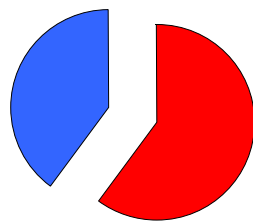




Great Lakes Precipitation Network (IADN)



Great Lakes Fish Contaminants Surveillance Program



GREAT LAKES FISH CONTAMINANTS SURVEILLANCE PROGRAM

Sean M. Backus

**Water Quality Monitoring and Surveillance Division
Science and Technology Branch**



Environment
Canada

Environnement
Canada

Canada

PROJECT TEAM

- Mike Keir
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OUTLINE

- PROGRAM OBJECTIVES
- PROGRAM FRAMEWORK/DRIVERS
- SAMPLING DESIGN
- ANALYTICAL DESIGN
- QUALITY
- BIOLOGICAL TISSUE ARCHIVE
- DATABASE MANAGEMENT
- REPORTING/OUTPUT



PROGRAM OBJECTIVES

- To Monitor Long-term Temporal Trends and Spatial Distributions of Toxic Chemicals in Great Lakes Fish
- Relate Trends to Changes in Food Web Structure
- Relate Trends to Changes in Loadings
- Identify Emerging **Issues**



PROGRAM FRAMEWORK/DRIVERS

- **GREAT LAKES WATER QUALITY AGREEMENT**

- **ANNEX 11 - Surveillance & Monitoring**

- (Trend Evaluation & Emerging Problems)

- **ANNEX 12 – Persistent Toxic Substances**

- (Early Warning System, Spatial Distributions & Temporal Trends & Biological Tissue Bank)

- **ANNEX 2 – RAPs & LaMPS**

- Critical Pollutants & Impairment of Beneficial Uses

- **ANNEX 1 – Specific Objectives**

- i.e.; DDT and Metabolites: *“The sum of the concentrations of DDT and its metabolites in whole fish should not exceed 1.0 microgram per gram (wet weight basis) for the protection of fish-consuming aquatic birds.”*

PROGRAM FRAMEWORK/DRIVERS

Canada Gazette



Welcome to the official newspaper of the Government of Canada published since 1841

Vol. 141, No. 11 — March 17, 2007

GOVERNMENT NOTICES

DEPARTMENT OF THE ENVIRONMENT

CANADIAN ENVIRONMENTAL PROTECTION ACT, 1999

Notice respecting the 2007 Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA)

In accordance with subsection 9(2) of the Canadian Environmental Protection Act, 1999 (S.C. 1999, c. 33), notice is hereby given that the Minister of the Environment ("the Minister") has negotiated the "2007 Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem" (COA). The new 2007 COA is available on Environment Canada's Web site at www.ec.gc.ca/CEPARRegistry/.



Environment Canada
Environnement Canada

Canada

PROGRAM FRAMEWORK/DRIVERS

ANNEX 2: HARMFUL POLLUTANTS

- **Result 4 - Develop and initiate a program for the Sound Management of Chemical Substances in the Great Lakes Basin**

Canada will:



- Implement activities to address substances identified under Canada's **Chemicals Management Plan** that are of concern within the Great Lakes Basin. This may include examining substances identified as high priorities, collecting information on potential releases to the Great Lakes, developing **national** preventive and control measures, and promoting environmental monitoring to track progress; and

Canada  Ontario.

Continue to lead the implementation of the Great Lakes Binational Toxics Strategy and develop links with the North American Commission for Environmental Cooperation to promote reductions in releases within the Basin as well as transport of harmful pollutants to the Basin from other jurisdictions.

4/30/2007

Page 8

PROGRAM FRAMEWORK/DRIVERS

ANNEX 2: HARMFUL POLLUTANTS

- **Result 5 - Improved understanding of the sources, fate and impacts of harmful pollutants in the Great Lakes Basin.**

Canada and Ontario will:



- Collaboratively research the occurrence, persistence, fate, and environmental and health impacts of substances of known and emerging concern and discharges from sectors, with the support and participation of industries and other sectors;

Canada  Ontario

- Continue to monitor and report on status and trends of substances of known and emerging concern in various media to support policy and program decision-making; and
- Maintain profiles of Tier 1 substances and develop and maintain inventories of substances targeted for action.

