7. CROSS-RESOURCE MONITORING

SURFACE WATER QUALITY

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Last updated: 10-2007

Status: Partially in Place

A Long-Term Trend (LTT) water quality monitoring network is currently being implemented at 42 river sites and on 68 lakes in the state. The monitoring program element described here provides broad spatial coverage of water quality sampling of rivers, streams and lakes across the state.

Monitoring Objectives

Clean Water Act objectives:

- Establishing, reviewing and revising water quality standards
- Determining water quality standards attainment
- Identifying impaired waters
- Identifying causes and sources of water quality impairments
- Supporting the implementation of water management programs
- Supporting the evaluation of program effectiveness

Specific objectives:

- Collect basic water quality information on Wisconsin lakes and streams
- Establish long-term trends in ambient water quality across the state
- Provide program-specific water quality data at a combination of stream, river and lake sites
- Provide water quality information to support 305(b) reporting and the TMDL/303(d) program

Monitoring Design

All aspects of water quality monitoring including lakes, streams and rivers are incorporated into this element of the Monitoring Strategy. Monitoring will be conducted over a broad spatial scale to provide basic water quality information to various water management programs.

The general stream monitoring strategy limits sampling to streams that are 3rd order or higher. These streams are generally more likely than smaller streams to receive full body contact recreational use, have a WPDES discharge, and provide at least some information as down gradient indicators of water quality for smaller headwater streams.

Sample sites will be identified to incorporate as many of the data needs of the monitoring objectives as possible. Programs that will benefit from this monitoring effort include:

1. Water quality standards development – phosphorus data will be used to help develop statewide phosphorus standards (to be promulgated by 2008).

2. Effluent limits development – provides data for determining local effluent limits and eventual revision of basin default values currently used in effluent limit development.
3. Water quality standards attainment – provides bacterial and chemical data which can compared with water quality standards. Non-attainment areas would be identified on the 303(d) impaired waters list.

Rivers (Nonwadeable)

Biotic Integrity River Sites - Currently, 108 sites are sampled by the WDNR Integrated Science Services program on 36 rivers annually for fish, habitat and at some sites, macroinvertebrates. Of these 108 sites, 20 are located on the Mississippi River and about 30 were established at or near existing Long-Term Trend (LTT) river monitoring stations. Ambient water quality data will be added to the suite of biological parameters sampled at those sites that are not already being sampled as part of the LTT network. This leaves a balance of about 85 sites for additional sampling of ambient water quality parameters (not including the Mississippi River sites). In order to accommodate this number of sites, the strategy will rely on sampling of core water quality parameters at about 10 sites annually on an eight-year rotational basis. This effort will yield at least 1 site per 15 river miles on each river in Wisconsin.

Field parameters to be measured monthly include dissolved oxygen, pH, turbidity, conductivity and temperature. Lab parameters are listed in Table 7.

Long Term Trend (LTT) River Sites - LTT river sites were selected to represent a wide range of ecological and land use categories. The parameters were selected to represent water quality conditions that are influenced by changes in land use and may indicate chronic water quality problems within drainage basins over time. The frequency of sampling varies by site and was determined by looking at past data sets and examining the effects of different sampling frequencies on the strength of trends detected in those data sets. Permanent and temporary field staff conduct the monitoring and samples are shipped to the State Lab of Hygiene for analysis (see chapter on Long Term Trends Ambient Water Quality Network).

Monitoring at the 42 LTT river stations will continue as currently being implemented during the first year of the 2005-'06 biennium. Water Quality staff will review previously collected LTT data during 2005 and implement any recommended changes during the second year of the biennium.

Core Water Quality Indicators

Core indicators of the Biotic Index Rivers program are specifically limited to these water quality parameters:

- Dissolved oxygen
- Temperature
- pH
- Conductivity
- Total Phosphorus
- Ammonia N
- Total Kjeldahl N
- Nitrite+nitrate N
- Chlorophyll *a*
- Turbidity
- *E. coli*

Supplemental Water Quality Indicators

- Alkalinity
- Conductivity
- Total Kjeldahl Nitrogen
- Dissolved Phosphorus
- Total Suspended Solids
- Chloride
- Hardness
- Total Rec. Low Level Metals (11+Hg)

Table 7. Water quality parameters for Biotic Integrity river sampling sites.

