US EPA ARCHIVE DOCUMENT

US EPA ARCHIVE DOCUMENT

Great Lakes Restoration Initiative Toxic Substances Interagency Monitoring and Surveillance Programs

Great Lakes Binational Toxics Strategy Teleconference Call
Chicago, IL
September 23, 2009

US EPA ARCHIVE DOCUMENT

GLRI Interagency Toxics Workgroup

- NOAA - Enhanced Mussel Watch Program
- USFWS - Early Warning System to Identify Effects of New Contaminants
- USGS – Tributary Monitoring and Effects of Contaminants on Great Lakes Indicator Species
- EPA - Developing Critical Information

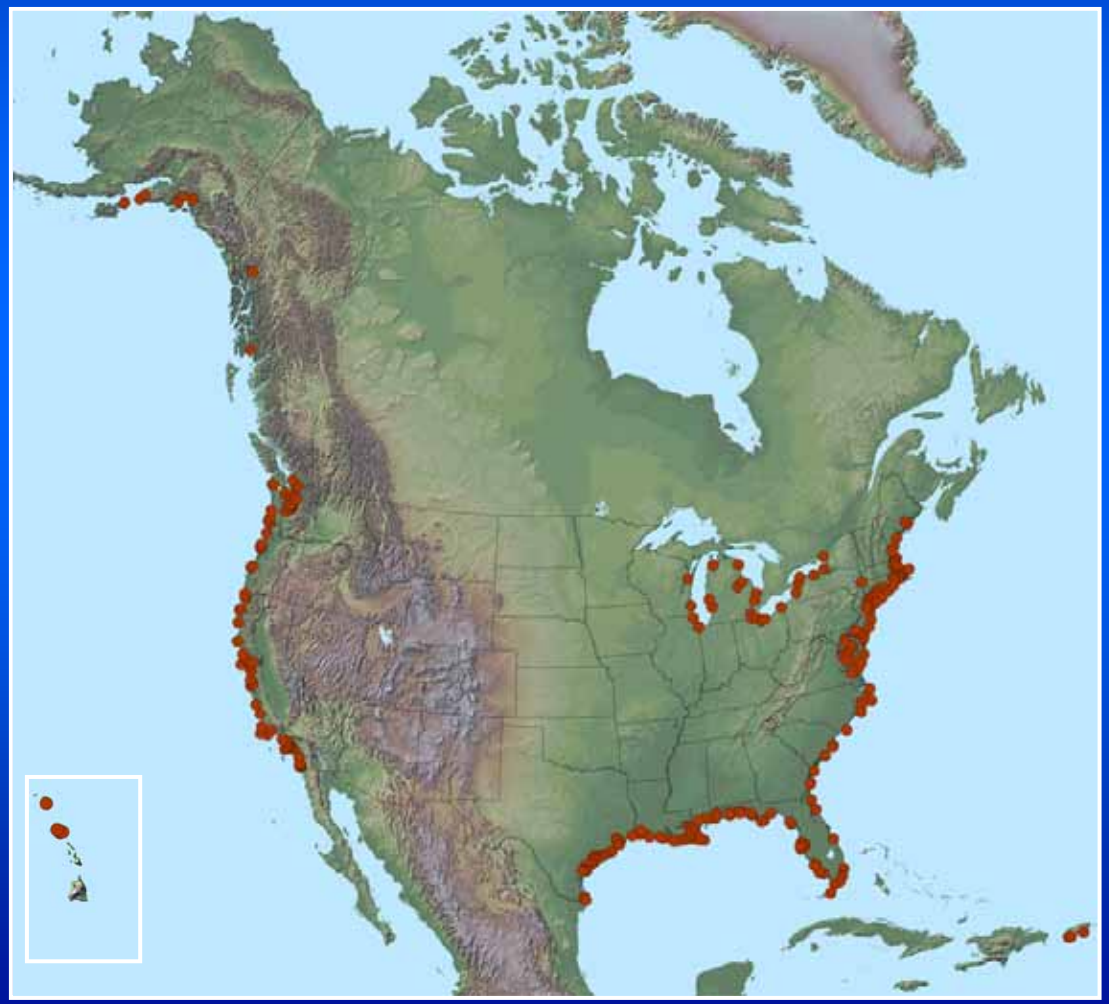
US EPA ARCHIVE DOCUMENT

NOAA Enhanced Mussel Watch Program

US EPA ARCHIVE DOCUMENT

NOAA Enhanced Mussel Watch Program

Background



Nation's longest running coastal contaminant monitoring program (24 years)

Mussels, oysters, and zebra mussels collected 300 Sites nationwide –
1/2 monitored annually

150 contaminants routinely analyzed in mussels, oysters, and sediments

Mussels and oysters are collected in winter, with the exception of the Great Lakes

