The National Coastal Condition Assessment
Western Lake Michigan and Southern Lake Superior

Steven Greb and Paul Garrison
Wisconsin Department of Natural Resources

Terra MODIS image of Wisconsin. Space Science and Engineering Center (SSEC) at the University of Wisconsin-Madison
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....with additional information on the WDNR nearshore survey

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The primary goal of the NCCA

To assess the condition of the nation’s coastal waters via an unbiased, statistically-representative approach by addressing 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 contaminated sediments?

Other key objectives:
• Evaluate changes in condition from previous studies
• Help build state and tribal capacity for monitoring and assessment, and promote collaboration

Assessment is directed and sponsored by US EPA
• 1,104 sites in estuarine and Great Lakes nearshore waters
• 35,400 square miles of U.S. coastal waters.
• Same methods at all sites to ensure that results would be nationally comparable.

In the Great Lakes............
• Sample size of 45 sites in Near Shore zone for each Great Lake
• Sample sizes were allocated proportional to shoreline length by state within each Great Lake.
• Embayment study added 150 sites into the Great Lakes assessment.
Coastal Condition Indicators

Water Quality Indicator:
- Water Clarity – Secchi, PAR
- DO, Temp, pH
- Chlorophyll $a$
- Nutrients (DIN, DIP, TP, TN)

Benthic Indicator:
- Oligochaete Trophic Index

Sediment Quality Indicator:
- Toxicity (10-day amphipod survival)
- Contaminants (PAHs, PCBs, Metals, Pesticides)
- TOC
- Grain Size

Fish Tissue Indicator:
- Whole-Fish Contaminant Burden – same as Sed chem

Human Health Indicator:
- Fillet – Fish Contaminant Burden (Great Lakes Only)
- Fish Plug for Mercury (new to 2015)
- Enterococci
- Microcystin/ Algal Toxins (new to 2015)
- Phytoplankton and Underwater Footage (Great Lakes Only)
2010 and 2015
Great Lakes Enhancements

• Embayment Study
• Phytoplankton Study
• Underwater Camera study
• Human Health Fish Tissue Study
• National Park Service Study (2010 only)
• Lake Erie Subbasin study (2015)
• Connecting Channels Study (2015)
The WDNR was responsible for surveying 20 of the 225 total NCCA Great Lake sites. There were 13 sites in Lake Michigan and 7 sites in Lake Superior.
Objectives

• What is the spatial and temporal variation in nearshore nutrient concentrations?

• What are the long-term trends in nearshore nutrient concentrations?

• What is the density and distribution of *Cladophora* along Wisconsin’s Lake Michigan coastline?

• Support of ongoing and new nutrient and ecosystem research
WDNR Nearshore Survey Summary

Sampling
- 16 sites
- Mid-summer
- 10 m contour
- Profiles

Chemistry
- Total Kjeldahl N
- Ammonia
- Nitrate
- Cl
- Dis. Si
- Total suspended solids
- Total P
- Total dissolved P
- Dissolved reactive P

Cladophora Distribution and Characteristics
- 10 m
- Substrate
- Density
- Dreissenid mussels
2015 NCCA Water Quality results

![Graph showing water quality results for Chl-A (ug/L), TN (mg/L), and NO3-N (mg/L) across different locations.](image)

- **Chl-A (ug/L)**: The highest concentration is in Green Bay, with values ranging from 8.3 to over 4.00.
- **TN (mg/L)**: Concentrations are lower across all locations, with Green Bay having slightly higher values.
- **NO3-N (mg/L)**: Concentrations are the lowest across all locations, with Green Bay having the highest value.
2015 NCCA Water Quality results

WDNR Nearshore Survey

Chl-a (ug/l)
2015 NCCA Water Quality results

WDNR Nearshore Survey
2015 NCCA Water Quality results

WDNR Nearshore Survey

Open Water

Chl-A (ug/L)  TN (mg/L)  NO3-N (mg/L)

Concentration

L. Superior  L. Michigan  Green Bay

WDNR Nearshore Survey

Chl a (ug/l)


Kenosha  S. Mill.  Ozaukee  Centerville  Two Creeks  Rostock  Lilly_Bay  Bailey  E_Wash_ ST_Martins
2015 NCCA Water Quality results

![Graph showing water quality results for TP (µg/L), TDP (µg/L), and Diss-P (µg/L) for L. Superior, L. Michigan, and Green Bay.]
2015 NCCA Water Quality results

**WDNR Nearshore Survey**

- TP (µg/L)
- TDP (µg/L)
- Diss-P (µg/L)

**Locations:**
- L. Superior
- L. Michigan
- Green Bay

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**Graph Details:**
- Y-axis: Concentration
- X-axis: TP (µg/L), TDP (µg/L), Diss-P (µg/L)
- Colors:
  - Blue: L. Superior
  - Red: L. Michigan
  - Green: Green Bay

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**Data Points:**

- Kenosha
- S. Mil.
- Ozaukee
- Centerville
- Two Creeks
- Rostock
- Lilly Bay
- Bailey
- E. Wash.
- St. Martins

**Year:** 2015
2015 NCCA Water Quality results

![TP, TDP, Diss-P concentrations for L. Superior, L. Michigan, and Green Bay](chart1)

WDNR Nearshore Survey

![TP concentrations from 2004 to 2015 for different locations](chart2)
2015 NCCA Water Quality results

WDNR Nearshore Survey

TP (µg/L)
2015 NCCA Water Quality results

- **Secchi Depth (m)**
- **SO4 (mg/L)**
- **Cl (mg/L)**

Comparison of L. Superior, L. Michigan, and Green Bay.
2015 NCCA Water Quality results
2015 NCCA Water Quality results

From Chapra et al. 2012
### 2015 NCCA Water Quality results

<table>
<thead>
<tr>
<th>Water Body</th>
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<th>TN (mg/L)</th>
<th>NH$_3$-N (mg/L)</th>
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<th>TDP (µg/L)</th>
<th>Diss-P (µg/L)</th>
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<td>0.392</td>
<td>&lt; 0.015</td>
<td>0.314</td>
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Thresholds used to calculate water quality condition at Great Lakes sites

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<td>TH1 5.3</td>
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<tr>
<td></td>
<td>TH2 10</td>
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**Good Fair Poor**

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Comparison of 2010 and 2015 results

- Chlorophyll (µg/L)
- Mean Secchi Depth
- Total Nitrogen (mg/L)
- Total Phosphorus (µg/L)

### Chlorophyll (µg/L)

- **L. Superior**: 0.00 (2010), 0.799 (2015)
- **L. Michigan**: 0.48 (2010), 0.702 (2015)

### Mean Secchi Depth

- **L. Superior**: 3.5 (2010), 5.0 (2015)
- **L. Michigan**: 3.6 (2010), 7.6 (2015)
- **Green Bay**: 40.7 (2010), 15.5 (2015)

### Total Nitrogen (mg/L)

- **L. Superior**: 0.440 (2010), 0.392 (2015)
- **L. Michigan**: 0.402 (2010), 0.396 (2015)
- **Green Bay**: 0.699 (2010), 1.168 (2015)

### Total Phosphorus (µg/L)

- **L. Superior**: 3.6 (2010), 7.6 (2015)
- **L. Michigan**: 3.6 (2010), 7.6 (2015)