Designated Use Supported	Metrics Sampled for Biotic Integrity River Sites
Fish & Aquatic Life	Monthly Lab Samples: Total Phosphorus, Ammonia N, Total Kjeldahl N, Nitrite+Nitrate N Chlorophyll-a (June-August only) Field parameters: Turbidity, Conductivity, Temperature, pH, Dissolved Oxygen

Streams (Wadeable)

There are approximately 19,040 miles of wadeable streams that are 3rd order or higher in the state. Ambient stream water quality monitoring will be conducted monthly over a one year period (October to September) at 55 sites statewide on 3rd order streams and higher. During October of each year a new set of sites will be identified prior to the sampling season. These ambient water quality stream sites will be identified from randomly selected watersheds over the course of a six year period. The intent of this monitoring effort is to capture water quality data from the largest drainage area from each watershed (ideally, at or near the pour point of each watershed). Monitoring sites are generally located in the furthest downstream reach of the largest wadeable stream in the watershed.

Field parameters include dissolved oxygen, pH, turbidity, conductivity and temperature. Lab parameters are listed in Table 8.

Table 8. Water quality parameters for wadeable streams sampling

Designated Use Supported	Metrics Sampled for Streams
Fish & Aquatic Life	Monthly Lab Samples: Ammonia N, Total Phosphorus, Total Kjeldahl N, Nitrite+Nitrate N Field parameters: Turbidity, Conductivity, Temperature, pH, Dissolved Oxygen

Lakes

LTT Lakes – Water quality monitoring is being conducted on 65 lakes statewide to monitor long-term trends and provide regional reference conditions for each defined lake class. These lakes will be used to characterize within-lake and among-year variability in baseline water quality monitoring. WDNR staff will review previously collected LTT lake data during 2005 and implement any recommended changes during the second year of the biennium.

Trend lakes are distributed throughout the state and were selected by the both lakes and fisheries staff in each region, with at least one lake in each of the defined lake classes. At least one lake was selected to represent the "typical" condition of lakes within a region and lake class, if possible. Trend lakes were selected to ensure that these lakes represent the class and will, over the long-term, represent trends for the region.

Trend lakes are sampled annually for water quality with an "expanded" baseline monitoring protocol. Trend lakes should be sampled every 3 years for fisheries parameters, when possible. Water quality parameters include total phosphorus in spring and components of the TSI (total phosphorus, Secchi depth and chlorophyll *a*) and field vertical profiles of dissolved oxygen, pH, temperature, and conductance three times during the summer (15 July - 15 September). In addition, other supplemental water quality parameters collected once each summer may include conductivity, alkalinity, color, and, on specified lakes, nitrate+nitrite-N and total Kjeldahl-N.

Table 9. Water quality parameters for Long Term Trend Lakes sampling.

Designated Use Supported	Metrics Sampled for Long Term Trend Lakes
Fish & Aquatic Life	Monthly Lab Samples (June-August): Total Phosphorus, Chlorophyll *a* Field parameters: Temperature, pH, Dissolved Oxygen, Conductivity, Secchi depth

Quality Assurance

A project-specific QAPP is not necessary for this program. However, sampling protocols and QA/QC sampling requirements are being followed for each of the parameters sampled as part of the LTT/AWQ monitoring program.

Data Management

Samples collected as part of this program are submitted to the Wisconsin State Laboratory of Hygiene (SLOH). Analytical results are then entered into the laboratory's database and eventually downloaded into the STORET system by WDNR staff in the Bureau of Fisheries Management. All station locations will have established STORET stations that include latitude and longitude coordinates in their station definitions. Annually, the data will be queried from State Laboratory database using the Microsoft Access database engine and exported into a Microsoft Excel database.

Data are available to WDNR staff through the SLOH database soon after laboratory analysis is complete. Data can be downloaded through the WDNR Intranet site via the Lab Data Portal or accessed directly through any database engine that can establish a remote link to an Oracle database. Plans are underway to make the LTT data tables as well as statistical analysis of the data available to the general public via the Internet. These data will be migrated to the Surface Water Integrated Monitoring System (SWIMS) in 2005.

Data Analysis/Assessment

The primary purpose of the LTT data is to establish a long-term record to determine trends in water quality from a variety of drainage areas and land use types throughout the state. Once water quality data has been collected for a sufficient period of time, the data will be analyzed to determine if trends can be detected indicating a change in mean value of each parameter over time. Water quality chemistry data collected by the program will also be compared to any applicable water quality standards to assess the level of use attainment of Wisconsin waters.