Sediments monitored periodically

US EPA ARCHIVE DOCUMENT

NOAA Enhanced Mussel Watch Program

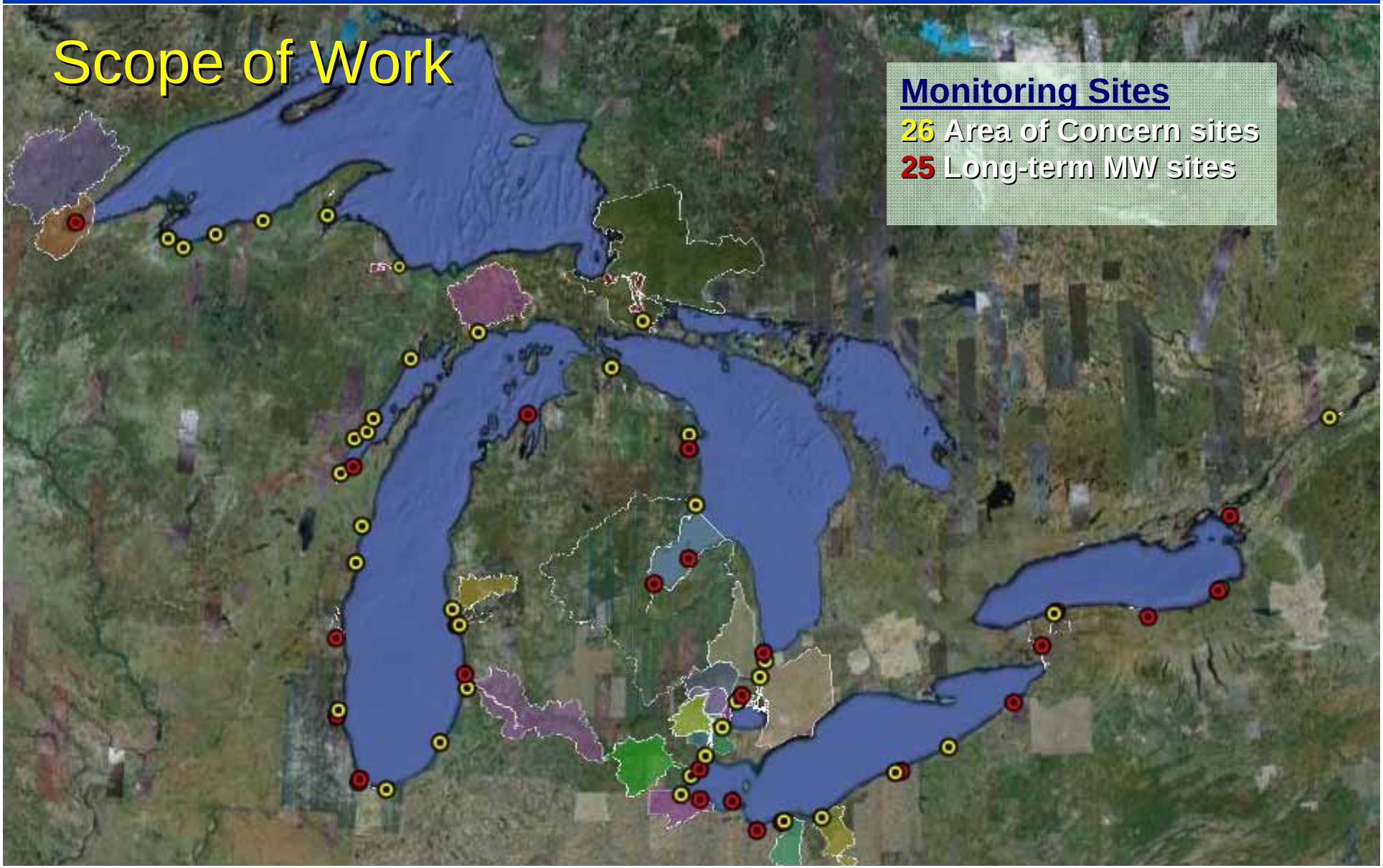
Background

- Original sites coincident with the U.S. EPA Mussel Watch sites of 1976-1978
- Program staff consulted with coastal state officials, university personnel, and others
- Some sites were established to monitor contaminant levels after oil spills
- Samples only collected from natural substrates
- Sites were not selected on a random basis
- Historically, sites were not selected in the vicinity of municipal sewage outfalls or pollution hotspots

US EPA ARCHIVE DOCUMENT

NOAA Enhanced Mussel Watch Program

Scope of Work



US EPA ARCHIVE DOCUMENT

NOAA Enhanced Mussel Watch Program

Scope of Work

Current Analytes

- Trace elements
- Pesticides
- PAHs
- Industrial chemicals
- Butyltins

Ancillary Measurements

- Reproductive stage characterization
- Bacteria characterization
- Parasite, pathology, and disease intensity characterization

Enhanced Analyses

- Sediment toxicity
- Contaminants of Emerging Concern
- Benthic (sediment) organism characterization

