

## Valued Component – Fish Quality (FINAL DRAFT)

### STATE OF KNOWLEDGE – WHAT IS HAPPENING?

A very brief overview of the state of knowledge with respect to fish quality in the NWT is presented below. This overview is preliminary and not intended to be exhaustive.

- **What are the baseline conditions with respect to fish quality?**
  - Fish quality is monitored in various lakes and rivers in the NWT. The availability of baseline conditions varies by fish species and lake or river locations. Although a large amount of diverse information is available from studies, little exists in the way of long-term monitoring programs. Through the Northern Contaminants Program, however, some long-term monitoring is being created at Fort Good Hope, Great Slave Lake and the Slave River.
- **What are the types and levels of contaminants found in fish?**
  - Persistent organic pollutants (POPs) and heavy metals can be found in fish. Among POPs, toxaphene and PCBs are of most concern. Some declines of POPs in burbot have been noted at Fort Good Hope. Among metals, mercury is of most concern and consumption advisories have been issued for many lakes. In addition, parasites are or can be considered a biological contaminant.
- **Are fish exhibiting changes in rates of disease and parasites?**

### KEY MONITORING INDICATORS

<i>Fish abundance and distribution</i>	<i>Contaminant levels</i>
<i>Presence of diseases/parasites</i>	<i>Invertebrates/insects</i>
<i>Water quality</i>	<i>Fish health</i>

- Rates of disease and parasites in fish are not regularly monitored in the NWT; therefore, changes in rates are not available. Observations have been made by local fishers on the condition of fish; however, these need to be systematically documented.
- **Are fish tainted (taste and/or texture)?**
  - There are varying comments from local fishers relating to “soft” or “watery” fish, but these have not been well documented.
- **Is the overall health of the fish being affected?**
  - Stress from physical and chemical disruption can affect the overall health of fish by disrupting several key biological parameters, including storage and utilization of energy and ions, hormone and micronutrient homeostasis.

### RECENT AND CURRENT MONITORING

Ongoing monitoring programs with respect to fish quality in the NWT are found below.

- Lower Mackenzie River index-netting program (Fisheries and Oceans Canada since 1999)

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- Contaminants in burbot from Fort Good Hope, Northwest Territories (Fisheries and Oceans Canada since 1999)
  - Changes over time in levels of persistent organic pollutants and heavy metals that bioaccumulate in livers of burbot are being studied. Results of analyses will be compared to previous studies in the Fort Good Hope area. This study is funded through the Northern Contaminants Program (NCP) (see Appendix A for more information on the NCP).
- Contaminants and heavy metals in fish from Great Slave Lake and Slave River (Environment Canada and Fisheries and Oceans since 1999; earlier research from 1993-1996)
  - Burbot, pike and lake trout from the West Basin (Fort Resolution) and East Arm (Lutsel K'e) in Great Slave Lake, and burbot from the Slave River are being sampled and analyzed for persistent organic pollutants and heavy metals. The length, age, weight, fat content, sex and condition of fish, and carbon and nitrogen stable isotopes are being determined. Contaminant concentrations will be compared with concentrations in fish in 1993-1995 to see if there has been any change. This study is funded through the Northern Contaminants Program (NCP) (see Appendix A for more information on the NCP).
- Mercury in fish from lakes in the western Northwest Territories (Fisheries and Oceans Canada and Environment Canada since 1996)
  - The presence and geographic distribution of mercury, selenium and arsenic from several lakes (three species per lake) in the western Northwest Territories is being studied. Biological data and mercury levels were

determined for fish in 24 lakes in the Sahtu and Deh Cho regions (1996-2000). Results will aid in determining amounts of fish that can be eaten from various lakes (based on species and size). This study is being funded through the Northern Contaminants Program (NCP) (see Appendix A for more information on the NCP).

- Mercury in predatory fish in the Mackenzie River Basin (Environment Canada and Fisheries and Oceans Canada since 1998)
  - Factors affecting high mercury concentrations in predatory fish such as pike, walleye and lake trout are being investigated in lakes in the Fort Simpson area. Because the lakes have not been previously studied, research begins by determining lake depth, nutrient levels and chemical properties of the water. Mercury is measured in water, sediments, plants, and various animals, including small fish, which live in these lakes. Research has been conducted at Cli and Little Doctor Lakes with more recent studies in Willow, Sibbeston and Tsetso Lakes. Analyses will be related to previous research on mercury concentrations in fish. This study is being funded through the Northern Contaminants Program (NCP) (see Appendix A for more information on the NCP).
- Contaminants and metals in fish in Great Bear Lake and nearby Lac Ste. Therese (Fisheries and Oceans Canada, new study)
  - This is a new study that will investigate metals, including mercury, and other contaminants in whitefish, pike, walleye and lake trout in Lac Ste. Therese (south of Great Bear Lake). It will also investigate metals in

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plankton, cisco and lake trout from Great Bear Lake. In addition, lake trout will be analyzed for persistent organic pollutants. This study is being supported by Environment Canada's Northern Ecosystem Initiative.

- Contaminants in burbot (loche) from the Aklavik area. This study was initiated in 2000 by the Arctic Borderlands Ecological Knowledge Co-op.
- Marine mammal monitoring questionnaire in the Tuktoyaktuk and Aklavik areas initiated by the Arctic Borderlands Ecological Knowledge Co-op.