Non-LTT data will be summarized annually and used in effluent limit determinations, water quality standards development and implementation, and 303d and 305b reporting.

Reporting

Data from the water quality monitoring program is available to WDNR staff and the general public through STORET and the WDNR Intranet and Internet. This data can be used for any number of purposes, including 303(d) list development, the integrated 303(d)/305(b) report, stream classification and use attainability analyses, TMDL development, water quality-based effluent limits in WPDES permit drafting, technical reports, brochure development and television & news media reports. WDNR staff completed a report summarizing the LTT rivers program in 2006 (WDNR 2006).

Programmatic Evaluation

As the program continues, an integral part of the data analysis will be to continually reevaluate the sampling regimen and make adjustments to the sampling frequencies based on the data collected to that point and the ability to detect trends within the data set.

General Support and Infrastructure Planning

Staff and Training: Staff support to collect the river and stream samples primarily comes from existing Watershed Management (WT) FTE staff or WT LTE allocations that are already provided to the regions. Lake sampling is primarily supported by Bureau of Fisheries Management FTE and LTE staff. Volunteers will be identified for some of the monitoring in this program, with consideration for quality assurance, accessibility and safety factors.

Laboratory Resources & Funding: Approximately $110,000 of the SLOH basic agreement lab allocation currently supports the LTT rivers program. An additional $44,000 in lab support is provided to the Lakes monitoring program. The baseline wadeable and nonwadeable stream monitoring effort requires about $93,000 annually in lab support. These allocations are expected to increase at a rate equivalent to the increase in analytical costs at the State Laboratory of Hygiene.

Program Gaps

Under the proposed water quality monitoring strategy, approximately 330 stream sites will be sampled over a 6 year period, providing one site per 57 miles of wadeable streams of 3rd order or greater. This strategy will require about 38 years of monitoring to provide full coverage of one site per 10 miles of wadeable streams that are 3rd order or higher. Monitoring of streams smaller than 3rd order will not be sampled as part of this strategy.

CONTAMINANTS IN FISH TISSUE

Contact: Candy Schrank
Last updated: 10-2007

Status: Currently in Place

This program has been in place since the mid-1970s. Current funding allows for return monitoring of advisory sites and some new site monitoring for PCBs and mercury. Current funds allow for limited monitoring of dioxin/furan and emerging chemicals. Overall, fish are collected from approximately 50 to 100 sites each year. Analyses completed each year include about 600 samples analyzed for mercury, 350 for total PCBs, 30 for banned pesticides, 20 for dioxin/furan analysis and 20 for other chemicals. Collection of fish for contaminants is not funded through the fish contaminant program funds but is achieved through fieldwork conducted for baseline, treaty, or other fisheries surveys.

Monitoring Objectives

The objectives of the fish contaminant program include but are not limited to protection of fish consumers, resource management, and environmental protection.

Clean Water Act Objectives:

- Determining water quality standards attainment – determine 'fishability'
- Identifying impaired waters – identify waters with bioaccumulative chemicals
- Identifying causes and sources of water quality impairments – fish tissue monitoring assists in determining sources or location of contaminated sediments.
- Supporting the evaluation of program effectiveness – fish tissue monitoring provides information to evaluate remediation of sediments. Fish tissue monitoring has in the past reflected efforts to control direct discharges of bioaccumulating chemicals. Fish tissue monitoring may also be helpful in evaluating success of control of other sources of pollutants (e.g. mercury and emerging chemicals but that has not yet been demonstrated.

Specific Objectives:

- Protection of fish consumers

  - Determine levels of bioaccumulative contaminants in the edible portions of fish and compare these levels to health guidelines as determined by the Wisconsin Division of Health.
  - Issue fish consumption advisories for certain species and sizes of fish from given areas where the concentrations of chemicals in the fish flesh exceed the health advisory levels.
  - Evaluate contaminant levels in commercial fish, issue reports to commercial fishers, the Wisconsin Department of Agriculture and the U.S. Food and Drug Administration (FDA), and issue commercial fishing bans where it is determined that all fish of a given species exceed FDA tolerance levels from a particular site.
- Resource Management
  - Evaluate the health impact of contaminants on piscivorous fish and wildlife by analyzing forage fish consumed by these species.
  - Evaluate stocking programs to promote practices which will lead to a reduction in the potential for accumulating contaminants.
- Environmental Protection
  - Establish baseline levels and determine major trends of contaminants
  - Identify potential sources of contaminants including industrial discharge, sediment, landfills, and groundwater contamination.
  - Evaluate the effectiveness of remedial programs on bioaccumulation potential and impacts of control of discharges to receiving waters.
  - Evaluate the impact of air emissions (atmospheric deposition) to surface waters. Examples include municipal incinerators (dioxin and mercury), coal combustion (mercury), and chor-alkali plants (mercury).
  - Evaluate the effects of past/present use of pesticides.