US EPA ARCHIVE DOCUMENT

NOAA Enhanced Mussel Watch Program

Timeline FY 2010

Month	9	10	11	12	1	2	3	4	5	6	7	8	9
Collect samples													
Contaminant analysis													
Toxicity													
Histopathology													
Gonadal Index													
VG													
Reporting													

Funding independent

FY 2010 funding dependant

US EPA ARCHIVE DOCUMENT

NOAA Enhanced Mussel Watch Program

Outputs

- Chemical monitoring data at Areas of Concern and Mussel Watch sites
- Assessment of sediment toxicity
- Measurement of contaminants of emerging concern
- Histopathology measurements for biological indicators
- Database with contaminant measurements
- Benthic (sediment) organism characterization

US EPA ARCHIVE DOCUMENT

NOAA Enhanced Mussel Watch Program

Outcomes

- Use of monitoring data to assess effectiveness of remediation
- Better spatial coverage for monitoring of chemicals
- Use contaminant monitoring data as an indicator of remediation success used in the delisting Areas of Concern
- Warning network for detecting new contaminants
- Enhanced monitoring coordination with other agencies
- Compare Areas of Concern and national Mussel Watch contaminant concentrations to gain perspective on the extent of contamination

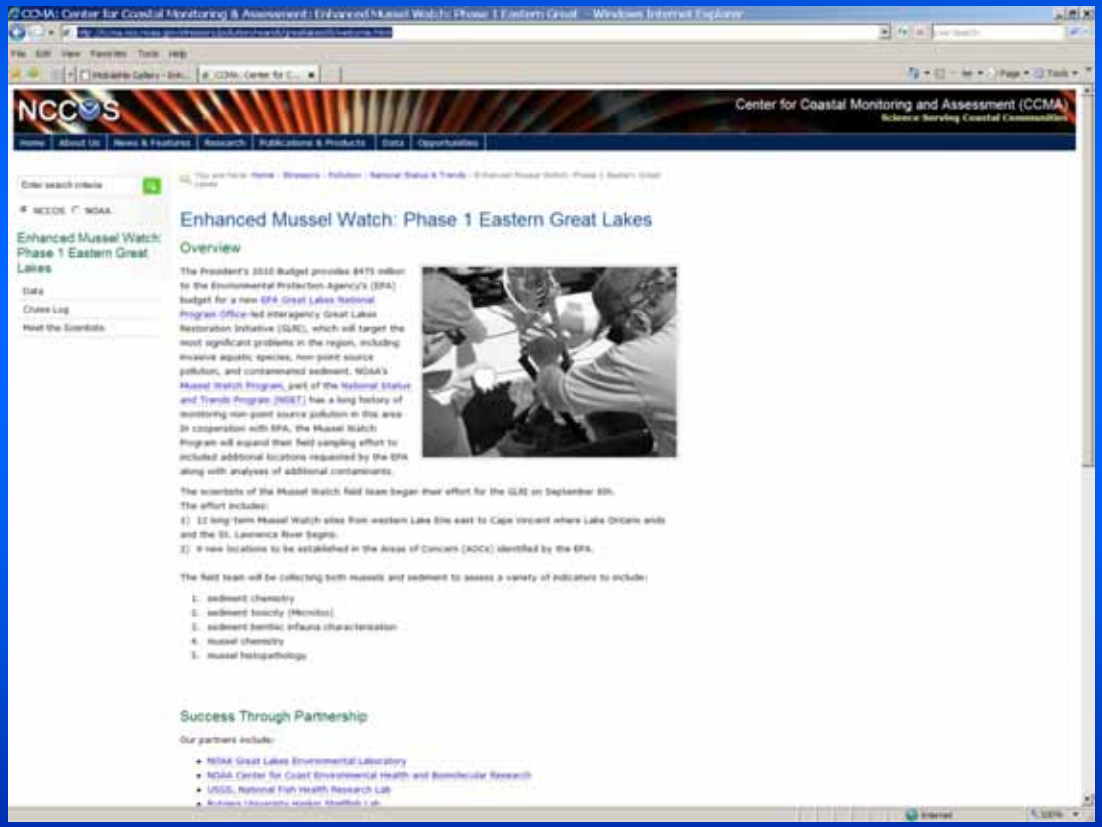
US EPA ARCHIVE DOCUMENT

NOAA Enhanced Mussel Watch Program

Results/Reporting

Web

- http://NSandT.noaa.gov
- Mussel Watch database
- Field sampling log
- Publication database
- Outreach content