4/30/2007

Page 9

PROGRAM FRAMEWORK/DRIVERS

ANNEX 3: LAKE AND BASIN SUSTAINABILITY

- **Result 1.4 - Enhanced knowledge about beneficial and harmful impacts of human activities on Great Lakes aquatic ecosystems and resources**



Canada and Ontario will:

- **c.** Undertake and support research and monitoring on the status of fish communities and aquatic food webs;
- **f.** Implement Binational Cooperative Monitoring programs in Lake Huron in 2007, Lake Ontario in 2008 and Lake Erie in 2009.

Canada  Ontario

4/30/2007

Page 10

PROGRAM FRAMEWORK/DRIVERS

ANNEX 3: LAKE AND BASIN SUSTAINABILITY

- **Result 2.4 - Enhanced knowledge about beneficial and harmful impacts of human activities on Great Lakes water quality.**



Canada and Ontario will:

- **a.** Collect environmental information through lake monitoring to assist in understanding the linkages between Great Lakes sources of harmful pollutants and human health;
- **b.** Undertake and support research and monitoring on the sources, fate and effects of harmful pollutants and nutrients, on aquatic food webs and species;

Canada  Ontario

4/30/2007

Page 11



Environment
Canada

Environnement
Canada

Canada

PROGRAM FRAMEWORK/DRIVERS

ANNEX 4: COORDINATION OF MONITORING, RESEARCH AND INFORMATION

- **Result 1 - Responsive and comprehensive monitoring and research programs**

Canada and Ontario will:



- Coordinate federal and provincial monitoring and research in support of Annex 2 to determine trends, impacts and sources of harmful pollutants;
- Coordinate federal and provincial monitoring and research in support of Annex 3 to optimize programs and address priorities in the near-shore zones, coastal areas, open waters and tributaries;
- Link Canadian Great Lakes research and monitoring with work being undertaken by other jurisdictions to improve efficiency and effectiveness of programs and to set priorities for future work;

4/30/2007

Page 12

PROGRAM FRAMEWORK/DRIVERS

ANNEX 4: COORDINATION OF MONITORING, RESEARCH AND INFORMATION

- **Result 3 - Increased sharing of data and information among governments, organizations and Basin residents**



Canada and Ontario will:

- **c.** Promote and maintain a web-based inventory (Binational Executive Committee Monitoring Inventory) of on-going monitoring programs and activities and track their status;
- **d.** Better utilize existing monitoring data to identify progress in environmental conditions, trends and emerging issues by reporting on indicators such as SOLEC and LaMP indicators using Lake Views;

Canada  Ontario

4/30/2007

Page 13

PROGRAM FRAMEWORK/DRIVERS



PROGRAM FRAMEWORK/DRIVERS

- **Canadian Environmental Quality Guidelines**

Canadian Tissue Residue Guidelines for the Protection of Wildlife Consumers of Aquatic Biota :

DDT

Methylmercury

Polychlorinated byphenyls (PCBs)

