



Great Lakes Monitoring and Surveillance Programs - GLNPO

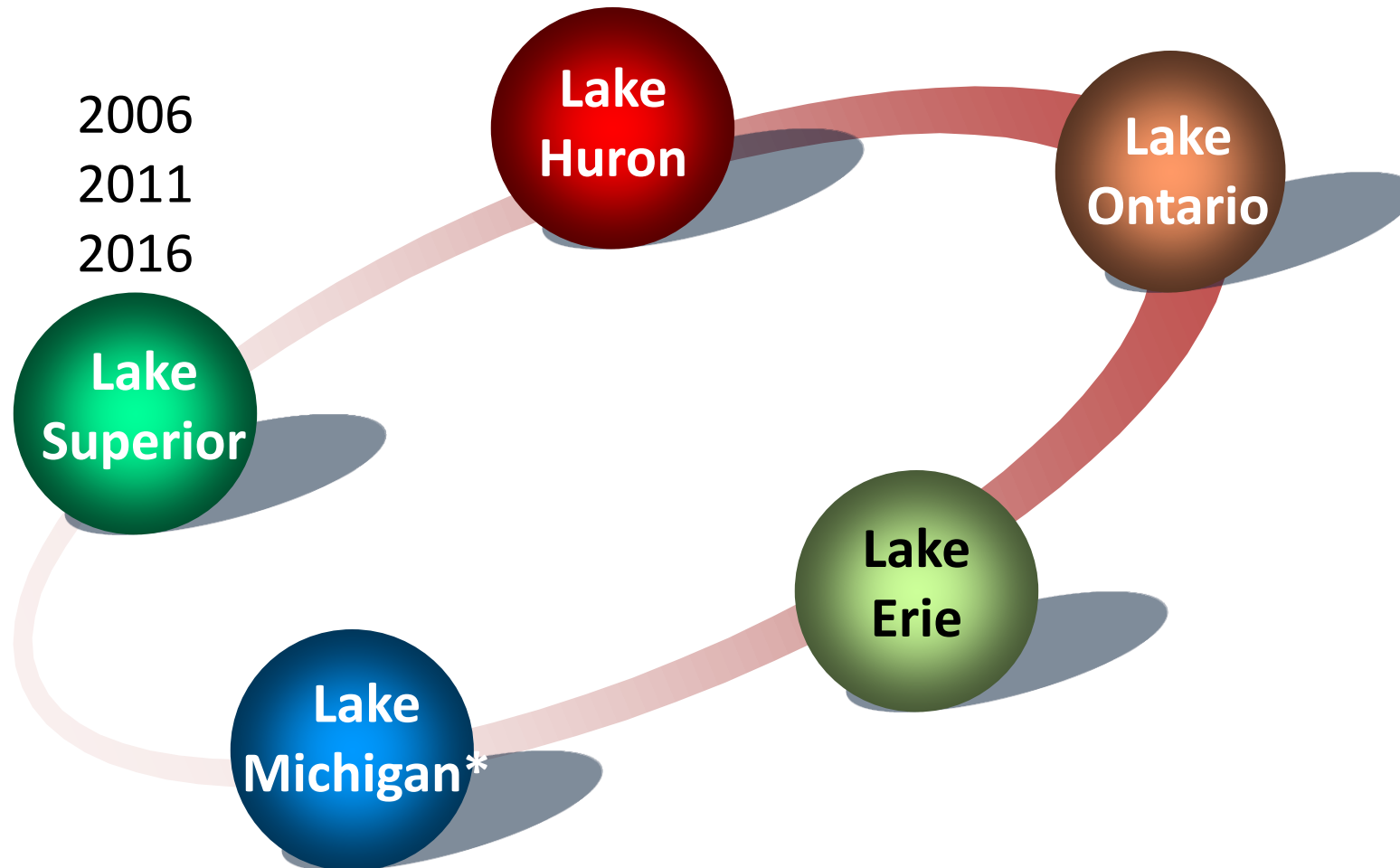
- Cooperative Monitoring
 - Coordinated Science and Monitoring Initiative
- Open Lake Water Quality Monitoring
 - Biological Monitoring
 - Water Quality Surveys
- Chemical Monitoring and Surveillance
 - Fish Monitoring and Surveillance
 - Integrated Atmospheric Deposition Network (IADN)
 - Sediment Surveillance
- Nearshore/Near Coastal
 - Coastal Wetland Monitoring
 - GLNPO Nearshore Monitoring
 - National Coastal Conditions Assessment
 - Great Lakes Human Health Fish Fillet Tissue Study



Cooperative Science and Monitoring Initiative - CSMI

- Program Purpose: Coordination of Science and Monitoring to address LAMP information needs
- Focus resources on key issues on one lake each year
- CSMI follows a 5 year rotational cycle
- CSMI does NOT set priorities
- Program Dates: 2002 to present

CSMI Rotation





CSMI Steering Committee Membership

Co-Chaired by EC and EPA-GLNPO

Members	
DFO	USGS
MOE	NOAA
MNR	USFW
EC	EPA-GLNPO
	EPA-ORD
	States
	Tribes



Lake Superior 2005/06 Priorities

- Atmospheric and open lake measurements of LaMP pollutants from all management categories, as well as atrazine and emerging chemicals
- Multi-agency inter-comparison study for contaminants in fish
- Enhanced lower trophic level monitoring
- Pilot project for their herptile indicator



Lake Superior 2011 Priorities

- Lake Superior chemicals of concern
- Emerging Chemicals
- Nutrients
- Tributaries (including baseline data collection in watersheds with potential development)
- Implement expanded monitoring of lower food web
- Aquatic invasive species monitoring
- Native fish species restoration progress monitoring



Lake Superior 2011-what was monitored?