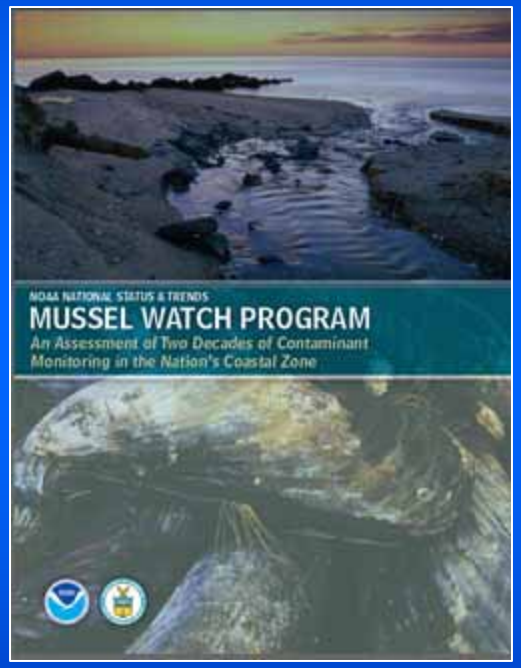


US EPA ARCHIVE DOCUMENT

Results/Reporting

Standardized Reporting Format

- Easily convey results to
  - Legislators
  - Resource managers
  - Concerned citizens
- Intra-Great Lakes comparison
- Temporal (Time) comparison
- National comparison
- State by state presentation of results
- Comparison to sediment quality guidelines
- Peer review submissions
- One page summary document



US EPA ARCHIVE DOCUMENT

USFWS

Early Warning System to Identify Effects of New Contaminants

US EPA ARCHIVE DOCUMENT

USFWS: Early Warning System to Identify Effects of New Contaminants

The Issue

-In recent years more than 300 compounds have been identified in water, sediments, and/or biota of the Great Lakes and their tributaries.

-Little is known of their spatial and temporal distribution, or toxicity to fish and wildlife.

-Some, such as brominated flame retardants have increased exponentially in open lake fish.

US EPA ARCHIVE DOCUMENT

USFWS: Early Warning System to Identify Effects of New Contaminants

Emerging Contaminants

New substances, chemicals, metabolites, or known substances with newly expanded distribution, altered release patterns, or newly detected presence, which are potentially toxic

Brominated flame retardants, pharmaceuticals, personal care products, plasticizers, new pesticides, detergents

US EPA ARCHIVE DOCUMENT

USFWS: Early Warning System to Identify Effects of New Contaminants

Objective

Better understand sources, distribution, routes of exposure, and impacts.

Protect the Great Lakes ecosystem health against future threats. Early detection of emerging contaminants in the Great Lakes will allow control, elimination, or resource management actions to be implemented before significant effects occur.

US EPA ARCHIVE DOCUMENT

Tentative Schedule

FY 2010:

- Literature and database search – concentrations of emerging contaminants, locations, toxicity information
- Pilot project - 3-5 locations

US EPA ARCHIVE DOCUMENT

USFWS: Early Warning System to Identify Effects of New Contaminants

FY 2010 target compounds:

- Polybrominated diphenyl ethers (PBDEs)
- Other Flame Retardants
- Perfluorinated compounds
- Current Use Pesticides
- Pharmaceuticals
- Chlorinated paraffins
- Phthalates
- Personal care products (synthetic musks)
- Alkylphenol ethoxylates

US EPA ARCHIVE DOCUMENT

USFWS: Early Warning System to Identify Effects of New Contaminants

FY 2010:

Probable Pilot Project Locations:

- Detroit River
- Milwaukee, WI
- Duluth, MN
- Rochester, NY
- Maumee Bay, Toledo, OH

Media to Sample

- Water
- Sediment
- Benthic invertebrates
- Pelagic invertebrates
- Fish at various trophic levels
- Birds (including eggs)
- Mammals

US EPA ARCHIVE DOCUMENT

USFWS: Early Warning System to Identify Effects of New Contaminants

Outcomes

- Better understand emerging contaminants - source, routes of exposure, and impacts to fish and wildlife
- Relate environmental concentrations to toxicity values
- Recommend controls/regulations or resource management actions to prevent or reduce adverse impacts to fish and wildlife resources in the future
- Collaboration with other Federal (EPA, NOAA, USGS, etc.) and State agencies to ensure efficient and effective use of funding

US EPA ARCHIVE DOCUMENT

Outputs

- Establish bibliographic database resulting from the literature search.
- Establish GIS based database for collecting pilot project and future study information.
- Annual reports

US EPA ARCHIVE DOCUMENT

USFWS: Early Warning System to Identify Effects of New Contaminants

Results/Reporting

- Annual reporting
- Bibliographic results database
- GIS-based database – location, concentrations, toxicity information, matrix, analytical methodology, method detection limits, quality assurance and quality control

US EPA ARCHIVE DOCUMENT

USFWS: Early Warning System to Identify Effects of New Contaminants

MILESTONES FOR FY2010

- Literature search conducted from January 1, 2009 – May, 2010
- Sample collection conducted from April 2010 – October 2010
- Preliminary toxicity studies/protocol development – May 2010 – October 2010
- Data Analysis – ongoing through 2010
- Reporting – annual.