Dioxins/Furans

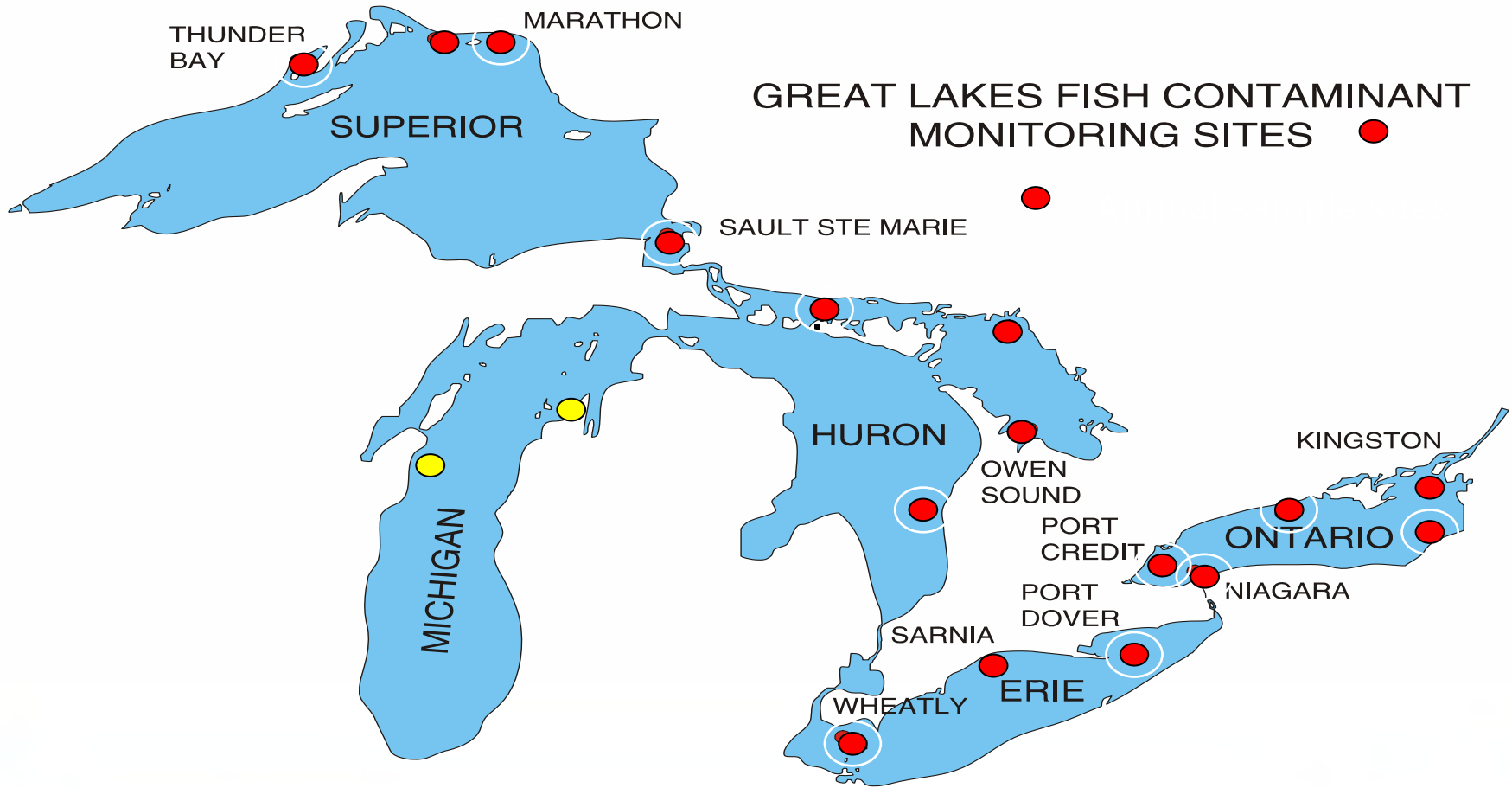
Toxaphene

SAMPLING DESIGN

- **Maintain all collections at previous sampling frequency**
- **Ancillary measurements**
 - Sex
 - Age
 - Weight
 - Diet



SAMPLING DESIGN



4/30/2007

Page 17

SAMPLING DESIGN

- **Lake Ontario: (Spring/Fall-2007, 2008, 2009, 2010, 2011)**
 - Port Credit
 - Niagara
 - Oswego
 - Cobourg
 - Burlington
- **Lake Erie:**
 - Port Dover (2007, 2008, 2009, 2010, 2011)
 - Amherstburg (MNR- 2007, 2008, 2009, 2010, 2011)
- **Lake Huron:**
 - Owen Sound (2007, 2010)
 - Meaford (2011)
 - Meldrum Bay (2009)
 - Goderich (2008)
- **Lake Superior:**
 - Thunder Bay (2007, 2009)
 - Whitefish Bay (2007, 2010)
 - Marathon (2008, 2011)