- Lake Superior chemicals of concern-several media
- Emerging chemicals
- Nutrients- open lake and tributaries
- Tributaries – Duluth Complex bedrock watersheds –chemistry baseline
- Lower food web assessment - 54 sites visited
- Aquatic invasive species monitoring - early detection monitoring
- Native fish species restoration progress monitoring-Sturgeon Index Survey



Draft Lake Superior 2016 Priorities

- Lower trophic food web/energy transfer
- Chemicals – legacy and emerging
- Lake sturgeon index survey
- Monitoring to support fish rehabilitation plans
- Nutrient loads from watersheds

Lake Superior Cooperative Science and Monitoring Workshop

September 24-25, 2013

Duluth, Minnesota

Summary of Input on Future Science and Monitoring



Photo: Duluth Harbor, courtesy of Environment Canada
Report prepared by Margaret Wanlin, Workshop Facilitator
Wanlin & Co., Thunder Bay, Ontario

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Presentation Summaries



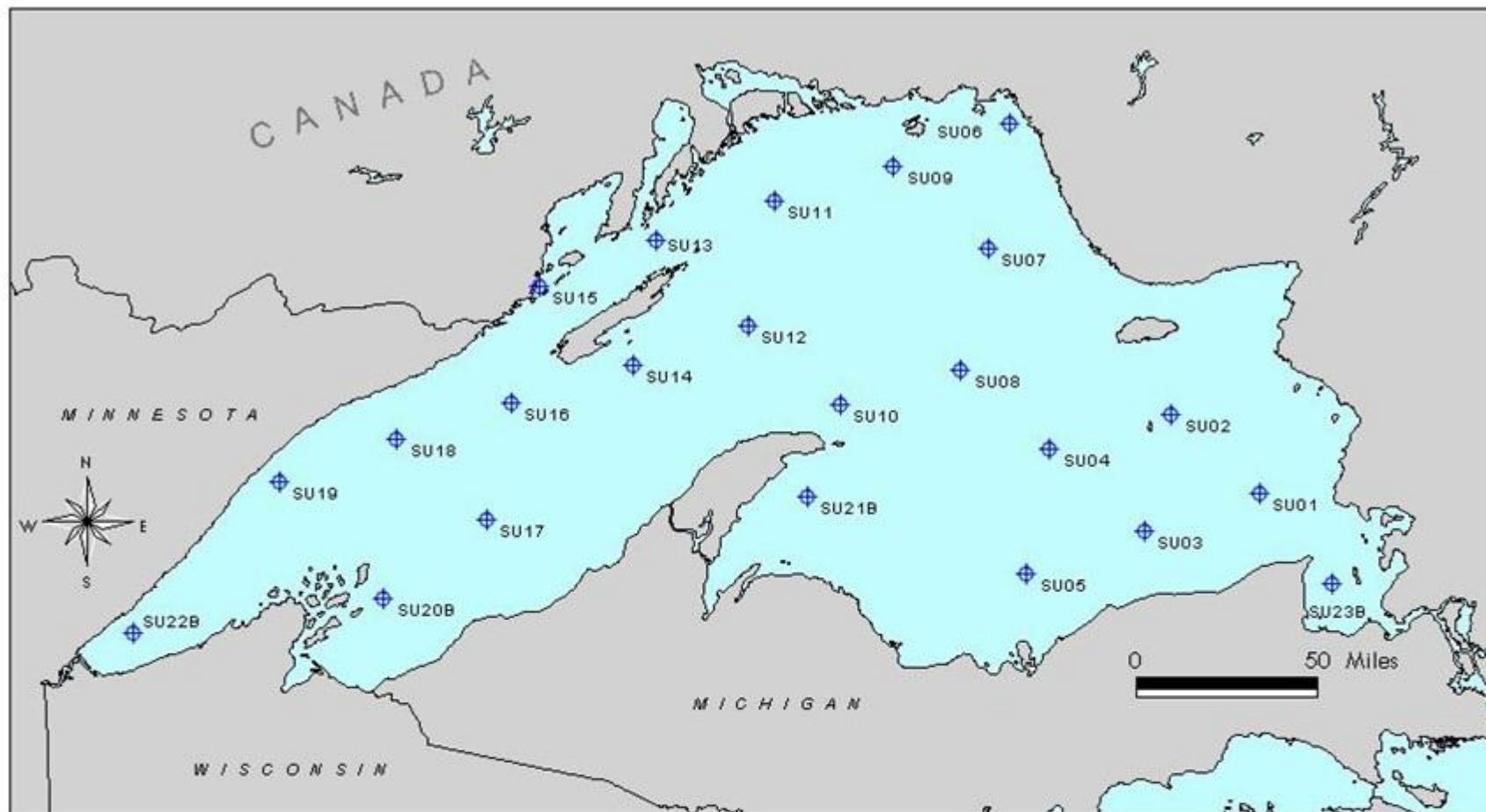
Photo: Duluth Harbor, courtesy of Environment Canada
Report prepared by Margaret Wanlin, Workshop Facilitator
Wanlin & Co., Thunder Bay, Ontario



GLNPO Open Lake Biological Monitoring

- Program Purpose:
 - Assess the health of the lower food web of the Great Lakes
 - Discover invasive species and impacts
 - Determine productivity levels
- Program Dates: Lake Superior – 1996 to present