Monitoring Design

The fish contaminant monitoring design consists of different components depending on the purpose of the monitoring (Tier 1, advisory, Great Lakes, or trend), the area of the state or the waterbody type (inland lakes, rivers, Great Lakes), and also varies depending on the contaminant (mercury, PCBs, pesticides, dioxin/furans, and emerging chemicals). These components are described in the following paragraphs. Each year, a specific sample collection schedule is formulated to provide guidance to field staff on locations where fish samples are needed to fulfill the monitoring design.

Tier 1 fish contaminant monitoring focuses on sampling new sites (not previously assessed for contaminants) and sites where contaminant data are old (more than 15 years old) or limited, or where existing data suggests that concentrations may be high and additional data would be beneficial to determine advisory needs. Collections of fish from lakes and rivers for contaminant analysis are coordinated with fisheries assessments to allow savings in field costs. In general, top-level predator species are first selected for contaminant monitoring and additional species may be added depending on the site characteristics and availability of past contaminant data, or statewide general advisory needs. Most fish are analyzed as edible portion forms unless there are trend data that need to be maintained. Samples are primarily analyzed for mercury content but some samples are also analyzed for PCBs and other contaminants, especially for flowing waters. The goal for return frequency to Tier 1 sites with limited or suspected high concentrations is 10 to 15 years or when fisheries management schedules allow more frequent monitoring. In these cases, additional samples may be taken to fill in data gaps.

Advisory fish contaminant monitoring refers to monitoring of fish for contaminants where special fish consumption advice is in place (site-specific advice more stringent than the general advisory) and data are needed to update consumption advice. This monitoring is generally conducted in major industrial rivers and locations where remediation may be necessary or underway. The goal is to return to inland (non-GL or non-border waters) locations with PCB-based special advice every five years in order to update the data for advisories and for trend monitoring. The goal for inland waters with mercury-based special advice is to return every 10 to 15 years. More frequent sampling can occur in areas where remediation is imminent. In addition, specific biennial monitoring designs are defined for Lakes Superior and Michigan (see Great Lakes

below). Samples collected at PCB advisory sites are primarily analyzed for PCBs and mercury content but a subset of samples are analyzed for dioxin/furan congeners, banned pesticides, and emerging chemicals. Species are chosen based on data gaps and advisories for the site, angler survey data, availability of species, desire to maintain consistency with past collections, and regulations for a specific water body.

Great Lakes and Mississippi River fish contaminant monitoring is conducted on a biennial basis. The collection schedule includes lake trout, siscowett, sculpins, and herring from the open waters of Lake Superior and walleyes from tributary areas along Lake Superior. For Lake Michigan, species under advisory are collected along with alewife. The collection schedule includes species under advisory for the Mississippi River in coordination with Minnesota collection efforts. Samples collected at Great Lakes and the Mississippi River are primarily analyzed for PCBs and mercury content but a subset of samples are analyzed for dioxin/furan congeners, banned pesticides, and emerging chemicals.

In addition, the Department has been cooperating with the EPA Great Lakes National Program Office since the late 1980s to determine trends and geographic patterns of contamination, to provide information for health advisories and for tracking contaminant levels in composite samples of key salmon species. The Department participates in some components of this monitoring by collecting fish, processing of samples, and shipping samples as defined in inter-agency agreements. This includes collection of coho or chinook salmon at three Great Lakes tributaries according to the inter-agency agreement (these samples are also analyzed as individual fillets for advisory purposes). In addition, WDNR collects lake trout from Lake Superior every other year for EPA. EPA provides the analytical services for PCBs, chloro-organic and other compounds. The data generated by this program are used for trend analysis and consumption advisories when the results are shared with WDNR.