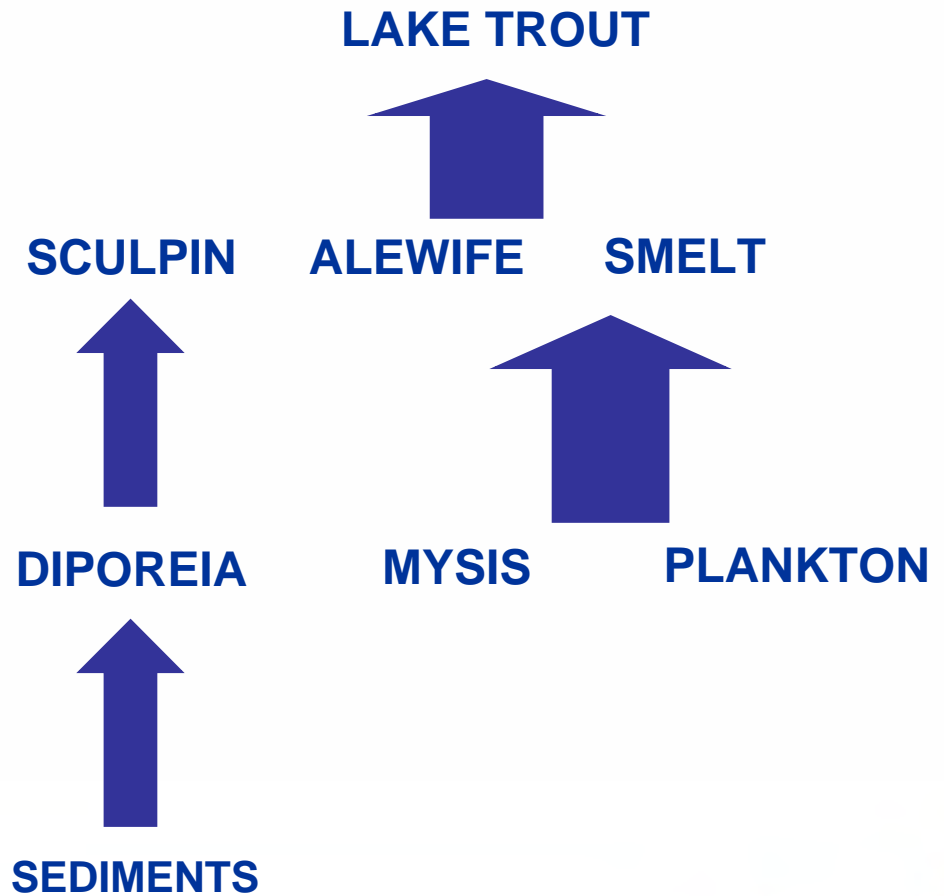
SAMPLING DESIGN: GREAT LAKES FOOD WEB

TOP PREDATOR:
(50 individual fish)

FORAGE SPECIES:
(5-10 pooled samples/sp)

INVERTEBRATES:
(5 x 25g pooled samples)

**DEPOSITIONAL
BASIN**
(500g)



4/30/2007

Page 19



SAMPLING DESIGN: GREAT LAKES FOOD WEB

Food Web Studies: 2007 (Spring/Fall)

Collaborators: A. Fisk/K. Drouillard - GLIER

- **lake trout:** 5 individuals from each of the age classes between 2 and 8 (6 age classes X 5 samples = 30 samples)
- **alewife:** 5 individuals from 4 sites;
- **smelt:** up to 5 individuals per site from 4 sites;
- **plankton** tows: 5 per site (20 total assuming 4 sites)
- **sculpin:** 5 per site (20 total assuming 4 sites)
- **gobies:** 5 per site (20 total assuming 4 sites)
- **zebra mussels:** 5 per site (20 total assuming 4 sites)
- **Diporeia:** 5 sample per site (20 total assuming 4 sites)
- **mysis:** 5 samples per site (20 total assuming 4 sites)