Lake Superior Open Lake Stations Summer Survey



◆ Open Lake Stations



Program Parameters

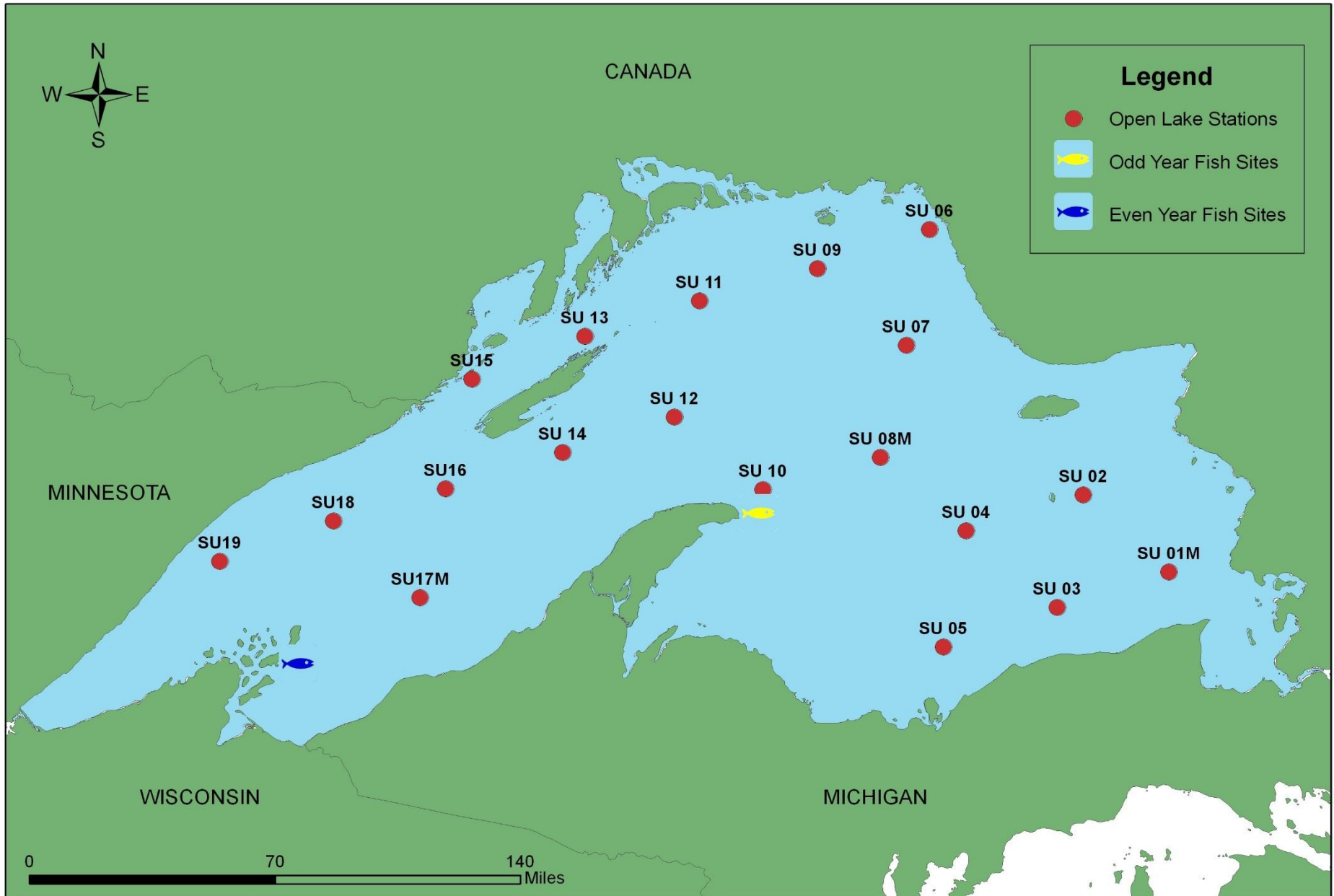
- Phytoplankton – to species or lowest achievable taxon
 - Counts, Biomass,
- Zooplankton – to species
 - Counts, Biomass,
- Benthos – to species or genus
 - Counts, Biomass
 - Chlorophyll a
- For more information:
<http://www.epa.gov/grtlakes/glindicators/biology.html>



GLNPO Water Quality Surveys

- Program Purpose: Monitoring and Surveillance is intended to fulfill provisions of the Great Lakes Water Quality Agreement calling for periodic monitoring of the lakes to:...3) evaluate water quality trends over time; and 4) identify emerging problems in the Great Lakes Basin Ecosystem.
- Program Dates: Two Surveys are conducted semi-annually in the Spring and Summer on Lake Superior since 1992.
- Info, data, and publications available at <http://www.epa.gov/grtlakes/monitoring/limnology/index.html>

Lake Superior Water Quality Survey Sampling Stations





Program Parameters

- Nutrients
 - Nitrate-Nitrogen and Total Nitrogen
 - Total and Total Dissolved Phosphorus
 - Dissolved Reactive Silica
- Water Quality Parameters
 - Chloride
 - pH
 - Specific Conductance
 - Turbidity
 - Alkalinity
 - Hardness
 - Sodium, Potassium, Calcium, and Magnesium
- Particulates
 - Carbon
 - Nitrogen
 - Phosphorus



Great Lakes Fish Monitoring and Surveillance Program

- Program Purpose – collect and analyze whole fish from the open waters of the Great Lakes to track trends of legacy contaminants and identify emerging contaminants to assess ecosystem health.
 - State and Tribal Fish consumption advisory programs partner through identification of priority emerging contaminants to prioritize limited resources.
 - Whole Fish
- Program dates – 1970 to present
- Info, data, and publications available at <http://www.epa.gov/grtlakes/monitoring/fish/index.html>



Great Lakes Fish Monitoring and Surveillance Program Collection Sites





Program Parameters

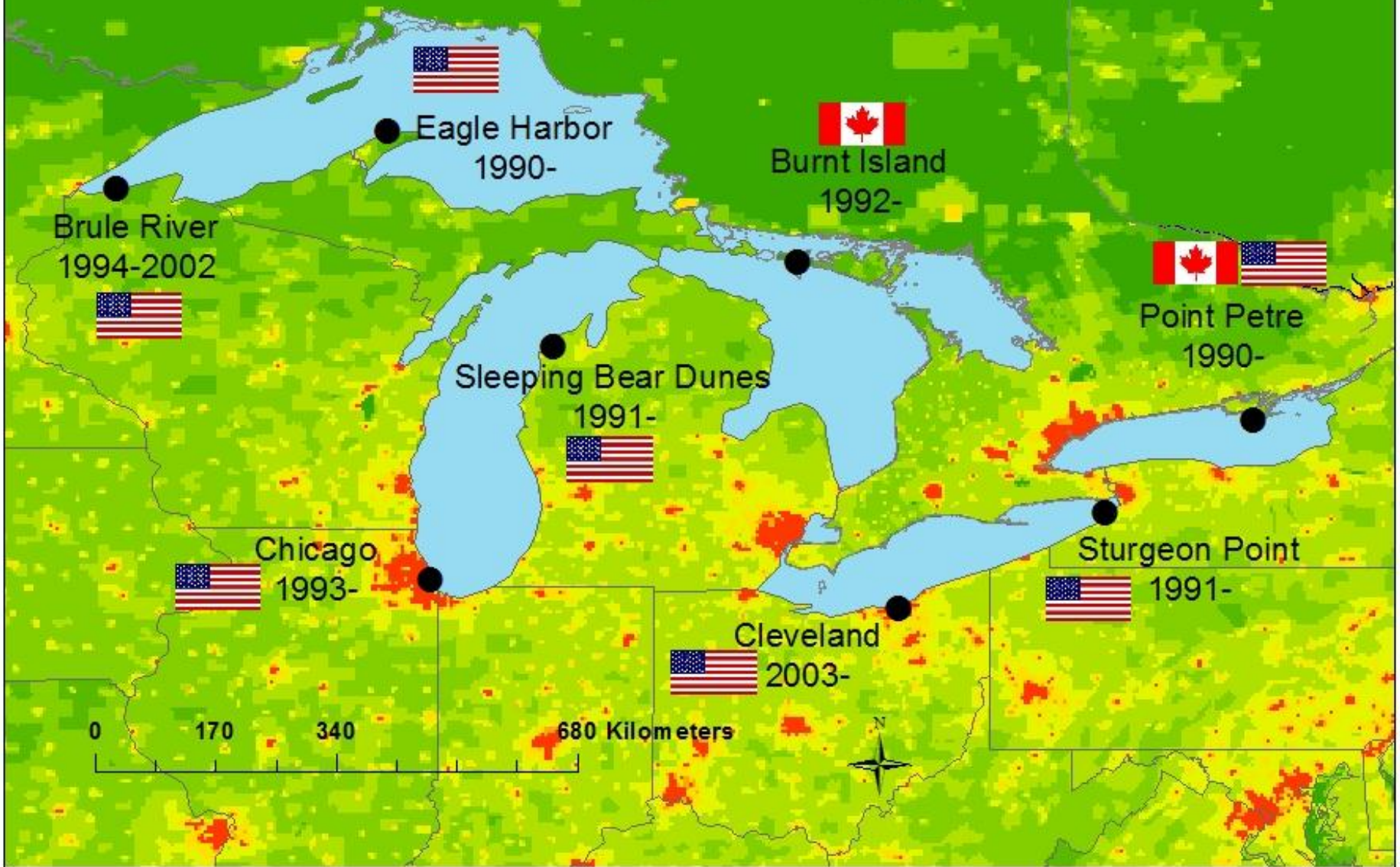
- PCBs
- Mercury
- PBDEs
- Legacy Organo Chlorine Pesticides
 - Toxaphene
 - DDT
 - Etc.
- Emerging Contaminants
 - Perfluorinated Compounds
 - Flame retardant replacements
 - Etc.
- Biology
 - Age
 - Lipid
 - Length
 - Etc.

