FY14 Fisheries and Aquatic Sciences Research Projects

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
MANAGE & SUSTAIN ECOSYSTEMS	***LANDSCAPE DYNAMICS***	**Using Satellite Remote Sensing to Develop Predictive Models of Lake Water Clarity**	Monica Turner (UW-Madison), Steve Greb	Monitoring lake water clarity on an annual basis since 2003 through remote sensing. This project aims to use this long-term dataset to identify landscape drivers of water clarity and develop predictive models.
	RESTORATION ECOLOGY	**Measuring the Value of Fish and Wildlife Habitat Restoration on Northern Wisconsin Lakes: the Wisconsin Lakeshore Restoration Project**	Michael Meyer	This study demonstrates the ecological benefits of shoreland habitat conservation and restoration by measuring aquatic ecosystem health (via biotic surveys) before, during, and after conservation and restoration activities on 5 developed lakes in northern Wisconsin and the City of Ashland waterfront on Chequamegon Bay, Lake Superior.
	INVASIVE SPECIES	**Evaluation of potentially invasive aquatic species, including macrophytes, algae, and cyanobacteria: a literature review for the Governor's Council on Invasive Species**	Michelle Nault, Alison Mikulyuk, Jennifer Hauxwell, Martha Barton, Kelly Wagner, Gina LaLiberte, and Susan Knight	Key study for developing and updating Chapter NR40 (Invasive Species Identification, Classification, and Control). Extensive literature reviews were compiled on Wisconsin-specific threats posed by 36 aquatic invasive species in 2007 (NR 40 initial development and promulgation) and 42 species in 2012 (NR 40 update and revision). These reviews were used by the Governor's Council on Invasive Species stakeholder species assessment groups in developing recommendations for additional species to list under NR 40.
		Statewide evaluation of early season whole lake and spot 2,4-D herbicide concentrations to determine effective management protocols for Eurasian water-milfoil in lakes	Michelle Nault, Martha Barton, Jennifer Hauxwell (SS), Tim Asplund, Statewide Lake Coordinators (WD), USACOE	Conduct water monitoring on herbicide applications in Wisconsin lakes and flowages in order to provide information regarding actual herbicide concentration and exposure time data for herbicide applications under a variety of operational conditions, and develop recommendations for improved control of invasive exotic aquatic plant species and reduced damage to native plant populations. Herbicide concentrations in the water were periodically collected post-treatment on a sub-sample of chemical treatments across the state. Samples were analyzed for 2,4-D, endothall, and triclopyr using enzyme-linked immunosorbent assay (ELISA) methods, and aquatic vegetation responses were monitoring using DNR's baseline monitoring methodology.
		Efficacy of early spring 2-4-D treatment as a management tool for Eurasian water-milfoil in northern Wisconsin lakes	Michelle Nault, Alison Mikulyuk, Martha Barton, and Jennifer Hauxwell (SS), Tim Asplund, Pam Toshner (WD), USACOE	Evaluate the effects of chemical treatments on invasive and native plants. Annual baseline aquatic plant surveys and biomass collection will be used to assess early-season 2,4-D treatment as a tool for managing Eurasian watermilfoil.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
		Strategic long-term monitoring of lakes infested with Eurasian water-milfoil: effects of region and management	Michelle Nault, Alison Mikulyuk, Martha Barton, Jennifer Hauxwell, Susan Knight	Evaluate the long term abundance and distribution of Eurasian water-milfoil (EWM) in a variety of lakes in Wisconsin. Results will allow us to understand the efficacy of management and how to best distribute the state's Aquatic Invasive Species grant funds. Twenty-four lakes were selected and surveyed annually to represent different ecoregions (north, central, south), EWM population levels (established or new), and management scenarios (best strategic management or no management).
		Technical assistance provided to assess the status of recently-discovered Eurasian water-milfoil populations in Wisconsin lakes	Michelle Nault, Martha Barton, Alison Mikulyuk, and Jennifer Hauxwell (SS)	Conduct rapid response surveys and provide technical assistance for newly discovered Eurasian water-milfoil populations. Newly discovered populations are assessed using the baseline aquatic plant survey method and data is used to inform the development of rapid response management plans and grants.