US EPA ARCHIVE DOCUMENT

USFWS: Early Warning System to Identify Effects of New Contaminants

2011 and Beyond

- Expand pilot studies to additional sites
- Expand toxicity studies to additional compounds
- Maintain and expand data base
- Potentially, trend analysis

US EPA ARCHIVE DOCUMENT

USGS

Monitoring Contaminants in Great Lakes Tributaries

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Scope of Work
- Timelines
- Outputs
- Outcomes
- Results/Reporting

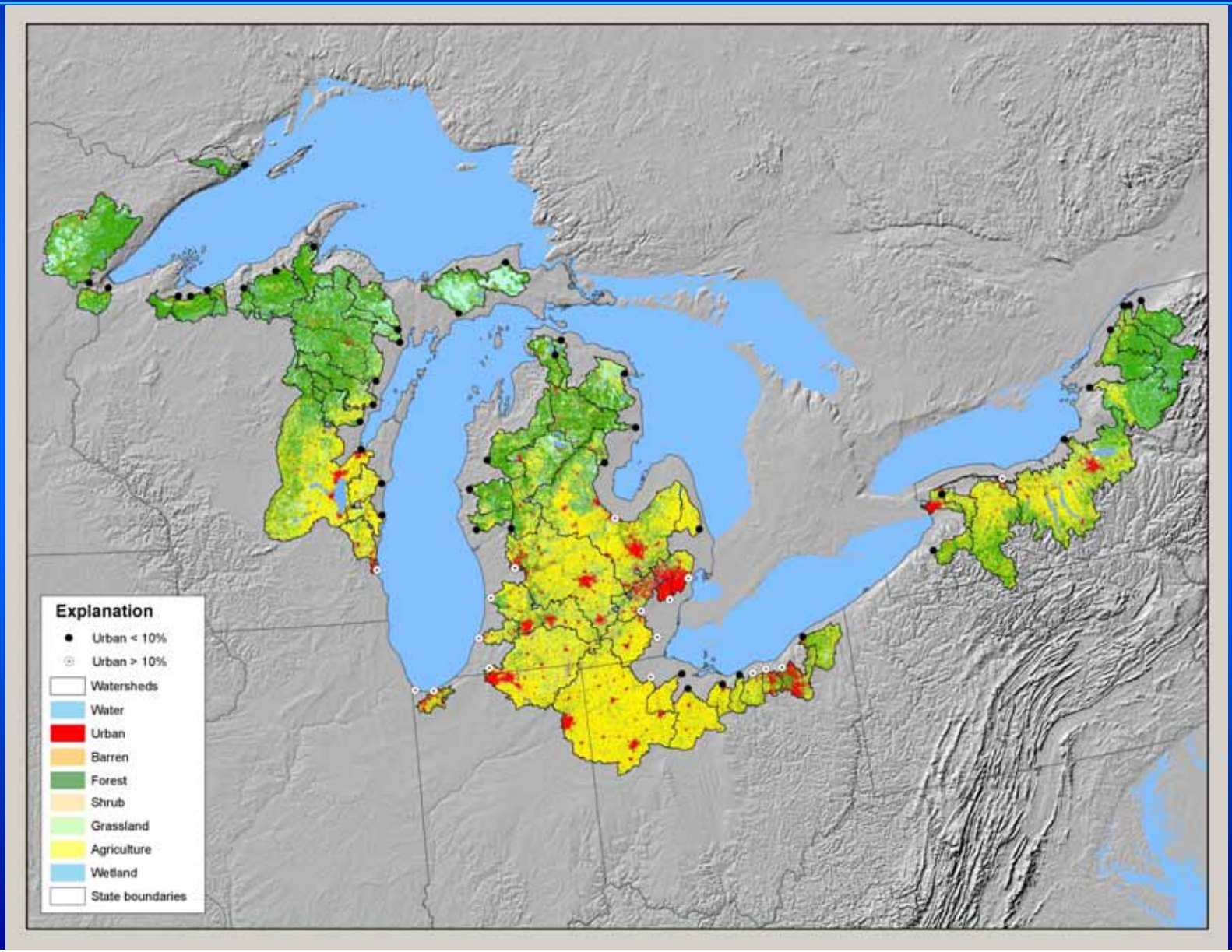
US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Scope of Work
  - Collect water column, sediment, and fish surrogate data from tributary and tributary mouth embayments associated with the National Monitoring Network for Coastal waters (NMN) design to provide baseline information, measure progress towards restoration goals, assess new threats and to support other contamination effects efforts.

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries



US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Install Polar Organic Chemical Integrative Samplers (POCIS) at all 59 NMN tributary sites .
- The POCIS is an integrative sampler which provides time weighted average concentrations over the deployment period.
- The POCIS samples chemicals in the dissolved phase mimicking the respiratory exposure of aquatic organisms.
- Analytes are hydrophilic contaminants which could be potentially endocrine disrupting or acutely toxic. These compounds include pesticides, prescription and OTC drugs, steroids, hormones, antibiotics, personal care products, etc.