Integrated Atmospheric Deposition Network



- Binational monitoring program since 1990
- Measures pollutants in air and precipitation samples
 - Air samples collected for 24-hours every 12 days
 - Precipitation samples composited monthly
- Goals:
 - Determine atmospheric loadings to the Lakes
 - Assess spatial and temporal trends
 - Identify sources and/or source regions
- For more information :
 - <http://www.epa.gov/grtlakes/monitoring/air2/iadn/resources.html>

Integrated Atmospheric Deposition Network sites



Program Parameters



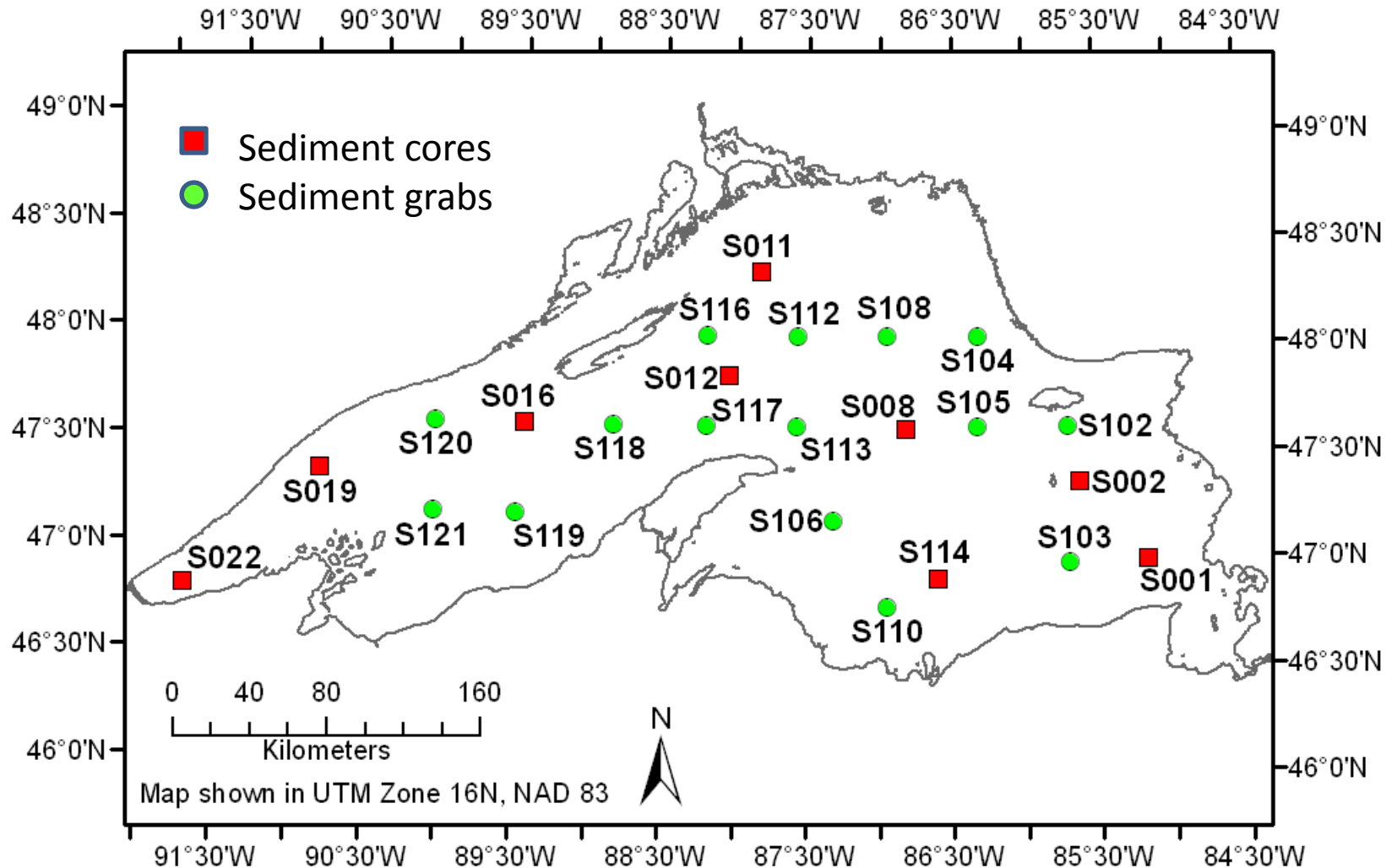
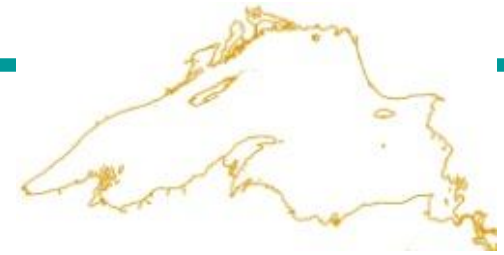
- PCB congeners
- Organo chlorine pesticides
 - e.g. DDT and HCH
- Polycyclic aromatic hydrocarbons (PAHs)
 - e.g. Benzo[a]pyrene
- PBDE congeners (including BDE-209)
- Other flame retardants
 - e.g. organophosphate flame retardants
- Meteorological measurements