		Efficacy of early spring harvesting or 2,4-D treatment as a management tool for Eurasian water-milfoil in southern Wisconsin lakes	Jennifer Hauxwell, Alison Mikulyuk, and Michelle Nault (SS), Tim Asplund, Sue Graham, Kurt Welke (WD), USACOE	This project is a partnership between DNR, Dane County, and the US Army Corps of Engineers to evaluate techniques to manage Eurasian watermilfoil. Evaluate the effects of chemical treatment and mechanical harvesting on Eurasian water-milfoil and native plant populations. A repeated block design was employed in 5-acre plots on Turville Bay, Lake Monona, Dane County, in order to assess the differing management strategies on the frequency and density of aquatic macrophytes. Point-intercept and biomass data was collected bi-annually and compared to reference plots to allow us to assess the use of these approaches in managing EWM.
		Regulated aquatic plants in trade: assessing prevalence in trade and risk to Wisconsin waterbodies	Kelly Wagner, Jennifer Hauxwell, Alison Mikulyuk, Elizabeth Haber, Mindy Wilkinson, Chrystal Schreck (SS), Scott Van Egeren (WD)	Reduce the availability of invasive aquatic plants via the trade industry by determining where regulated species are sold, educating vendors through outreach, and determining barriers to change through social survey of vendors. Biological surveys of vendor stock before and after education will determine efficacy of education campaign, and surveys of 150 small waterbodies near retail sources will determine risk of species introductions on the landscape.
		Spiny water flea and zebra mussel veliger laboratory service	Paul Garrison, Gina LaLiberte	Process 800-1300 plankton samples as part of WQ-led GLRI project on AIS.
	GREAT LAKES	**Evaluation in Wisconsin's Lake Michigan Areas of Concern**	Paul Garrison	Analyze benthic invertebrate and plankton communities in Wisconsin's four Lake Michigan Areas of Concern (AOCs; Menominee River, Lower Green Bay and Fox River, Sheboygan River, and Milwaukee Estuary). Collect data on AOC sites and closely related non-AOC sites to allow comparison of AOC sites to relatively-unimpacted or less-impacted control sites with similar physical and chemical characteristics.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
		***Cladophora* and water quality of Lake Michigan: a systematic survey of Wisconsin nearshore areas**	Steven Greb, Paul Garrison	Implement a monitoring program to observe the density, distribution, and associated water quality impacts of Cladophora along Wisconsin's Lake Michigan shoreline. Continuing investigation designed to test sampling techniques and assist with developing long-term monitoring plans and research needs, as well as identifying short-term beach clean-up and odor mitigation options, and addressing public information needs.
		Nearshore Monitoring site - Kewaunee station	Steve Greb	Deploy in situ sensor and track water quality parameters at a Lake Michigan nearshore station. This system complements 2 other units deployed by UW-Milwaukee School of Freshwater Science.
		Evaluation of Areas of Concern (AOCs) using Satellite Remote Sensing- A Pilot Study	Steve Greb	Although a substantial amount of water quality data exists for the AOC, comprehensive data sets are often not available. As such, multiple lines of evidence have to be employed to help determine whether a BUI should be removed or persist after remediation efforts have been completed. This projects investigates new methodologies to obtain spatially uniform, systematic water quality measurements across Wisconsin's AOCs. There are a variety of satellites in orbit that present different capabilities (spatial and spectral resolution, and temporal passover). The purpose of this project is to explore the use of two satellite sensors in the evaluation of water quality parameters of interest with respect to AOCs. The sensors to be evaluated are WorldView-2, a high resolution commercial satellite and NASA's Landsat 7.
	MISSISSIPPI RIVER			
	GROUNDWATER, DRINKING WATER, & WATER USE	**Characterizing the sources of elevated groundwater nitrate in Dane County, WI**	Cory McDonald	The goal of this project is to elucidate spatial and temporal trends in groundwater nitrate contamination in Dane County and to identify the drivers of these trends. Specific objectives are to: 1. Develop accurate, time-resolved maps of nitrate concentrations in the shallow aquifer of Dane County and identify localized areas of the county where nitrate concentrations are consistently high or low, as well as areas where concentrations are increasing or decreasing over time, 2. Develop an empirical model of nitrate concentration as a function of hydrological parameters (groundwater flow and residence time, location in the aquifer), soil characteristics, and land use that can be applied from well- to basin-scales, and 3. Run model scenarios to explore the potential for conservation measures, etc. to reduce regional groundwater nitrate concentrations in the future.