Core and Supplemental Water Quality Indicators

Fish tissue concentrations of mercury and PCBs are core indicators as is resulting consumption advice; however, tissue concentrations are difficult to portray as indicators because of the complexity of confounding factors like fish age, growth and migration. Tissue concentrations may vary as a result of non-water quality factors and therefore appropriate analyses must be conducted to use tissue concentrations as an indicator of water quality. In addition, data for some parameters like dioxin/furan, banned pesticides, and some emerging chemicals are limited.

Quality Assurance

Quality assurance processes may be found in sampling and procedure documents describing the fish contaminant monitoring program, in the procedures for each of the analytical laboratories that provide analytical services, and in Department quality assurance documents. The Wisconsin State Lab of Hygiene, a certified laboratory with approved quality assurance procedures, completes most fish contaminant analyses. See the following items for more information.

- WI WDNR Field Procedures Manual. Intranet Edition. Part B: Collection Procedures. 1005.1 Fish Contaminant Monitoring Program – Field and Lab Guidelines. http://intranet.dnr.state.wi.us/int/es/science/ls/fpm/1005_1.htm
- Fish Contaminant Program Procedural Guidelines. Wisconsin Department of Natural Resources Manual Code 3611.1
- Wisconsin Department of Natural Resources Quality Management Plan. http://intranet.dnr.state.wi.us/int/es/science/quality/qmp/
- Wisconsin Department of Natural Resources Field Procedures Manual. Intranet Edition. Part A. General Information. I Introduction to Sampling. B. Sampling and Quality Assurance Planning. http://intranet.dnr.state.wi.us/int/es/science/ls/fpm/I.htm#IB

Data Management

Contaminant data are stored in the Department's fish-sediment contaminant database consisting of a series of Oracle tables and managed on a client-server system. Data are available to the public upon request after field verification and Department analyses are completed.

The Fish-Sediment Contaminant Database contains the results and associated sample and site information for contaminants analyzed in fish tissue. It contains contaminant results for over 32,000 fish samples collected from about 1600 locations in Wisconsin waters from around 1970 to 2005. The data are contained in ORACLE tables that are linked by defined relationships (relational database).

Sample results information is captured by the State Lab of Hygiene on their Laboratory Information Management System (LIMS) and made available to WDNR through the Lab Data Entry System (LDES). Other laboratories provide required results data in a similar system that is batch uploaded into the LDES. Automated systems transfer the results to the fish contaminant database for long-term storage and manipulation. More information on the LDES system structure is available at: http://intranet.dnr.state.wi.us/int/es/science/ls/lab_data/help.htm . The home page for this data system is located at: http://intranet.dnr.state.wi.us/int/es/science/ls/fpm/VII.htm

DNR staff can access the fish contaminant data using an ORACLE client-server system that is accessible on the WDNR intranet at http://intranet.dnr.state.wi.us/int/water/fhp/pages/database-fishcontaminants.shtml. The server system allows data entry into the fish contaminant database component by designating fish file managers to create sampling locations and fish samples, or to edit data, track and tally samples, and query and extract data.

The client-server system allows Department staff to query the database using the ORACLE client server system by selecting the location, species, collection date, chemical parameter, and other restrictions.

Verified data are also available to other agencies and the public upon request specifying the desired collection dates, geographical area, species and form of fish, and parameters.

Data Analysis/Assessment

Each year, the Department reviews newly obtained contaminant data in the context of existing data and advisories. The WDNR, in a cooperative effort with the Wisconsin Division of Public Health in the Dept. of Health and Family Services (DHFS), determine whether a sample is of public health significance. When concentrations of contaminants exceed health guidelines, WDNR and WDHFS jointly issue a fish consumption advisory for the appropriate water body. Data are shared and advisories are determined for boundary waters in coordination with other Great Lakes states. The process of collection, data management and interpretation, and policy development is outlined in Department manual code 3611.1.

PCBs and mercury are responsible for most of the advisories for Wisconsin waters although several waters are also listed due to dioxin or chlordane contamination. Where two or more contaminants exceeding their respective health guidelines are found, the contaminant with the most stringent health advice is used for giving advice. Additivity of multiple contaminants is not considered at this time except in evaluating dioxin toxicity.

PCB advisories hare issued according to the "Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory" (Anderson, et. al., 1993) since 1997. Prior to that, the percentage of samples that exceeded FDA's 5 and 2 ppm tolerance level was assessed to determine the appropriate consumption advice.