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Install Semi-permeable membrane devices (SPMD) at all 59 NMN tributary sites.
- SPMDs are passive samplers for assessing trace levels of hydrophobic organic contaminants.
- SPMDs are designed to mimic biological membranes, such as the gills of fish.
- The following classes of compounds have been shown to concentrate in SPMDs: wastewater indicators, pharmaceuticals, PAH's, SVOC's, Pesticides, organochlorine pesticides and PCB's.

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Collect monthly and storm water chemistry samples at a subset of NMN tributary sites. Some of these sites will use automated samplers (as appropriate).
- Ten to twelve sites that have significant urban influence, 4 - 6 sites with significant agricultural influence, and 2 background reference sites.
- Analyze samples for pharmaceutical and personal care products (PCP's). Samples will also be analyzed for Major Ions, nutrients, and physical parameters as part of another project.

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Three basins (one urban, one agricultural, and one reference) up stream of the subset of NMN sites will be instrumented and monitored for human and animal viruses.
- Three sites in upstream portion of the basin monitored to help differentiate between sources of viruses and pathogens at the mouths of the rivers.
- Collect monthly and storm water chemistry samples for qPCR measurement of:
  - Cryptosporidium parvum,
  - Salmonella enterica (and subspecies),
  - Campylobacter jejuni,
  - enterohemorhagic E. coli (e.g. O157:H7),
  - bovine Group A and C rotavirus,
  - bovine coronavirus,
  - bovine diarrhea virus Types 1 and 2,
  - bovine enterovirus,
  - 6 human viruses
  - **Wastewater indicators**
  - **veterinary antibiotics**

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Install horizontal sediment traps at the 15 AOC sites
- Analyze samples from sediment traps for PAH's and Total PCB's in Bed sediment, Alkylated PAH's in bed sediment, OC's and PCB's in sediment, and Pharmaceuticals in sediment .

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Additionally, real time sensors (ph, SC, turbidity, DO, chlorophyll, etc.) will be deployed at a subset of sites to develop statistical relations (through regressions) between continuously measured parameters and constituents of interest.
- Chromophoric dissolved organic matter (CDOM) sensors and autonomous underway vehicles (AUV) will be tested for use in embayments and the near shore at the end of select tributary mouths.

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Design a model or set of models that can be used throughout the Great Lakes Basin to estimate flow, contaminant loads, and the effects of individual basins on the ecological well-being of the Great Lakes.
- This effort will begin during FY10 with identification of models, contaminants, and basins to be modeled

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Timelines
  - We hope to begin this effort in FY10. During FY10 the equipment will be installed and sampling will begin.
  - The work will continue during FY11 with some adjustment in parameters analyzed.
  - Additional focus during FY11 on legacy contaminants at a subset of AOC sites where future remediation efforts being planned.

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Outputs
  - Contaminant occurrence and distribution data and information
  - Contaminant source modeling results

US EPA ARCHIVE DOCUMENT

USGS: Plans for Monitoring Contaminants in Great Lakes Tributaries

- Results/Reporting
  - All data and information will all be compiled in a USGS database.
  - The database will expose high-priority datasets via common data formats and exchange interfaces to the GLOS database.
  - No specific publication plans at this point

US EPA ARCHIVE DOCUMENT

USGS

Effects of Contaminants on Great Lakes Indicator Species

US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

Birds as Indicators of Contaminant Exposure in the Great Lakes:

- Scope of Work
- Timelines
- Outputs
- Outcomes
- Results/Reporting

US EPA ARCHIVE DOCUMENT

Birds as Indicators of Contaminant Exposure in the Great Lakes

Birds include charismatic species of public concern

Some feed high on the food chain and accumulate high contaminant concentrations

Birds can serve as indicators of human health

US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

- Scope of Work

  - Use tree swallows and colonial waterbirds in the Great Lakes to evaluate contaminant
    1) Exposure
    2) Trends through time
    3) Effects
    4) Monitor cleanup actions

  - Use a combination of extensive (objectives 1 & 2) and intensive (objectives 1, 2, & 3) studies