	INLAND LAKES, RIVERS, STREAMS, & WETLANDS	**Citizen monitoring to ground-truth satellite remote sensing data on lake water quality**	Steve Greb	Citizens collect in situ data in lakes to ground-truth data from satellites.
		Lake temperature study	Richard Lathrop	Evaluate long term patterns in lake temperatures for a variety of resource management applications.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
	DAM REMOVAL & FISH PASSAGE	**Evaluation of Prairie du Sac Dam fish passage project**	John Lyons	Provide scientific leadership in the design and evaluation of a proposed upstream passage facility and to determine if it is successful in re-establishing extirpated species above the dam and improving fisheries. The installation of upstream and downstream fish passage through the dam in would be the largest project of its kind in the Midwest, with an unprecedented opportunity to learn how to better reconnect fragmented river systems and restore their fisheries.
		Great Lakes Basin Aquatic Connectivity Assessment	Matt Diebel	Key study for prioritizing replacement of culverts. Key study for prioritizing replacement of culverts. Cost-benefit approach to maximizing gains in fish passage across the Great Lakes basin while minimizing negative effects of aquatic invasive species. Develop infrastructure for collection, storage, and analysis of barrier data across the Great Lakes Basin. Develop a volunteer monitoring program for evaluating fish passage at road crossings. Provide specific guidance for restoration at scales from individual watersheds to the entire basin, refine methodologies for spatial analysis of barriers, and provide a systematic framework for comparing costs (direct economic costs, species invasions) and benefits (connectivity, focal fish species) of barrier removal. Utilize spatial data on the location and attributes of barriers (dams and road-stream crossings) and fish breeding habitat throughout the Great Lakes basin to analyze the optimum strategy for enhancing connectivity and restoring fish migrations.
		Northern pike spawning habitat connectivity	Matt Diebel	Key study for prioritizing replacement of culverts. Guide the restoration of stream connectivity by identifying the most significant fish migration barriers in the Green Bay watershed. These results will provide a quantitative basis for prioritizing barrier removal and tracking the progress of connectivity restoration. Utilize a GIS-based analytical approach that bases the value of barrier removal on both the amount and quality of reconnected habitat. The results of this project will include a detailed map of habitat suitability and accessibility for northern pike and stream-resident species and a list of barriers ranked on connectivity effect.

FY14 Fisheries and Aquatic Sciences Research Projects

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
MANAGE & SUSTAIN POPULATIONS	***SUSTAINABLE FISHERIES***	**Ceded Territory Walleye Sustainable Harvest Modeling / The effects of exploitation on northern walleye populations**	Greg Sass, Andrew Rypel, Gretchen Hansen, Michigan State researchers, FM	Key study for setting sustainable walleye harvest goals. Statistical modeling using all available and appropriate Ceded Territory walleye data and conduct walleye population assessments in northern WI lakes. Build a statistical catch-at-age model to test for exploitation rates in a mixed fishery (including tribal pulse fishing) (35%, 50%, 75%, 90%) that lead to long-term walleye sustainability by varying compensatory recruitment responses and initial adult walleye densities. Independent of the first model, we will test various recreational harvest regulations, tribal exploitation rates, and various angler effort and behaviors; an emergent property of this model will be sustainable exploitation rates under the various scenarios.
		Modeling bass-walleye population dynamics in northern Wisconsin lakes	Gretchen Hansen, Greg Sass, John Lyons, Andrew Rypel, UW-Madison, UWSP, FM	Key study for implementing the Wisconsin Walleye Initiative. Document current abundance and distributions of walleye and bass and model factors to predict future abundance and distribution. Develop ecological-simulation computer models that allow managers to examine how bass and walleye interact, particularly in terms of how they may prey on each other, compete for food and space, and respond differently to changes such as warmer temperatures, lower lake levels, different plant communities, and changes in shoreline land use. Models will be used to explore how various fisheries management actions (e.g., regulation changes, stocking, habitat enhancement) might be used to favor one species or the other.