Great Lakes Sediment Surveillance Program



- Measures chemicals in sediment cores and sediment surface grab samples
- One lake sampled each year per CSMI schedule
- Goals:
 - Investigate spatial and temporal trends
 - Determine total loadings to lakes
 - Assess whether sediments are a sink or source
 - Identify emerging chemicals

2011 Lake Superior sediment sampling locations



Program Parameters



- PCB congeners
- Organo chlorine pesticides
- Dioxins and furans
- Polychlorinated naphthalenes
- PBDEs and other flame retardants
- Musk fragrances
- Perfluorinated compounds (e.g. PFOS)
- Physiochemical properties (e.g. density, OC)
- Sediment core dating (e.g. Pb 210)

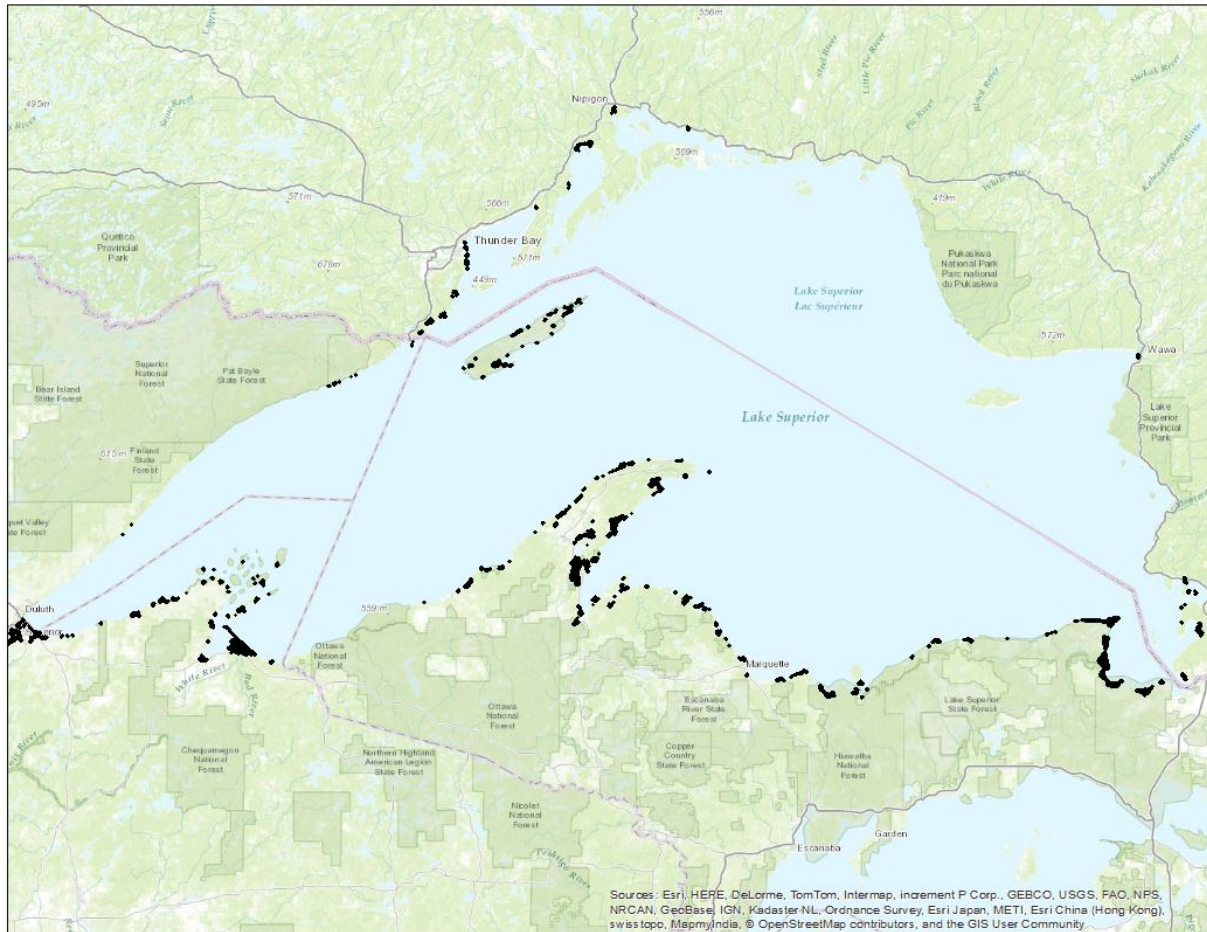


Coastal Wetland Monitoring

- Program purposes:
 - Establish baseline conditions for all US and Canadian coastal wetlands
 - Track conditions of particular wetlands over time to establish trends
 - Evaluate restoration techniques leading to improved methods
 - Strategically invest in coastal wetland protection, restoration and enhancement
- Program Dates: 2011-2016
- Website: <http://greatlakeswetlands.org/>



Coastal Wetland Monitoring Map





Coastal Wetland Monitoring Program Parameters

- Amphibians
- Birds
- Wetland Plants
- Fish Community Health
- Invertebrate Communities
- Surrounding Landscape Composition
- Water Chemistry