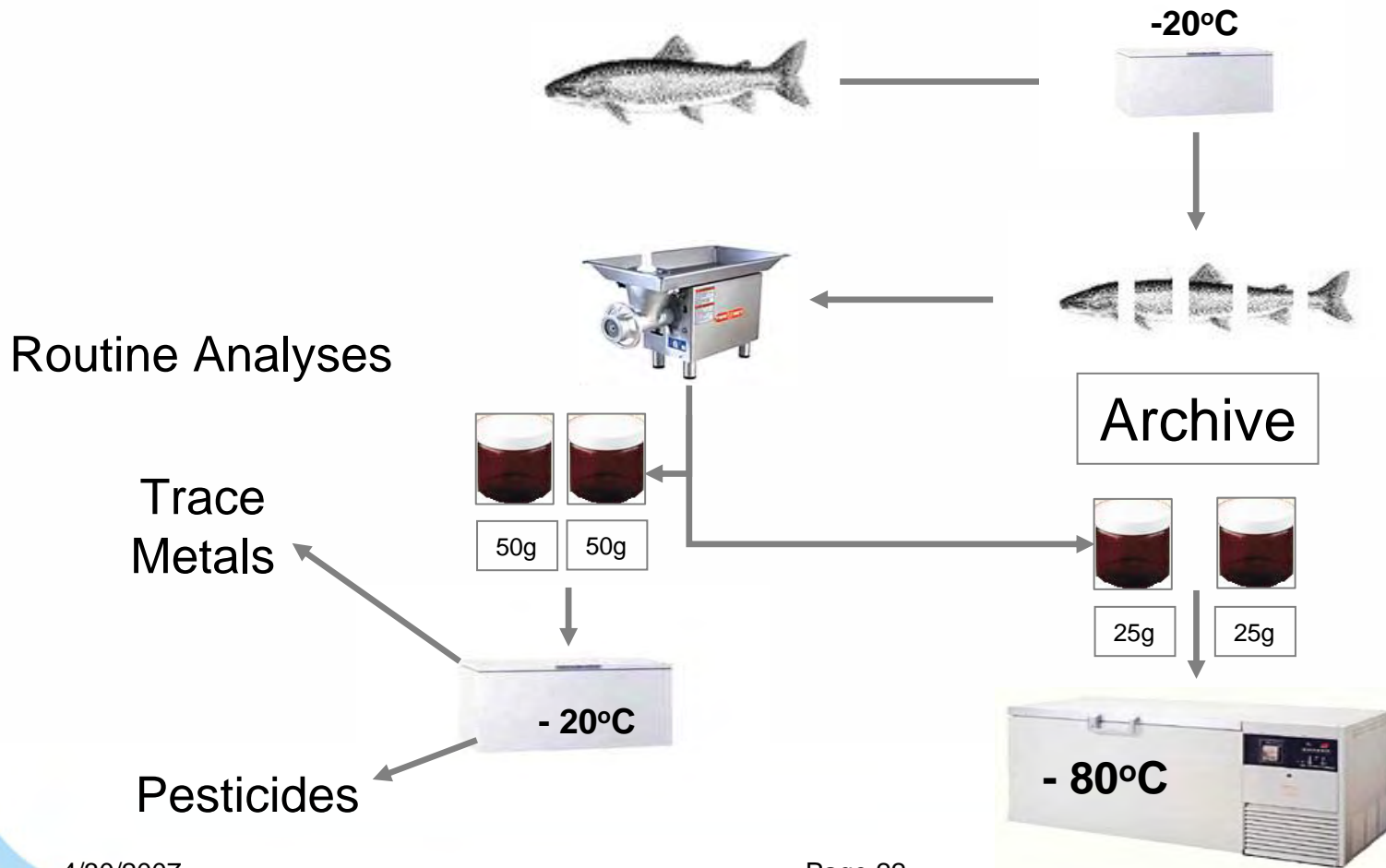
ANALYTICAL DESIGN



4/30/2007

Page 21

ANALYTICAL DESIGN



4/30/2007

Page 22



ANALYTICAL DESIGN:ROUTINE

Metals:

- Hg
- As
- Se
- Cu
- Zn
- Ni
- Pb
- Cr

Ag, Al, As, Ba, Be, Bi, Cd,
Co, Cr, Cu, Fe, Ga, La, Li,
Mn, Mo, Ni, Pb, Rb, Sb,
Se, Sn, Sr, Tl, U, V, Zn, Hg

Pesticides/Organics

- Σ PCB
- Σ DDT & Metabolites
- Heptachlor Epoxide
- Dieldrin
- Chlordane (α, γ)
- Lindane (α HCH)
- HCB
- Mirex

ANALYTICAL DESIGN:INTENSIVELY

A-HCH

B-HCH

G-HCH

D-HCH

HCB

HEPTACHLOR

HEPT. EPOX.(B)

HEPT. EPOX.(A)

G-CHLOR

A-CHLOR

ALDRIN

OCS

DIELDRIN

ENDRIN

B-ENDOSULFAN

PP'-TDE

OP'-DDT

PP'-DDT

OP'-DDE

PP'-DDE

TOXAPHENE

PHOTOMIREX

MIREX

PCB's

ANALYTICAL DESIGN:NON ROUTINE

- Toxaphene Congeners
- PCB Congeners (Ortho & Non Ortho)
- PCDD/PCDF Congeners
- PBDE Congeners (+HBCD)
- PFOS (PFOA, PFNA, PFDA)
- PCTs, PCNs etc.