		Hatchery and Fisheries Management support services	Jeff Kampa	Provide study consultation and conduct studies to inform science-based operational planning in the Fish Management Propagation program. Refinement of some standard hatchery practices to reduce stress and improve condition of stocked fish, as well as adapt to meet unforeseen challenges (e.g. new diseases) in the statewide production program. Document oxytetracycline (OTC) mark efficacy, implement lab quality control procedures and maintain lab equipment at the Governor Tommy Thompson State Fish Hatchery to support Fish Management stocking evaluations.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
		Muskellunge growth characteristics	Jeff Kampa	Develop better documentation of age and growth characteristics in premier muskellunge fisheries, with an objective of setting realistic goals based on limnology, fish community, and angling pressure. Evaluate new approaches to user group participation in research, with local guides and anglers reporting data from tagged muskellunge. Monitor population age structure, and validate age and growth of muskellunge in Wisconsin. Provide information on stocked year class strength and contribution of propagation program to muskellunge fisheries. Assess impact of catch and release fishing on mortality and size structure. Evaluate accuracy of current population estimation methods. Collect limnological data and improve understanding of relations between angling pressure, capture probability, hooking mortality, and growth.
		Cisco assessment and walleye-cisco interactions in Wisconsin lakes	Jeff Kampa	This project is surveying Wisconsin lakes with historical records of cisco (Coregonus artedi) populations (key forage for walleye and muskellunge) to assess current distribution. A subset of lakes will be monitored, and relations between cisco and gamefish will be modeled. Sampling will consist of variable mesh size vertical gillnets and hydroacoustics. This project is part of a tri-state effort to understand the relationship between cisco abundance and temperature and land use on as well as resulting impacts on walleye.
		Long-term viability of source populations of wild brook trout and brown trout for Wisconsin's wild trout stocking program	Matthew Mitro	This study investigates the long-term viability of wild brook trout and brown trout populations as source populations for Wisconsin's wild trout stocking program. Develop a quantitative understanding of the long-term viability of wild brook trout and brown trout populations as source populations for Wisconsin's wild trout stocking program. This study will enable science-based management decisions that will work to ensure the long-term viability of a successful program.
		Monitoring temporal trends in trout populations and base flow in streams	Matthew Mitro	Key study for developing the Driftless Area Master Plan. Understand the role of stream flow (base flow and extreme flow events) and stream temperature in trout population dynamics. Trout population response to stream flow will assist in determining appropriate minimum flows and in identifying risks to trout populations associated with changing land use, groundwater use, precipitation, and temperature. Also received grant to track gill lice.
		Restoration of a Brook Trout Fishery in Tenny Spring Creek Using an Artificial Barrier	Matthew Mitro	Investigate the effect of stream habitat restoration on brook trout and brown trout populations in order to guide future trout stream restorations. This study also evaluates how trout age structure and abundance varies among restoration sites, the role that environmental conditions and recruitment play in restoration success, and the implications for future monitoring of stream habitat development projects and the setting of recovery expectations.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
		Effects of known exploitation rates on trout population dynamics	Matthew Mitro	This study will investigate the effects of a known exploitation rate on a brown trout population in Trout Creek. Specific objectives include quantifying the effects of a known exploitation level of trout under a maximum size limit on trout population abundance, size structure, recruitment, growth, and mortality.
		Center for the Study of Fish Age and Growth	Matthew Mitro	Provide research support toward implementing the Wisconsin Fisheries Analysis Center–a cooperative effort between UW-Stevens Point faculty and WDNR research scientists and managers–which will provide three broad services of value to fisheries management in Wisconsin: 1) Analysis of fish population dynamics and quantitative fishery science metrics used by WDNR fisheries biologists and technicians in response to natural variation, management intervention, or human induced environmental change within Wisconsin and the region; 2) Quality assurance and quality control systems for fish age estimation; and 3) Technical training (seminars and short courses) for state fisheries professionals and technical staff (provided on a cost per trainee basis), and graduate students, including the development of distance education and certification programs that would increase accessibility for agency professional staff.