### GAPS AND RECOMMENDATIONS FOR MONITORING

**A list of monitoring gaps and recommendations for future monitoring under the NWT Cumulative Impact Monitoring Program is found below.**

#### **Gaps**

- Monitoring of parasites and diseases as an indicator of fish quality and climate change (e.g. warmer water temperatures could increase fish susceptibility to parasites and diseases). Gaps exist for both larger harvested fish species as well as smaller species such as minnows.
- Invertebrate distribution and abundance as an indicator of water quality has not been carried out in the NWT.
- There is no information being collected regarding the overall physical health of fish.

- Large gaps exist on information on contaminant levels by species, type of contaminants and geographic area.

#### **Recommendations**

- A community-based program to monitor changes in parasite loads and frequency of diseased or lamprey scarred fish, as local fishers are most familiar with the general condition of fish (added to existing studies). Encourage the use of DFO parasite booklet to aid identification, preservation and reporting of parasites. Parasite and disease monitoring could also be added to existing community based and other monitoring programs (i.e., Rat River char monitoring program).
- Monitoring of invertebrate distribution and abundance as an indicator of fish and water quality. This is linked with the Fish Habitat and Water Quality VCs.
- Increased water quality monitoring (as an indicator of fish quality). Some fish diseases are linked to water quality. For example, black spot disease found in some Ontario fish may be an indicator of poor water quality. Northern diseases and parasites should be reviewed to determine if similar potential indicators exist in the NWT. Linkage to Water Quality VC.
- Repetition of studies carried out in the early 1970s to determine changes in fish quality conditions over time
- Monitor indicators of the overall physical health of fish. The best indicators would be those that integrate information regarding energy storage and utilization, exposure to contaminants and reproductive capacity. Among the available indicators, energy stores and lipid soluble vitamins in liver, and

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ions and lipids in muscle are excellent options for inclusion in a community based monitoring program.

### REFERENCES

Relevant monitoring reports, past monitoring programs, research documents, and scientific publications are found below.

Evans, M.S., R.A. Bourbonniere, D.C.G. Muir, W.L. Lockhart, P. Wilkinson and B.N. Billeck (1996). **Depositional history of sediment in Great Slave Lake: spatial and temporal patterns in geochronology, bulk parameters, PAHs, and chlorinated contaminants.** Northern River Basins Study Project Report 99. 173 pp.

Evans, M.S., L. Lockhart and J. Klaverkamp (1998). **Metal studies of water, sediments, and fish from the Resolution Bay area: studies related to the decommissioned Pine Point Mine.** National Water Research Institute Contribution 98-87. 209 pp.

Evans, M.S., D. Muir, L. Lockhart and G. Stern (1998). **Metal and persistent organochlorine pollutant (POP) concentrations in four species of predatory fish from Resolution Bay, Great Slave Lake: summer 1996 studies.** National Water Research Institute Contribution 98-93. 76 pp.

Fisheries and Oceans Canada. **Fish quality and physiological condition.** (1985-1988).

Stewart, D.B., W.E.F. Taptuna, W.L. Lockhart and low, G. 2003 **Biological Data from Experimental Fisheries at special Harvesting Areas in the Sahtu Dene and Metis Settlement Area, Nt: Volume 2. Lakes near the communities of Colville Lake, Fort**

**Good Hope, Norman Wells, and Tulita.** *Can. Data Rep. Fish Aquatic Sci.* 1126: viii + 101 p.

Stewart, D.B., Taylor, P.L., Taptuna, W.E.F., Lockhart, W, W.L., Read, C.J., and Low, G. 2003. **Biological data from experimental fisheries at lakes in the Deh Cho region of the Northwest Territories, 1996-2000.** *Can. Data Rep. Fish. Aquatic Sci.* 1127: x + 116 p.

Steve E. Hrudey and Associates Ltd. **An assessment of freshwater impacts from petroleum hydrocarbons on the Mackenzie River at Norman Wells, NWT** (1985-1988).

Indian and Northern Affairs Canada. **AES Baseline Water Quality Monitoring Program** (1991-1997).

The Government of Canada provided \$100 million for the Arctic Environmental Strategy (AES), of this; \$15 million was used for water-related research in the Northwest Territories and Nunavut. This research resulted in the production of 218 publications, including several on fish quality. The Arctic Science and Technology Information System (ASTIS) produced "An Annotated Bibliography of the Northwest Territories Action on Water Component of the Arctic Environmental Strategy", available at <http://www.aina.ucalgary.ca/aes/>.

Indian and Northern Affairs Canada and GNWT. **Slave River Environmental Quality Monitoring Program – Summary report, final five year study report and data volumes** (1990-1995, 1998).

The objectives of this five year investigation of contaminants in the aquatic ecosystem of the Slave River were to: address concerns of northerners regarding possible contamination of fish, water and suspended sediment from pulp mill, hydrocarbon and agricultural developments upstream; and, provide baseline data on contaminant levels in fish, water and suspended sediment at the territorial boundary to support transboundary water negotiations with Alberta. An annotated bibliography of the Northwest Territories Action on Water component of the Arctic

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*Environmental Strategy, which includes information on the SREQMP, is available at <http://www.aina.ucalgary.ca/aes/>.*

*Snowshoe, N. and S.A. Stephenson (2000). **1999 Peel river fish contaminant study.** Gwich'in Tribal Council.*

*Analysis of 10 each of broad whitefish, inconnu and burbot from the Peel River near Fort McPherson in 1999 showed normal conditions for heavy metal and organochlorine .*

*Snowshoe, N. and S.A. Stephenson (in preparation). **2000 Arctic red river fish contaminant study.** Gwich'in Tribal Council.*

*Analysis of 10 each of broad whitefish, inconnu and burbot from the Arctic Red River near Tsiigehtchic. Results*