GLNPO Nearshore Monitoring

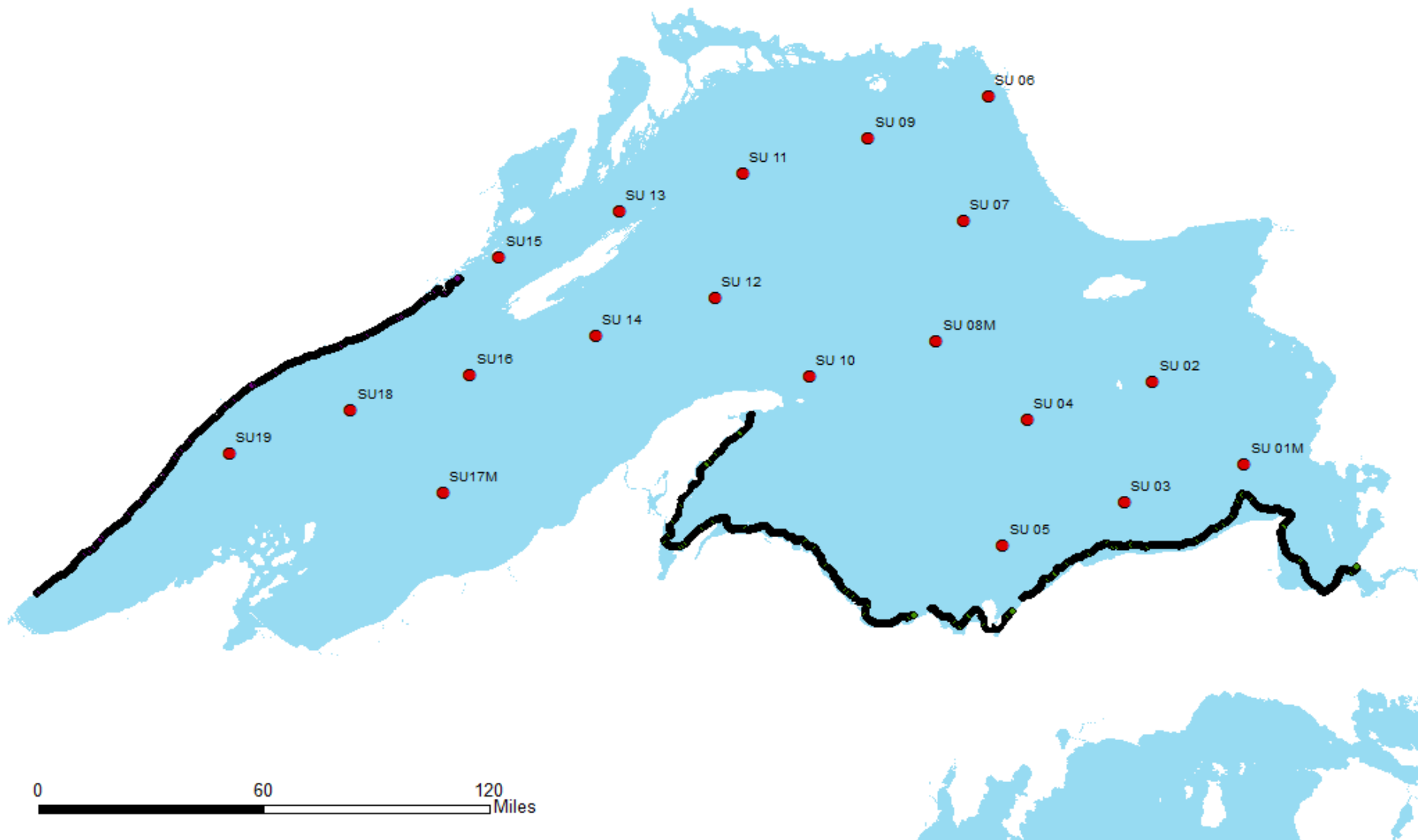
- **Program Purpose:** The goal of this project is to utilize data-rich *in situ* sensor technologies to document patterns in water quality variables, relate these to landscape characteristics, such as tributaries, and be able to discern shifts in these patterns indicative of significant environmental change.
- **Program Dates:** Generally two times per lake in a 5 year period, beginning in 2009 – present. Only one survey conducted on Lake Superior in 2011.

2011 Lake Superior Nearshore Tow

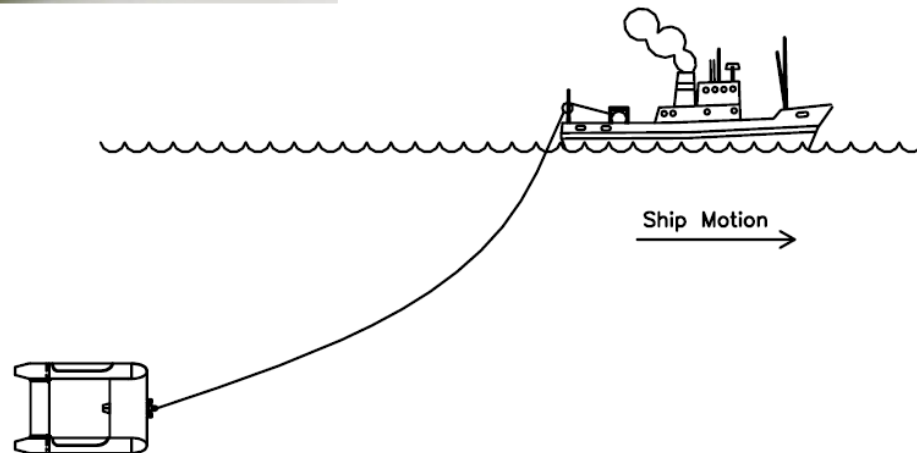


Legend

- ◆ Triaxus Tow
- Open Lake Stations



TRIAXUS 3D Towed Undulating Vehicle

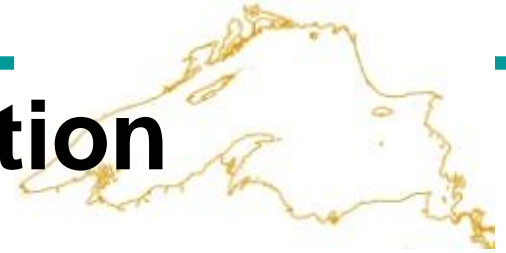




GLNPO Nearshore Program Parameters

- Water Quality Parameters
 - Temperature
 - Dissolved Oxygen
 - Specific Conductance
 - Beam Attenuation
- Biology
 - Total Chlorophyll Concentration
 - Zooplankton Density
 - Zooplankton Biomass
 - Phytoplankton Percent Yield
- Nutrients
 - Nitrate