		Lake sturgeon distribution, movement, and stocking success in the Upper St. Croix River and Namekagon River	Jeff Kampa	Estimate lake sturgeon population size from the confluence of the St. Croix River and Namekagon River upstream to the first barrier in both river systems. In cooperation with WDNR and MDNR Fish Management staff, document lake sturgeon movement throughout the upper St. Croix River system in Wisconsin and Minnesota. Assess the performance of lake sturgeon stocked above movement barriers in the St. Croix River and Namekagon River.
		Characterizing thermal regimes of coolwater walleye in the warm Lower Wisconsin River	Brian Weigel/Justin Haglund	Characterize the thermal regime of the lower Wisconsin River and how it may affect walleye movement and survival. Collect data on 1) the summer maximum water temperature, 2) the water temperatures inhabited by walleye through out the summer, with special emphasis during peak summer temperatures, and 3) identify thermal refugia used by walleye.
		Predicted effects of temperature and precipitation on Wisconsin stream fishes	John Lyons, Matthew Mitro	Key study for developing the Driftless Area Master Plan. Improve the sensitivity of an existing GIS-based, watershed-scale model that predicts stream suitability for 50 fish species to variation in climate and groundwater flows by developing a hydrologic model to link changes in air temperature and precipitation to changes in water temperature and stream flow. Use the improved model to predict how various temperature and precipitation scenarios will alter the distribution and abundance of Wisconsin stream fishes. Predict the response of stream fishes to Wisconsin-specific projections over the next 25-50 years and identify streams particularly vulnerable to guide management planning.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
		Fish response to hydrologic modification	Matt Diebel	Flow regime is a primary determinant of the structure and function of aquatic and riparian ecosystems for streams and rivers. Our scientists and various collaborators are working to understand how stream flow affects fish communities. Areas of focus - Dane County and Statewide. Evaluate relationships between stream fish species distributions and hydrologic metrics, including low and storm flows. These relationships will then be used to predict changes in fish assemblages that would result from hydrologic modification from groundwater withdrawals and increases in impervious surfaces.
		Fisheries-based lakes classification	Andrew Rypel	This project will link fisheries biological information with limnological data to classify lakes according to the fisheries they support. To be used as a tool for fish biologists and the public in setting realistic management goals on individual water bodies.
		Statewide panfish research	Andrew Rypel	This project provides long term trends in panfish and other species. Data used in statewide information sessions by FM to guide a revision of the statewide panfish management plan.
		A regional decision support tool for identifying vulnerabilities of riverine habitat and fishes to temperature and precipitation	John Lyons	This project provides data across the Upper Midwest on stream fisheries under various temperature and precipitation scenarios.
	NONGAME SPECIES	**Status of snuffbox mussel in the Wolf River System**	Randal Piette, Bill Smith and Lisie Kitchel (ER)	Determine distribution and abundance of federally endangered species in Wolf River System. Define key habitat requirements and determine feasibility of management strategies.
		Research support to WQ, WT, NHC, OEEA - Evaluating freshwater mussel populations	Randal Piette	Mussel surveys are required for a variety of reasons including water resources permitting and dam relicensing. Science Services provides technical expertise in mussel taxonomy and survey work. Provides advice and assistance to Fisheries Management and Water Quality staff and DNR's DOT liaisons in determining impacts of project permits on mussel communities.
	FISH, WILDLIFE, & PLANT GENETICS	**Conservation genetics of WI Fishes**	Brian Sloss (UWSP)	Apply the principles of conservation genetics to protecting and enhancing Wisconsin's fisheries. Currently funding a graduate student and academic staff genetics laboratory manager through Dr. Sloss's lab at UWSP (Wisconsin's Fisheries Cooperative Unit) focused on gamefish genetics
POLLUTANTS & HUMAN HEALTH	***NUTRIENT IMPACTS TO SURFACE WATER & GROUNDWATER***	**Long term trends in the water quality of Wisconsin rivers**	Matt Diebel	Evaluate trends over time in selected water quality parameters on Wisconsin rivers. Results of 42 sites on Wisconsin rivers will provide an overall picture of how water quality has changed over the last 30-50 years and factors associated with trends including agricultural and urban land management practices and wastewater discharges.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
		Phosphorus and nitrogen in Lake Mendota's tributary streams and shallow groundwater systems: Trends and linkages to agriculture (comp project)	Dick Lathrop	Conduct monitoring in the Yahara tributaries for N and P. Conduct a sub-project as part of Yahara CLEAN to analyze long-term P loading and lake response data that would allow specific P loading reduction targets to be recommended and if achieved would produce measureable water quality benefits for the four Yahara lakes. The analyses were completed and a final report written in December 2011. The results and recommendations of that work have been foundational to new lake clean-up efforts by Yahara CLEAN partners and Clean Lakes Alliance, a local non-profit group.
