Integration of Probabilistic Surveys, Intensive Watershed Designs, and Targeted Sampling for Monitoring and Assessing Surface Waters in Minnesota

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Overview

- Summarize various approaches used to monitor MN Lakes, Streams, and Wetlands [Condition Monitoring]
- Integration/coordination of the various designs in Minnesota
- Discuss partnership opportunities with National Surveys
**Lake Water Quality Assessment Program**

### 10 Year Monitoring Strategy

<table>
<thead>
<tr>
<th>Area (acres)</th>
<th>#</th>
<th>Monitoring Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 500</td>
<td>~800</td>
<td>Census</td>
</tr>
<tr>
<td>100 - 500</td>
<td>~4000</td>
<td>Targeted; selection based on Citizen Monitoring, Remote Sensing, and/or Local Interest</td>
</tr>
<tr>
<td>&lt; 100</td>
<td>~7000</td>
<td></td>
</tr>
</tbody>
</table>

- Monitor ~100 Lakes/Year
- Assess swimmable use (primary contact)
- Indicators: TP, Chl-a, Secchi Depth
- 305(b) report/303(d) list
## Other Lake Assessment Programs

<table>
<thead>
<tr>
<th></th>
<th>Monitoring Design</th>
<th>Indicators</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citizen Lake Monitoring (CLMP)</td>
<td>Fixed-Station</td>
<td>Secchi Depth</td>
<td>Status &amp; Trends (individual lakes)</td>
</tr>
<tr>
<td>CLMP+</td>
<td>Fixed-Station</td>
<td>TP, Chl-a, DO, Secchi, Temp</td>
<td>Supplement CLMP dataset</td>
</tr>
<tr>
<td>Remote Sensing</td>
<td>Census (lakes &gt; 20 acres)</td>
<td>Water Clarity</td>
<td>Statewide Status &amp; Trends</td>
</tr>
</tbody>
</table>
National Lakes Assessment Project: MN

- Probabilistic Survey Design
- Enhance regional/national scale results with additional random sites to support state scale surveys
- Sample collection during summer of 2007 using standardized protocols
- Indicators measured represent biological condition, recreational use, and trophic status
- MN Contributors: Pollution Control Agency, Dept. of Natural Resources, US Forest Service
• 41 lakes ranging from 10 to 16,314 acres (Cass Lake)
• Added 9 lakes to gain statewide estimates of condition (±10% with 95% confidence)
• Good regional coverage across 4 ecoregions with 98% of MN lakes;
Stream Biological Monitoring Program

1990 – 1994 - Red and Minnesota Assessments (Fish IBI): Targeted Site Selection

1996 - Initiated rotating basin assessments (Fish & Invert IBIs): Probabilistic & Targeted

2005 - Collected data from all 10 major river basins

2006 - Repeated probabilistic survey in initial basin (St. Croix)
  - Initiated Intensive Watershed design (Snake River): Targeted/Systematic Site Selection

2007 - Phase II of Snake R. survey; Initiate Phase I of intensive design in two new watersheds

Future - Continue basin assessments: Probabilistic
  - Continue intensive watershed surveys
Stream Biological Monitoring 1990-2006

- Rotating Basin Design
- Wadeable streams and large rivers
- St. Croix and Upper Miss. reports completed
- St. Croix re-sampled 2006
- Assessments used for both 305(b) and 303(d)
Snake River Intensive Watershed Pilot: Phase I

- Biological monitoring for determination of aquatic life use support (n=58)
- Monitoring for determination of aquatic recreation and aquatic life use support (n=11)
- Monitoring for determination of aquatic consumption, aquatic recreation, and aquatic life use support (n=1)

305(b) Reporting & 303(d) Listing
National Stream and River Assessments

MN Participation

- Site reconnaissance
- Methods/Assessment Comparability (Fish & Inverts)
  - WSA vs. MN Methods
- Provided Reference (Least-impacted) sites for ecoregion expectations

Large & Great Rivers Assessments

- Large River Method Comparison (Fish & Inverts)
- Great River Method Comparison (Fish only) – planned for 2007
Wetland Biological Monitoring Program

1992 – 2006 - Monitoring efforts focused on indicator development: Targeted Site Selection

2003 - First wetland probabilistic survey conducted: Redwood River Watershed

2007 - Indicators developed statewide for depressional marshes: Plant and Invertebrate IBIs
  - Initiate first phase of statewide wetland probabilistic survey

Future - Develop condition indicators for other wetland types: Targeted Site Selection
  - Monitor set of sites in each ecoregion to assess condition trends: Fixed-Station
Probabilistic Statewide Wetland Survey Design: Status & Trends of Wetland Quantity & Quality

3-Panel Interpenetrating Design
Plot Selection: GRTS Survey Design (Areal Resource)

Year (Panel) 1
1580 1 mi² plots
+ 250 Common Plots Sampled each year

Year (Panel) 2
1580 1 mi² plots

Year (Panel) 3
1580 1 mi² plots
Panel 1: 2006 Wetland Quantity Status
2007 Wetland Quality Status

2006
Panel 1 (black) and
Common plots (red)
National Wetland Condition Assessment

- Scheduled for 2011
- MN participating in National Wetlands Monitoring Workgroup discussions
  - Communicating with National Wetland Assessment Team
- Collaboration on Method/Indicator Development??
## MN Condition Monitoring Design Matrix

<table>
<thead>
<tr>
<th>Design</th>
<th>Lakes</th>
<th>Streams</th>
<th>Wetlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Census</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Targeted</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Probabilistic</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fixed-Station</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Intensive Watershed</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
Conclusions

- Probabilistic designs support some programs better than others
- Alternative designs needed to better support other program needs (e.g., TMDL)
- Integration of designs will result in most efficient use of monitoring resources
Conclusions

- Integration with National Surveys depends on whether a statewide probabilistic design already exists for the resource:
  
  - If one exists → comparable assessment endpoints may allow results of State survey to be used supplement National survey, and vice versa
  
  - If not → supplementing National survey with additional sites is an efficient way to obtain statistically valid statewide estimates of condition.
Questions?

Minnesota Pollution Control Agency