QUALITY

- Reviewing Data Quality Objectives (DQO's)
- Currently working on updating QAPP
- Currently undertaking inter-laboratory study on routine organic parameters (Great Lakes Community)
- 2007 Peer Review of EPA Program

BIOLOGICAL TISSUE ARCHIVE



- Maintain fish tissue archive:



4/30/2007

Page 27



Environment Canada
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BIOLOGICAL TISSUE ARCHIVE

Contains >25,000 Frozen Fish & Invertebrate Tissue Homogenates (1972-present)

Represents samples from the Great Lakes and across Canada

Additional Archive inventory – surficial sediments, solvent extracts, fish scales & otoliths (stable isotopes)

Archive Facility: 12 Freezers @ -80C
23 Freezers @ -20C
Automated Backup Systems (CO₂)
Central Temperature Alarm System
Emergency Electrical Power System

Searchable Database: Sample origin (date, site, species), volume/mass, archive location, sample history – prior analyses

BIOLOGICAL TISSUE ARCHIVE

- **Maintain fish tissue archive**
 - **An Updated Guide to the Great Lakes Fisheries Specimen Bank (1977 to 2006)**
- **Ensure Fish research complements water, sediment, and wildlife research**
 - **Policy for Biological Tissue Access**

BIOLOGICAL TISSUE ARCHIVE

Collaborative Research with the University of Windsor, GLIER.

The review and analysis of historical Great Lakes Fish Contaminants Surveillance Program data by Drs. Doug Haffner, Ken Drouillard and Gord Paterson (GLIER) and Michael Whittle (DFO)

This collaboration will investigate the significance of bioenergetics and population growth in regulating temporal and spatial trends of persistent organic pollutants in Great Lakes lake trout populations.

BIOLOGICAL TISSUE ARCHIVE

Collaborative Research with the University of Windsor, GLIER.

Integration of existing data from the Great Lakes Fish Contaminants Surveillance Program and the Great Lakes Herring Gull Egg Monitoring Program by Dr. Craig Hebert (Environment Canada) and Michael Whittle (DFO). This collaboration will improve our understanding of the factors regulating contaminant dynamics in important biomonitoring species.

BIOLOGICAL TISSUE ARCHIVE

Collaborative Research with the University of Windsor, GLIER.

Coordination of selected archived specimens held in the Great Lakes Fisheries Specimen Bank for ecological tracer analysis including fatty acids, stable isotopes and energy density determinations by Drs. Aaron Fisk (GLIER), Michael Whittle (DFO), Michael Conroy (USGS), Craig Hebert, and Michael Arts (Environment Canada).

Environment Canada will determine PCB congeners on the selected subset. These retrospective analyses will allow an investigation of specific hypotheses regarding the quantity and quality of the Great Lakes prey fish forage base.

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DATABASE MANAGEMENT

CURRENT EFFORT:

- Implement and maintain a single (1) Operational Database
- EDAMs (Environmental Data Analysis and Management System- Access Database)

FUTURE INTEGRATION/OPTOMIZATION (LakeViews/Envirodat)

REPORTING/OUTPUT

- **SOLEC Indicator #121**

http://www.solecregistration.ca/documents/0121%20Contaminants%20in%20Whole%20Fish%20(SOLEC%2020) Microsoft Internet Explorer

File Edit Go To Favorites Help

Back Forward Stop Refresh Home Search Favorites

Address http://www.solecregistration.ca/documents/0121%20Contaminants%20in%20Whole%20Fish%20(SOLEC%202006).pdf