		Devils Lake Responses to 10 Years of Bottom Water Withdrawals	Dick Lathrop	To install and analyze a bottom-water withdrawal system to remove excess internal recycling of P from the lake, and return the lake to a lower trophic state. The 5,500-foot long withdrawal pipe system was installed in 2002 and continued evaluation the lake's water quality responses to the repeated withdrawals of P-rich water is ongoing.
		Exploring the role of wetlands in the nutrient cycles of Lakes Waubesa and Kegonsa	Cory McDonald	The Yahara chain of lakes is an important natural and cultural resource for Dane County. This system of lakes, Mendota and Monona in particular, has been extensively studied. Yet, water quality remains poor, especially in the lower lakes (Waubesa and Kegonsa). Current efforts to reduce phosphorus loading to the system (i.e., Yahara Clean) focus on the Mendota watershed. While the majority of inflow and P loading to the lower lakes is from the upstream lakes, additional watershed P loading appears to be significant as well. This study will investigate the role of wetlands in the nutrient cycles of the lower lakes.
	CONTAMINATED SEDIMENTS			
	VAPOR INTRUSION			
	PESTICIDES			
	MINING IMPACTS	**Taconite iron mining in Wisconsin - a review**	Cory McDonald	Coordinate an interagency team including WQ and Air and Waste to draft an overview of taconite mining in Wisconsin. Provide research and technical consultation to Water Division staff in developing recommendations for list of parameters and spatial and temporal monitoring design for minining applications.
	BEACH PATHOGENS	**Beach Nowcast Modeling**	Adam Mednick	This project will significantly expand operational nowcasting of beach water quality by building multivariate models for high priority and impaired beaches. We will provide hands-on training & technical assistance to beach managers to build long-term local capacity to operate and refine the models, and provide user feedback to EPA and USGS to further enhance the tools and lower barriers to their use.
	HARMFUL BLUE-GREEN ALGAE	**Coordination of blue-green algae statewide monitoring**	Gina LaLiberte	Coordinate agency's response and follow-up monitoring of blooms of blue-green agae. Work cooperatively with the Department of Health Services.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
	FISH & WILDLIFE CONTAMINANTS	**Sentinel lakes – tracking long-term trends in acid rain and mercury**	Carl Watras	As part of the Northern Wisconsin Long Term Ecological Research Program (LTER), a number of lakes are routinely monitored for a number of parameters - represents a partnership with UW. This project has yielded key information for use in establishing scientific information for mercury and acid rain. The project is the foundation for other projects including fisheries consumption advisories.
		Effects of Contaminant Exposure on Top Predator Populations in Wisconsin Aquatic Habitats	Michael Meyer	Develop and maintain the Wisconsin Great Lakes Biosentinel Program, a biosurveillance and early warning system where sensitive organisms are monitored to identify, spatially and temporally, ecosystems and populations impacted by persistent bioaccumulating toxic substances in the Great Lakes basin. Quantify the ecological risk of anthropogenic emissions of mercury (Hg) and carbon dioxide (CO_2), both now regulated as atmospheric pollutants by USEPA under the federal Clean Air Act.
SUPPORT ADAPTATION TO CHANGE	***FISHERIES & WILDLIFE IMPACTS***			
ASSESSMENT, MODELING, MONITORING	***FISH POPULATION MODELING & REGULATIONS MONITORING***			
	BIOLOGICAL CRITERIA & DESIGNATED USES	**Development and evaluation of watershed models for predicting stream fishery potential**	John Lyons, Matthew Mitro	This study is key for FM and also for WQ's Bioassesment reporting for EPA. Develop computer models that use readily available, watershed-scale, GIS-based information to predict flows, water temperatures, and suitability for 50 fish species in all 55,000+ miles of streams and rivers in Wisconsin. Utilize these models to assess, map, and classify the current status of stream fisheries in the state and will provide tools for managers to determine stream potential and to effects of land-use, temperature, and precipitation on stream fisheries.