In 2001, a new reference dose (RfD)/meal frequency approach was adopted for mercury based advisories. This approach resulted in a statewide general fish consumption advisory in addition to site specific advice where mercury levels require more specific advice. Two different RfDs are used, one for the sensitive population (A Protocol for Mercury-based Fish Consumption Advice, May 2007) and one for the general population. The new statewide advisory was adopted after new information showed that lower amounts of mercury were harmful to developing fetuses and young children (National Research Council and EPA). The new general statewide advisory was based on the new effect levels and typical levels of mercury found in Wisconsin fish while considering harvest, consumption patterns, fishing regulations and other factors.

From 1985 to 1999, mercury advisories were developed according to "Wisconsin Mercury-Fish Consumption Health Advisory" (Anderson and Olson, 1986) and tissue criteria ranged from 0.5 ug/g, to 0.75 ug/g, to 1 ug/g and the associated advice varied by consumer group.

While a one-time sampling event may lead to the issuance of an advisory, levels of a particular contaminant must decline below the state criterion for at least two years (of sampling) within 5 consecutive years before an advisory is rescinded or changed.

Reporting

Analyses and reports are prepared on a project specific or as needed basis. These reports vary in their purpose: e.g. site-specific, or species-specific, contaminant-specific, or statewide summaries of contaminants, contaminant-specific trend analysis, advisory determination, etc). Appropriate statistical analyses are determined specific to the purpose of the data analysis and reporting. The reports are available upon request and sometimes remain in draft form as additional data are collected.

The following reports are updated each year after new data are evaluated:

- Annual review of new data in context of existing data, advisories and other information to determine necessary advisory updates and publication of the advice.
- Data summaries for specific advisory or remediation sites or for specific fish contaminants on a statewide or regional basis on an as needed basis.
- Annual update of the report, Wisconsin's Fish Contaminant Monitoring Program and Advisory Summary.
- Reporting of fish contaminant monitoring and fish consumption advice is included in the biannual 305b report to congress.
- Completion of EPA's annual survey for the Listing of Fish and Wildlife Advisories
- Reporting to EPA Region V through the ENPPA program.
- Reporting of accomplishments through the Department's biennial workplanning process.

In addition, the data and reports from the fish contaminant monitoring are used by various Department programs including reporting of information necessary for the 303d and other Clean Water Act requirements and sediment remediation programs.

Programmatic Evaluation

The fish contaminant monitoring program operates within the framework of the Water Division biennial workplan. Any changes to the protocol or strategy are recommended to the Water Division Monitoring Team. Reviews of workplan performance are completed annually, to evaluate job completion. In addition, program staff participate in regional and national workshops and evaluations of fish contaminant monitoring programs.

Overall review of monitoring programs occurs each time a component of the program is evaluated (e.g. Great Lakes trend monitoring, baseline monitoring, advisory updates). Review of state monitoring programs is also a part of the Department-EPA ENPPA process. These processes allow annual and biennial workplanning goals to be established. In addition, ongoing discussions of monitoring occurs with other groups like the Division of Health, the Great Lakes National Program office and EPA programs, contacts with other fish contaminant monitoring coordinators including coordinators from the states adjacent to Wisconsin.

General Support and Infrastructure Planning

Fish contaminant budgets have remained at a fairly consistent basis since about 2000. The primary focus has been on PCBs, mercury with limited analysis for banned pesticides, dioxin/furans, and emerging chemicals. Currently the program is funded by a mix of funds. Since about 2000, the fish contaminant program depended on the following basic activities supported by different funding sources:

Collection of fish – supported by fisheries staff and program funding as they conduct routine monitoring. The cost to collect fish is not tracked because these activities are for other purposes and supported by a variety of fund types. Fish collection is coordinated with these other activities to minimize field costs and uses equipment, staffing, and supplies from fisheries funded programs.
SLOH analysis of samples – supported by the Wisconsin State Laboratory of Hygiene (SLOH) basic agreement services. Wisconsin uses approximately $100,000 worth of services annually on laboratory chemical analysis of fish tissues. Analysis of certain compounds requires the program to contract with other laboratories (below).
Special analyses, supplies, fish processing, fish processing facilities and advisory materials – Supported by EPA PPG 106 funds totals about $50,000.
Program management – Supported by 1 FTE WI WDNR staffing supported by EPA funds (2007)

The mix of funding that is used to support these activities has changed over the years to reflect changes in funding levels. Over the 35+ years of the program fish have been collected from a total of 1594 different sites. Many of these sites have multiple collections over the year to address changes over time.

