in Landlocked Arctic char (*Salvelinus alpinus*). , Presented at the Society of Environmental Toxicology & Chemistry (Europe) meeting, The Hague, The Netherlands. May 2006., 1, Published

Power, M., Storm-Suke, A., Reist, J. D., Dempson, J. B. , 2006, The thermal ecology of Ikarut River Arctic Charr: new sagas from old otoliths. , 5th International Charr Symposium, Reykavik, Iceland, August 2006., 1, Published

Storm-Suke, A., Dempson, J. B., Reist, J. D. and M. Power. , 2006, Latitudinal clines in young-of-the-year Arctic charr habitat use in eastern North America., The 5th International Conference on Applications of Stable Isotope Techniques to Ecological Studies, Queens University Belfast, Northern Ireland, August 2006., 1, Published

Gantner, N., Muir, D. C., Köck, G., Wang, X., Power, M., Babaluk, J., Reist, J. D. and Solomon, K. R. , 2006, Trophic Effects on Mercury Concentrations in Landlocked Arctic char (*Salvelinus alpinus*) from four remote lakes in the Canadian High Arctic., Presented at the 8th International conference on Mercury as a Global Pollutant. Wisconsin, August 2006, 1, Published

Muir, D., Evans, M., Jackson, T., Kling, H., Antoniades, D., Douglas, M., Pienitz, R., Smol, J., Wang, X. and Yang, F., 2006, Investigating Relationships between Climate Warming and Mercury in Arctic and Subarctic Lake Sediments., 8th International Conference on Mercury as a Global Pollutant. Wisconsin, August 2006, 1, Published

Storm-Suke, A., Power, M., 2006, Effects of formalin and ethanol preservation on the  $d^{18}O$  signatures of brook charr and Atlantic salmon otoliths., The 5th International Conference on Applications of Stable Isotope Techniques to Ecological Studies, Queens University Belfast, Northern Ireland, August 2006., 1, Published

Gantner, N., Muir, D. C., Wang, X., Koeck, G., Reist, J. D., Babaluk, J., Power, M. and Solomon, K. R., 2006, Dietary Effects on Mercury Concentrations in Landlocked Arctic char (*Salvelinus alpinus*)., Society of Environmental Toxicology & Chemistry (North America), Montreal, November 2006. Abstr. 254., 1, Published

Gantner, N., Muir, D. C., Lawson, G. Reist, J. D., Babaluk, J., Wastle, R., Meili, M., Solomon, K. R. and Halden, N. , 2006, Mercury and trace element analysis in otoliths from Arctic char from the Canadian High Arctic lakes and Northern pike from northern Swedish lakes., Society of Environmental Toxicology & Chemistry (North America) Montreal, November 2006. View Pres 635., 1, Published

Evans, M., D. Muir, M. Kwan, N. Gantner, L. Harwood, T. Dick, J. Keating and X. Wang, 2006, Comparisons of Mercury Concentrations in Sea-Run Char, Landlocked Char and Seals in Arctic Canada, Traditional Food Items Commonly Consumed by Coastal Communities, Presented at the 8th International conference on Mercury as a Global Pollutant, 1, Published

Gantner, N, D. Muir, X. Wang, G. Köck, J. Reist, J. Babaluk, M. Power, K. Solomon, 2006, Dietary Effects on Mercury Concentrations in Landlocked Arctic char (*Salvelinus alpinus*). , ArcticNet 3rd Annual Scientific Meeting, Victoria, B. C., December 12-15, 2006, 1, Published

Michaud, W. K., Power, M., Kinnison, M. T., 2006, The potential for adaptation to climate change in Arctic charr (*Salvelinus alpinus*)., ArcticNet 3rd Annual Scientific Meeting, Victoria, B. C., December 12-15, 2006., 1, Published

Chavarie, L., Power, M., Doidge, W., Chum, M. and Lewis, A., 2006, Development of an Arctic charr (*Salvelinus alpinus*) stream database (GIS) for management and resource enhancement in Nunavik., ArcticNet 3rd Annual Scientific Meeting, Victoria, B. C., December 12-15, 2006., 1, Published

Gantner, N., Koeck, G., Reist, J., Babaluk, J., Power, M., Solomon, K. R. and Muir, D. C., 2007, Mercury Bioaccumulation in Food Webs of Arctic char-bearing Lakes in 3 Regions of the Canadian Arctic; Insights from Stable Isotope Analysis, SETAC Europe 17th Annual Meeting, Porto, Portugal, May 20-24, 2007, 1, Published

Gantner, N., Power, M., Lawson, G., Muir, D., 2007, Food webs of Arctic char Lakes in 3 Regions of the Canadian Arctic: trophic influences on mercury in fish tissue, 30th Congress of the International Association of Theoretical and Applied Limnology, Montreal, QC, August 12-18, 2007, 1, Published

Gantner, N, M. Power, M. Meili, H. Borg, M. Sundbom, J. Hammar, J. Reist, K. Solomon, G. Lawson, D. Muir., 2007, Food webs of Arctic char lakes of the Canadian Arctic: Spatial comparison of trophic influences on mercury in fish tissue, Workshop on "High Latitude Terrestrial and Freshwater Ecosystems: Interactions and Response to Environmental Change", September, 2007 Abisko, Sweden, 1, Published

Gantner, N., Wang, X., Koeck, G., Pienitz, R., Reist, J., Babaluk, J., Power, M. Solomon., K. and Muir, D. , 2007, Mercury concentrations of landlocked Arctic char (*Salvelinus alpinus*) and bioaccumulation factors from 18 lakes In 3 regions of the Canadian Arctic, 2007 ArcticNet Annual Conference Proceedings, 1, Published

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Morris, A., Muir, D., Sturman, S., Teixeira, C., Fisk, A., Solomon, K., 2007, Bioaccumulation and Biomagnification of Brominated Flame Retardants and Current Use Pesticides in a Canadian Arctic Marine Food-Web, 2007 ArcticNet Annual Conference Proceedings, 79, Published

Muir, D., Yang, F., Wang, x., Jackson, T., Evans, M., Douglas, M., Köck, G., Pientitz, R., Smol, J., Vincent, W., Quinlan, R., Lamoureux, S., 2007, Spatial Trends and Historical Inputs of Mercury and Lead in Northern Canada Inferred from, 2007 ArcticNet Annual Conference Proceedings, 80, Published

### **Specialized Publications**

Storm-Suke, A. L., 2007, Oxygen stable isotope analysis of fish otoliths from the Genus *Salvelinus*: preservation, MSc. Thesis, University of Waterloo, Waterloo, ON., 81p., Published

Chavarie, L., 2008, The response of Arctic charr (*Salvelinus alpinus*) to climate-induced environmental variation, MSc. Thesis, University of Waterloo, Waterloo, ON, 84p., Submitted