		Assessing drivers of variability in the chlorophyll phosphorus relationship in Wisconsin lakes	Matt Diebel, Cory McDonald	This project is important for developing site-specific phosphorus criteria. Better understand what caused outliers in the redevelopment of the P-Chl relationship for WI lakes. Assess drivers of variation in the phosphorus/chlorophyll relationship in shallow lakes.
		Developing an aquatic macrophyte-based bioassessment tool	Kelly Wagner, Scott Van Egeren, Alison Mikulyuk, Michelle Nault, Jennifer Hauxwell	Develop a macrophyte-based bioassessment tool and indicator of environmental quality. Utilize a database of standardized aquatic plant surveys conducted on 266 Wisconsin lakes.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
		Service to lake associations - nutrient management studies - Anvil Lake, Big Moon Lake	Paul Garrison	Science Services provides research support to various lake groups evaluating water quality. Paleolimnological techniques provide information on past water quality which assists in setting reasonable goals for future water quality conditions. Use diatoms, geochemistry, and sediment accumulation to assess water quality status of lake and compare to historical conditions.
	BASELINE ASSESSMENT & MONITORING	**U.S. Environmental Protection Agency National Lake Assessment**	Paul Garrison	This project is part of a national program to assess the condition of the Nation's lakes. Indicators and stressors that are being evaluated are nutrients, algal toxin, water chemistry, sediment mercury and diatoms, phytoplankton, zooplankton, shoreland habitat, benthic macroinvertebrate community, and macrophytes.
		U.S. Environmental Protection Agency National Lakes Assessment Design Support - Developing a rapid assessment protocol for macrophytes	Alison Mikulyuk, Kelly Wagner, Michelle Nault, Martha Barton, Jennifer Hauxwell	Developed a transect method to quickly screen macrophyte communities and will be compared against the current baseline protocol to determine its suitability as a Tier I monitoring protocol for macrophytes.
		The use of satellite remote sensing for monitoring Wisconsin lakes	Steve Greb, Eric Erdmann	Science Services provides support to WQ for WDNR's baseline monitoring program with a focus on statewide assessments of lake water clarity using satellite imagery. Utilization of remote sensing as a cost-effective alternative to traditional in-situ monitoring methods. This technique provides spatial coverage ranging in scale from with-in lake variation to statewide coverage.
		Remote Sensing Research Scientist	under recruitment	Remote sensing, particularly the use of satellites, has emerged as a cost-effective method for a variety of environmental monitoring applications. Examples of remote sensing uses include forest ecosystem health, forest fire monitoring, land use changes and land cover changes, such as percent imperiousness. One of the most important advantages remote sensing has over conventional monitoring is cost savings. This position will provide scientific leadership in assessing the variety of remote sensing options and applications and implementing a cost-effective approach to lake monitoring.
		U.S. Environmental Protection Agency National Rivers and Streams Assessment	Paul Garrison, Gina LaLiberte	Inform nutrient and runoff management decisions, as well as listing/delisting of impaired waters. Rivers and streams periphyton soft algae and diatoms will be used to assess nutrients and biological integrity.
		Citizen based monitoring – developing a user-friendly protocol to track lake levels and water tables across Vilas County	Carl Watras	Develop standardized protocols that citizens may use to monitor lake levels across Vilas County. Volunteers currently monitor weekly ice-out to ice-on water level fluctuations in 26 Vilas County lakes, and compiled data are being incorporated into the SWIMS database by Lake Management staff.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
SOCIAL & ECONOMIC VALUES	***CUSTOMER SATISFACTION & BEHAVIOR***	**Statewide angler mail creel survey**	Matthew Mitro	This is a key study, typically conducted on a 5-year cycle to determine statewide patterns in fishing preference, catch, and many other variables.