Program Gaps
Gaps include limits on the number of sites where fish can be collected each year, the number of fish that can be processed, and the number and types of analytes that can be assayed on each sample. In addition, gaps include the ability to monitor fish extensively enough to specifically examine differences on a geographical basis or for specific sites in more detail to examine changes in fish contaminants over time at a particular sites or area. Although additional funds would allow expanded coverage and more detailed sampling within advisory sites, field collection costs would increase and additional staffing to handle fish and maintain the database would be required.

Additional FTE to manage the program would be necessary to expand the current program to handle and process fish, manage the database, and evaluate results. In addition, funds would be required to increase the current level of effort to collect fish, handle and process fish, and add analytes.

References

WDNR Field Procedures Manual. Intranet Edition. Part B: Collection Procedures. 1005.1 Fish Contaminant Monitoring Program – Field and Lab Guidelines.
http://intranet.dnr.state.wi.us/int/es/science/ls/fpm/1005_1.htm

Fish Contaminant Program Procedural Guidelines. Wisconsin Department of Natural Resources Manual Code 3611.1. http://intranet.dnr.state.wi.us/int/mb/codes/MC361110.pdf

Wisconsin Department of Natural Resources Field Procedures Manual. Intranet Edition. Part A. General Information. I Introduction to Sampling. B. Sampling and Quality Assurance Planning.
http://intranet.dnr.state.wi.us/int/es/science/ls/fpm/

Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory. Great Lakes Sport Fish Advisory Task Force. September 1993.

A Protocol for Mercury-based Fish Consumption Advice. An addendum to the 1993 "Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory". Great Lakes Consortium. May 2007.

Wisconsin Department of Natural Resources. Manual Code 3611.1. Fish Contaminant Program Procedural Guidelines.

PATHOGEN MONITORING ON INLAND BEACHES

Contact: Bob Masnado
Last updated: 7-2006

Status: Pilot Program in Place; Temporarily Funded

In 2002 inland State Park beaches were monitored once per week in an effort funded through the Bureau of Parks. In 2003 a pilot beach monitoring program modeled after the Great Lakes beach program was developed and implemented with 10 inland State Park Beaches. The pilot is scheduled to continue during the 2006 beach season.

Monitoring Objectives

Clean Water Act Objectives

- Establishing, reviewing, and revising water quality standards
- Determining water quality standards attainment
- Identifying impaired waters

Monitoring Design

Ideally, each public beach throughout the state would be monitored every summer. However, given limited funds, beaches are ranked based on usage to determine which areas are highest priority for monitoring. An initial stage of this project would involve identification and ranking of all public beaches in the state. Once beaches are ranked, they would initially be monitored during storm events to determine whether water quality at individual beaches is adversely affected by storm events. For those at which this is the case, advisories will be posted after each rain event. After this initial determination, sampling during storm events is not necessary, and the focus would shift to regularly scheduled monitoring. In order to make the best scientific decisions about water quality as it relates to bacteria, a cross section of samples should be collected on each water body. The geometric mean criteria require that at least 5 samples collected within a 30-day period, throughout the recreational season.

Recreation occurs in many forms; hence EPA has provided several approaches to managing risks in recreational waters in its *Implementation Guidance for Ambient Water Quality Criteria for Bacteria.* The recreational use options are provided in Table 10.

In the event that Wisconsin adopts one or more of EPA's approaches, monitoring should be implemented and must be designed to assess recreational waters for the appropriate recreational use category or subcategory.

Table 10. Recreational use, criteria, and supporting analysis.

Designated Use	*E. coli* Criterion	Supporting Analysis
Primary Contact Recreation		
Identified Public Beach Area	235 cfu/100mL sample maximum 126 cfu/100mL geometric mean	None
Other Primary Contact Recreation Waters	Maximum Criteria 941 cfu/100mL sample maximum 206 cfu/100mL geometric mean	None
Seasonal Recreational Use	Primary contact recreation criteria apply during specified recreational season; secondary contact recreation criteria apply rest of the year.	Information explaining choice of recreation season (e.g., water and air temperatures, time of use, etc.)