National Coastal Condition Assessment

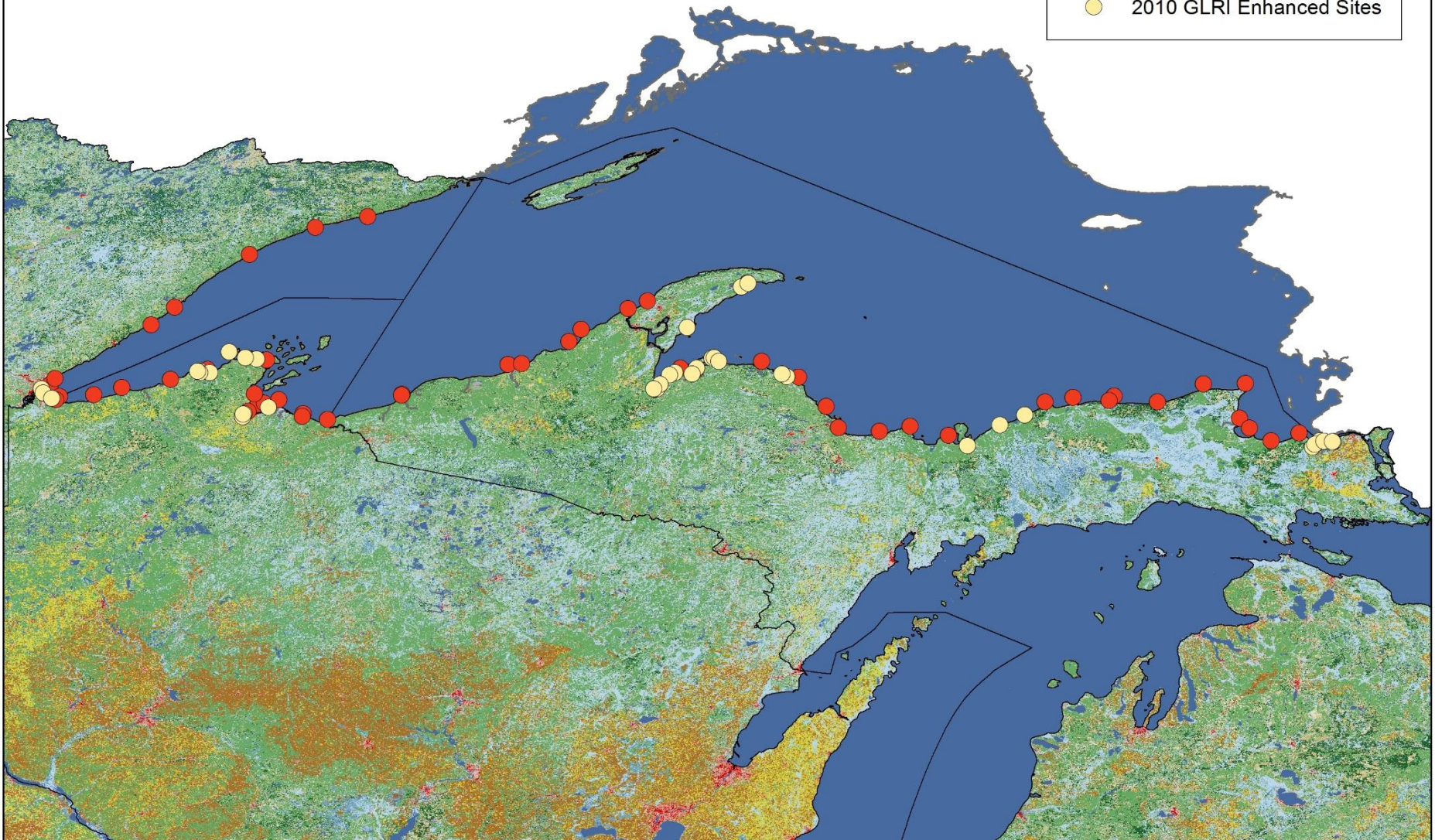


- EPA OW program (part of National Aquatic Resource Surveys)
- Goals is to answer two key questions about the quality of the Nation's coastal waters:
 - What percent of the Nation's coastal waters are in good, fair, and poor condition for key indicators of water quality, ecological health, and recreation?
 - What is the relative importance of key stressors such as nutrients and pathogens?
- For more information:
<http://water.epa.gov/type/oceb/assessmonitor/ncca.cfm>

2010 Lake Superior National Coastal Condition Assessment Sites

Legend

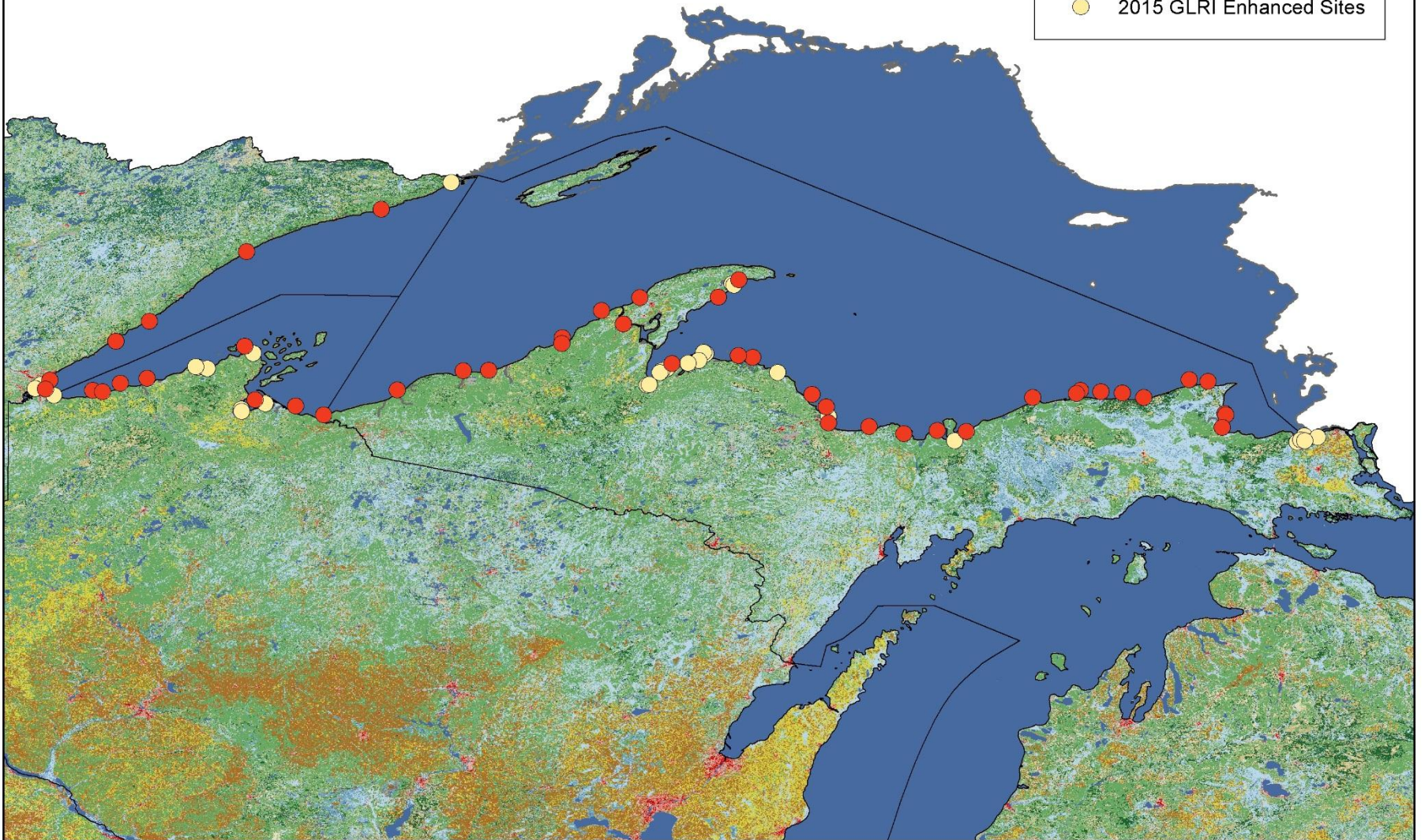
- 2010 NCCA Base Sites
- 2010 GLRI Enhanced Sites