US EPA ARCHIVE DOCUMENT

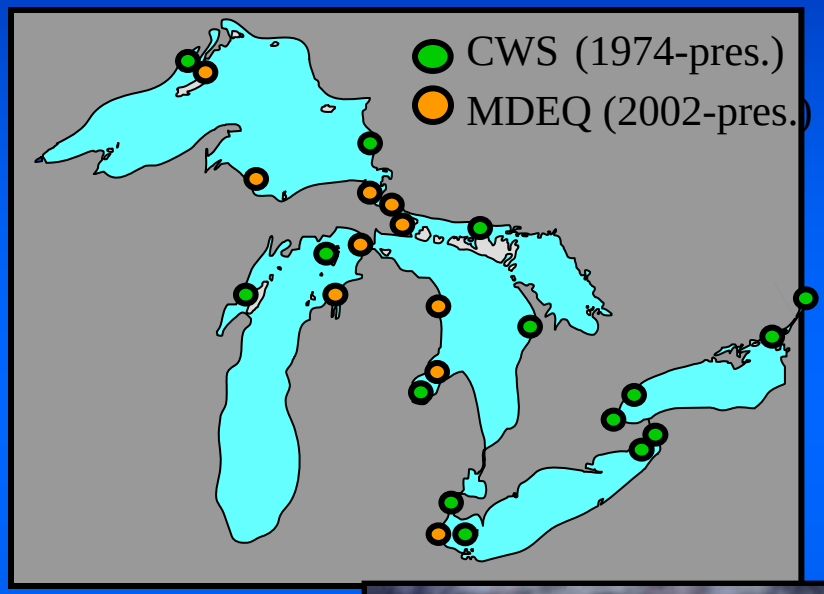
USGS: Effects of Contaminants on Great Lakes Indicator Species

1) Exposure

- Support chemical analyses of MDEQ herring gull samples (●)

- Sample birds at selected sites (AOCs, National Parks, etc.)

- Include newer contaminants such as PFCs, PBDEs, and non-PBDE flame retardants



US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

2) Trends through time

- Analyze herring gull samples (U.S. locations) for PFCs and PBDEs

- Collect and analyze red-breasted merganser eggs, Door Co, Lake Michigan and compare to archived collections from late 1970s

- Begin new timelines for the new sites

US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

3) Effects

- At intensive sites investigate contaminant effects, especially of new, little-study contaminants such as PFCs, PBDEs, other flame retardants, or legacy contaminants with limited data

- Select intensive study sites based on known hotspots and from results of new extensive sampling

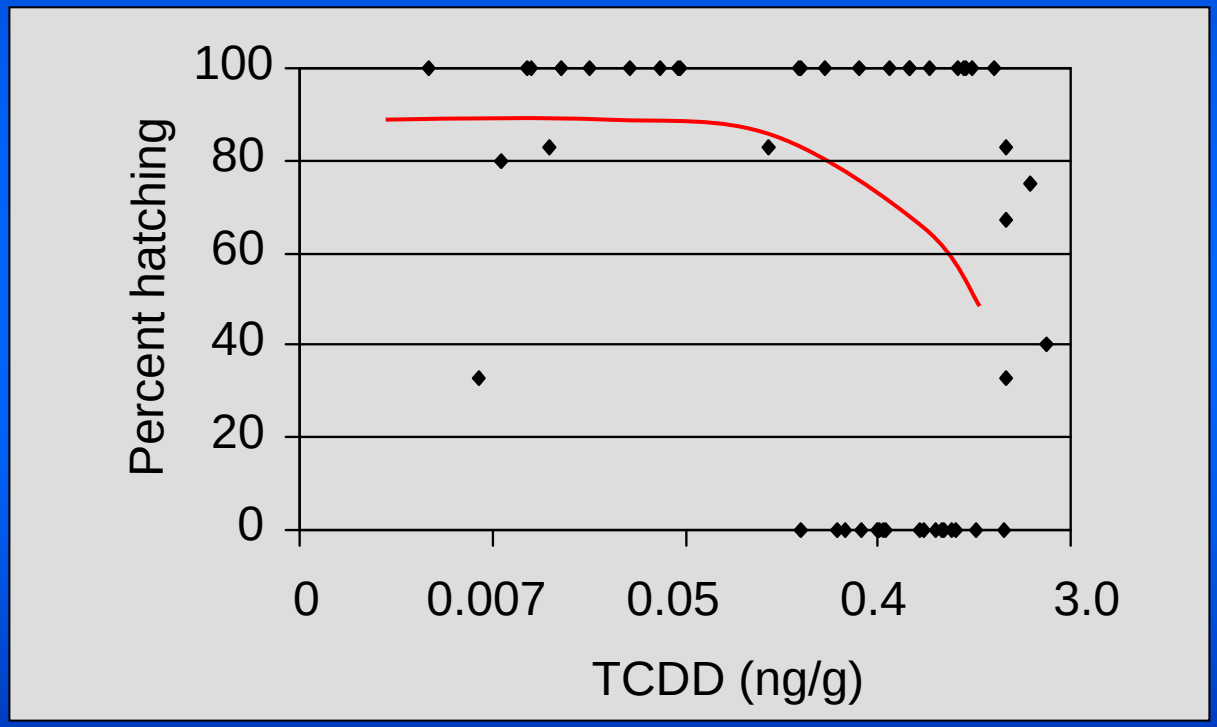
- Use colonial waterbirds, swallows, or both as appropriate

- Initiate laboratory effect studies as needed

US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

Example: Effects of dioxin contamination on tree swallow hatching success on the Woonasquatucket River, RI