Recreational Use Subcategories		
Exceptions for high flow events	Exception to criteria at high flows based on flow statistic or number of exceedances allowed.	Use Attainability Analysis
Wildlife Impacted Recreation	Criteria reflecting natural levels of bacteria.	Use Attainability Analysis and data demonstrating wildlife contributes a significant portion of the fecal contamination
Other Categories of Recreation		
Secondary Contact Recreation	Criteria sufficient to protect the use but not greater than 5 times the primary contact recreation value	Use Attainability Analysis

Core and Supplemental Water Quality Indicators

Following are core indicators that should be evaluated to assess recreational water quality:

- Wisconsin recreational water standards have historically been based on bacteriological criteria. The State is in the process of changing from its current criteria using fecal coliform bacteria to using *E. coli* bacteria. After adoption of new criteria, the core indicator that will be used to determine attainment of recreational water standards will be *E. coli* bacteria.
- Nuisance plant growth (Cladophora, algae blooms, excess aquatic plant growth)
- Nutrients (phosphorus, TKN, ammonia)
- Chlorophyll A
- Turbidity (Secchi depth)
- Runoff control (landscape)

If Wisconsin decides to adopt different recreational use categories or subcategories, additional indicators will be required.

- Water temperature
- Air temperature
- Rainfall
- Waterbody flow
- Waterbody velocity

Quality Assurance

Monitoring ambient water for *E. coli* bacteria is not covered under the Department's Quality Management Plan. It is however covered under the Quality Assurance Project Plan for the Wisconsin Beach Monitoring Program.

Data Management

The WDNR LabData System stores all data analyzed by the State Lab of Hygiene, including water quality data for bacteria indicators. This may include, total coliforms, fecal coliforms, *E. coli* or enterococci. Most of the data comes from individual beach monitoring efforts throughout the State, from individual studies conducted in certain waterbodies or compliance monitoring. The data are entered within 24 hours of analysis and is available to State Lab personnel and WDNR staff on the WDNR intranet at http://prodmtin00.dnr.state.wi.us/pls/prod1/pk_eq508_ldes$.startup. The data will be stored in the SWIMS system in the future, and will flow to USEPA from there.

Collecting samples for analysis of fecal coliforms or *E. coli* is currently not included in our baseline monitoring strategy for lakes, rivers, and wadable or non-wadable streams.

Data Analysis/Assessment

Currently, waters are not being assessed for attainment of water quality standards for bacteria, and there is not yet any standard methodology that Wisconsin has for assessing waters for attainment. There are a few water bodies that are on the 303(d) list for bacteria, namely fecal coliforms. Requests to place these waters on the list came mostly from citizen groups reviewing data generated from individual research studies on these particular water bodies, not from data collected as a part of a formal monitoring plan. WDNR staff are currently working on establishing a formal process for listing waters on the 303(d) list; however, staff time will still need to be allocated to data analysis in order to determine which waters should be listed.

Reporting

Any data that has been assessed is usually reported in the integrated 303(d)/305(b) Report.

Programmatic Evaluation

Currently, there is no formal evaluation method.

General Support and Infrastructure Planning

Staff and Training - Currently one staff person is assigned to bacteria standards. Ultimately about 4 FTEs will be required for full implementation. WDNR would like to develop a program for collection of beach pathogen data by local public health officials and volunteer groups, following WDNR methodologies. Standard sampling and analytical protocols for monitoring *E. coli* were developed for the beach-monitoring program. Training will be required for field staff collecting samples. Several methods have been approved for analysis. Currently there is ongoing training developed by our Science Services section, for laboratory staff. Data can be stored in the current lab portal database however assessment methodology will need to be developed and the data will need to be evaluated and assessed.
Laboratory Resources/Funding - It is difficult to determine the funding needs for monitoring lakes and streams for *E. coli*. The Wisconsin State Lab of Hygiene is trained and equipped to test for *E. coli*. The cost of samples average about $20.00 per sample, and at least 5 samples will be taken at each site. Currently it requires approximately $350,000 to monitor 113 Great Lakes beach areas for *E. coli*. Statewide, there are significantly more inland waterbodies to monitor, and the number of sites to be monitored each year has yet to be determined. BEACH Act funding used for the Great Lakes beaches is not available for inland beaches and is only guaranteed through 2005. Funding sources for the 2003 pilot beach monitoring program on 10 inland State Park Beaches include:

- State Lab of Hygiene (SLOH) General Program Revenue (GPR) WDNR Basic Agreement
- SLOH GPR Health & Family Services (HFS) Basic Agreement
- DNR Conservation Segregated Fund
- HFS Performance Grants

References

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