2015 Lake Superior National Coastal Condition Assessment Sites

Legend

- 2015 NCCA Base Sites
- 2015 GLRI Enhanced Sites



Program Parameters



- Water Column

- Salinity
- Temperature
- pH
- DO
- PAR
- Secchi depth
- DIN, DIP, TN, TP
- chl *a*
- *Enterococci*
- Phytoplankton & underwater video (Great Lakes)



- Sediment

- TOC
- % silt/clay
- Chemistry
- Toxicity
- Benthic macrofauna



- Fish

- Whole fish tissue
- Fish fillet (Great Lakes)





Great Lakes Human Health Fish Tissue Study

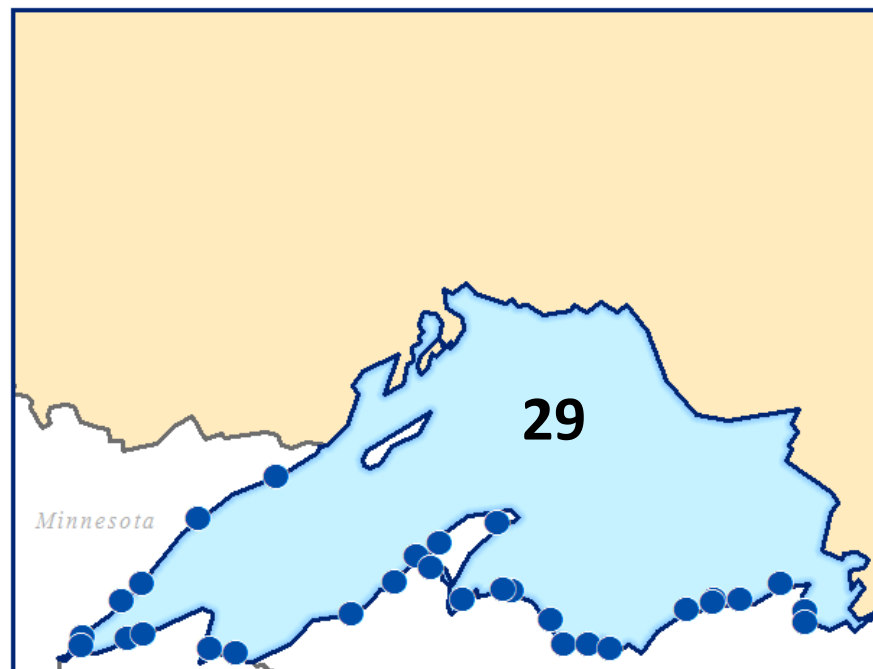
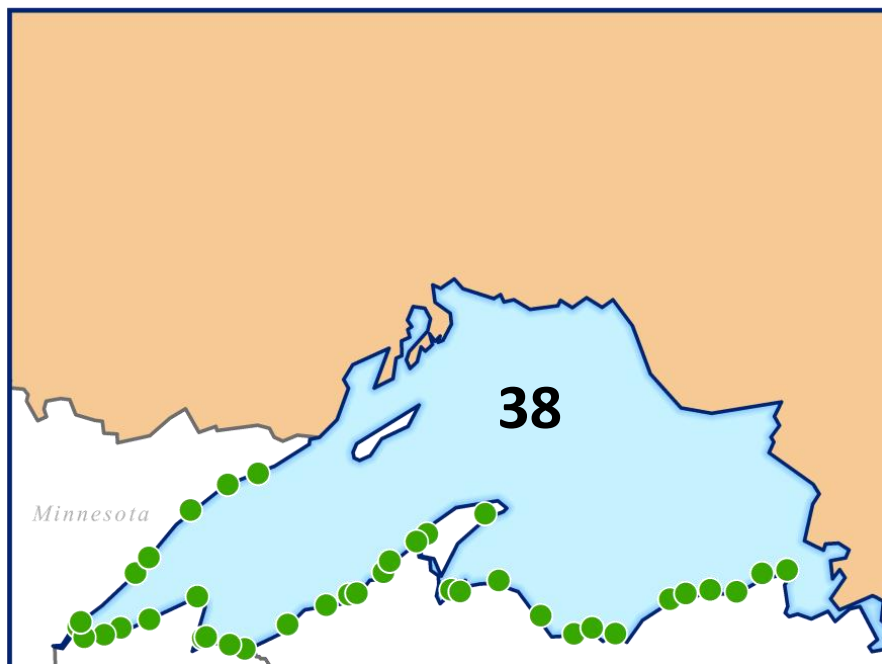
- Supplement to the National Coastal Condition Assessment to monitor the occurrence of toxic chemicals in fish fillet samples to assess the potential health impacts to people who consume fish.
 - GLNPO is funding a portion of this program to add contaminants that are a priority to State and Tribal Advisory Programs.
 - Fish Fillets
- Program dates – 2010 and 2015
- <http://water.epa.gov/scitech/swguidance/fishstudies/>

Collection Location



2010

2015





Program Parameters

- PCBs
- PBDEs
- Mercury
- Perflourinated Compounds
- Omega 3 & 6 Fatty Acids
- Emerging Contaminants TBD



Reporting

- Science-based ecosystem indicators
- Lakewide Action and Management Plans
- Scientific reports and publications
- GLRI reports