Custer et al. 2005. ET&C 24:93-109

Part of an EPA Ecological Risk Assessment

US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

Other effect endpoints:

- Oxidative stress
- EROD induction
- Mitochondrial DNA

US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

- Scope of Work
- Timelines

2010 – extensive and intensive sites selected and sampled

2011 – work at extensive and intensive sites continues

- 2010 extensive sites may (1) become intensive sites if warranted or (2) be continued for trend analysis thorough time.
- new extensive and intensive sites may be added

2012 and beyond

- work at a matrix of extensive and intensive studies continues

US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

- Scope of Work
- Timelines
- Outputs

  - Peer-reviewed publications, examples:

  Trends in contaminant concentrations in herring gulls from the U.S. Great Lakes 2002-2007

  Tree swallows as indicators of environmental contaminants throughout the Great Lakes (results of extensive sampling). Could include publications on other waterbird species as well.

US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

- Scope of Work
- Timelines
- Outputs (continued)
  - Effects studies require 2 – 3 years of data collection. These results will be available as site or chemical evaluations are completed

US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

- Scope of Work
- Timelines
- Outputs
- Outcomes
  - The data can be used to assess the distribution and trends through time of contaminants in the Great Lakes
  - Effect levels established here can be used in contaminant assessments nationwide
  - The data can be used to assess clean-up efficacy at AOCs and other contaminated sites

US EPA ARCHIVE DOCUMENT

USGS: Effects of Contaminants on Great Lakes Indicator Species

- Scope of Work
- Timelines
- Outputs
- Outcomes
- Results/Reporting

  - A continual process with some immediate publications expected and then on a re-occurring basis as studies wrap up at specific locations and new locations and chemicals are assessed

US EPA ARCHIVE DOCUMENT

EPA

Developing Critical Information

US EPA ARCHIVE DOCUMENT

EPA Developing Critical Information

New Chemical Screening

- Continuation of Muir/Howard efforts
- Identification and prioritization of chemicals in commerce that may be of interest in Great Lakes
  - Results of initial project already available
  - New efforts on pharmaceuticals should be available in 2010
  - GLRI enhanced efforts not available until 2011/2012

US EPA ARCHIVE DOCUMENT

EPA Developing Critical Information

Great Lakes Fish Contaminant Monitoring & Surveillance Program

- Base Program / Open Lakes Trend Program
  - Lake trout (walleye) whole fish composites
  - Legacy contaminants, toxaphene, mercury, PBDEs, and PFOS
  - SOLEC, GLBTS, GPRA reports 2 years after fish collected
- Emerging Chemical Surveillance
  - Screening for emerging chemicals based on PBT & “analyzability”
  - Work already under way on the many of the chlorinated and brominated compounds on the Muir/Howard priority 50
  - Preliminary results in 2010; results of GLRI enhanced efforts not available until 2011/2012
- Special Studies
  - Stable isotope analyses
  - Forage fish
  - Gut analyses

US EPA ARCHIVE DOCUMENT

EPA Developing Critical Information

Integrated Atmospheric Deposition Network (IADN)

- Base Program
  - Air, particle and precipitation samples 1 in every 12 days
  - Legacy contaminants, PBDEs and some other BFRs
  - SOLEC, GLBTS, GPRA reports 2 years after samples collected
- Emerging Chemical Surveillance
  - Screening for emerging chemicals based on PBT & “analyzability”
  - Work already under way on the some of the chlorinated and brominated compounds on the Muir/Howard priority 50
  - Recent publications; results of GLRI enhanced efforts not available until 2011/2012
- Special Studies
  - Perfluorinated compounds and mercury
  - Cooperative Science and Monitoring Initiative (CSMI)
  - More data in urban areas

US EPA ARCHIVE DOCUMENT

EPA Developing Critical Information

Sediment Core Surveillance

- Existing effort with Dr. An Li and University of Illinois – Chicago
- Looking for many chemicals of emerging concern
  - Focus on brominated and chlorinated compounds
  - Results of initial project should be available in 2010
- GLRI enhanced efforts
  - Collected additional cores in strategic locations
  - Better coordinate with Canada
  - Expand scope of analytes to include perfluorinated compounds and other compounds on the Muir/Howard priority 50
  - Results GLRI enhanced efforts not available until 2011/2012

US EPA ARCHIVE DOCUMENT

EPA Developing Critical Information

Other efforts

- Enhancement of Great Lakes Air Deposition (GLAD) grant program
- Assessment of Ecological Exposure and Effects
  - Evaluation of new PBT chemicals found in GL fish
  - Combined biological endpoint measurements with chemical measurements for “pseudo-persistent” compounds in fish
    - Estrogenicity, androgenicity, thyroid action
    - Lab and field studies
    - modes of action
- Toxicity testing methodology
  - Hyalella culturing conditions
  - Freshwater native mussel toxicity tests
  - Assessment of modes of action and reproductive effects on freshwater mussels