1 / 14 125%

State of the Great Lakes 2007 - Draft

Contaminants in Whole Fish Indicator #121

Overall Assessment

Status: **Mixed**
Trend: **Improving**

Primary Factors **Whole fish are monitored by both EPA GLNPO and Environment Canada** to determine the effects of contaminant concentrations on wildlife and monitor trends. Both governments collect and analyze whole fish independently from a variety of locations within each Great Lake using different methods. The differences between the two programs, collection sites in all 5 Great Lakes, and differences in species yield a mixed status for the basin as a whole.**

Determining Status and Trend

**** In the spring of 2006, Environment Canada assumed the responsibilities of the Department of Fisheries and Ocean (DFO) Fish Contaminant Surveillance Program. All data included in this indicator report were produced by DFO.**

Lake-by-Lake Assessment

PCB and DDT levels are measured in lake trout and walleye while only smelt samples have recent Hg trend data available.

Lake Superior

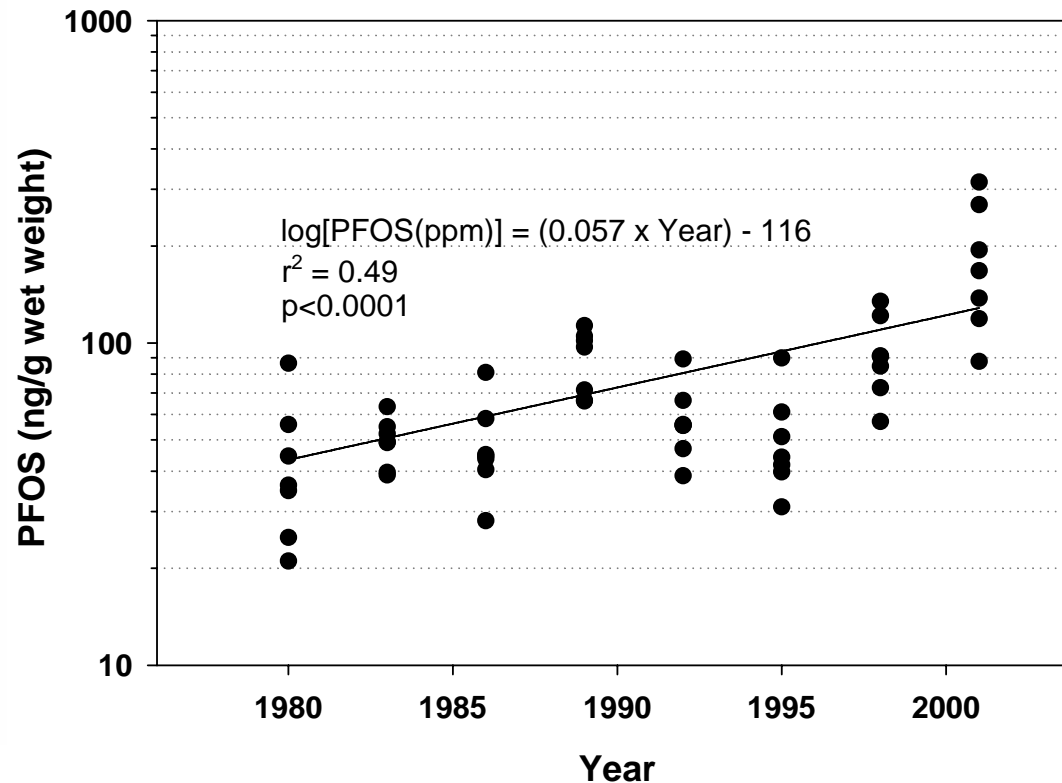
Status: **Fair**

start | IGL_FCP | DFO-Contaminants... | food_web_2007... | http://www.solec... | Fish Contaminants... | 8:28 AM

4/30/2007

Page 35

REPORTING/OUTPUT



Martin, J.W., D. M. Whittle, D.C.G. Muir & S.A. Mabury. 2004. **Perfluoroalkyl Contaminants in the Lake Ontario Food Web.** Environ. Sci. Technol. V 38, No 20 (5379-5385)

REPORTING/OUTPUT

- PCNs (P. Helm)
- PBDEs (P. Helm/G. Tomy)
- Dechlorane Plus (G.Tomy)



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Thank you!