ENSURE SOLID SCIENCE FOUNDATION	***LONG-TERM MONITORING & FOUNDATIONAL SCIENCE***	**Rewrite the book *Fishes of Wisconsin***	John Lyons	Summarize the extensive and rapidly increasing new information on all 165 species of fishes in Wisconsin that has become available since the standard reference work Fishes of Wisconsin was published in 1983. The project will provide improved interpretation and access to information essential to the conservation and management of fisheries and aquatic resources in Wisconsin. Make both the new and older information accessible through innovative online applications, including a photo-based fish identification system, a customizable distribution-mapping tool, a comprehensive searchable bibliography, and an updatable "e-book" of species accounts.
		Northern Highland Fishery Research Area (NHFRA) population and harvest monitoring	Greg Sass	Key study for implementing the Wisconsin Walleye Initiative. Continue to collect fisheries assessment and limnological data, as well as angler data to add to the valuable and extensive NHFRA database, in order to provide information that will address a number of high priority issues that were identified by the Joint federal-state-tribal Assessment Steering Committee. Maintain the long-term NHFRA database and to continually monitor fishing pressure, angler characteristics, and fish populations through a compulsory creel census and fish population sampling. The Northern Highland Fishery Research Area (NHFRA) was established by the Wisconsin Department of Natural Resources (then the Wisconsin Conservation Commission) in 1946 to study the effects of angling on fish populations. There are five lakes in the NHFRA which have been continuously managed as experimental research waters including Escanaba (293 acres), Nebish (98 acres), Pallette (176 acres), Spruce (16.5 acres), and Mystery (16 acres). These lakes were chosen for research because they were typical of the different types of lakes in northeastern Wisconsin and because their location favored control of anglers by a compulsory permit system.
		Status and trends in sportfish populations of southwestern Wisconsin warmwater streams	John Lyons	Document the responses of smallmouth bass to nutrient runoff, to floods and droughts. Provide data and interpretation to improve the conservation and management of a unique and valuable type of stream fishery. Monitor sportfish abundance, reproductive success, size structure, and growth rate each year in seven streams in southwestern Wisconsin that support (or once supported) high quality fisheries, continuing annual survey since 1989.

THEME	PRIORITY FOCUS AREA	PROJECT TITLE	LEAD RESEARCHER	PROJECT DESCRIPTION & OBJECTIVES
		Status and trends in the fish community of the lower Wisconsin River	John Lyons	Provide data and interpretation to improve conservation and management of one of the most important fisheries in the state (Wisconsin River). Monitor long-term fish community dynamics each year over the entire Lower Wisconsin River. Evaluate sportfish abundance, reproductive success, size structure, and growth rate each year for the Prairie du Sac Dam tailwater, continuing annual surveys begun in 1987.
		Historic and future flows of Wisconsin rivers and associated impacts on river island resources	Steven Greb	Determine how the flows of Wisconsin's major rivers are changing over time and how these hydrologic changes might impact river channel and island shape and size. In recent past, Wisconsin has experienced both record flooding and record drought conditions, resulting in dramatic swings in the flow of water in Wisconsin rivers. Changes in river flow have major effects on fisheries ($2.75 billion industry supporting 30,000 jobs in WI), navigation, water quality, recreational safety (boating, camping, etc.), and diversity of species found on islands. We have partnered with the Department of the Interior's Bureau of Land Management to conduct work to better understand river hydrology in Wisconsin as well as to inventory the lands associated with riverine islands. Wisconsin has thousands of river miles and over 400 river islands.
		Developing wireless radio-sensor networks to monitor effects of temperature and precipitation on lakes and wetlands	Carl Watras	Understand how temperature and precipitation affect basic biogeochemistry of lakes and wetlands. Biogeochemistry affects everything from water clarity to fisheries. Each network of sensors can monitor water table fluctuations, precipitation, evaporation, dissolved organic carbon and bulk ionic solutes at 30 minute intervals throughout the ice-free season. The data are transmitted via low-power radio to a remote base station that is affiliated with UW-Madison GLEON project.
		Lake level fluctuations in the Northern Highland Lake District of Wisconsin: historical and current patterns	Carl Watras	Understand the regional water cycle and linkages between lake levels and temperature and precipitation. Records of lake stage, water table elevation, precipitation and evaporation are being investigated.