1. Funding Opportunity No: EPA-R5-GL2010-1
Focus Area: Toxic Substances and Areas of Concern
Program: Enhanced State/Tribe Fish Consumption Advisory Support

2. Name of Proposal: Enhancing Wisconsin's Fish Advisory Program: Emerging Chemicals, Angler Awareness, Exposure, Health Status and Outreach

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4. Type of Organization: State agency

5. Proposed 5-yr Funding Request: $1,858,408

6. Brief Project Description (595 character limit)

Key terms: Great Lakes, sportfish, contaminant, selenium, omega-3 fatty acids, angler, men, health, advisory, cardiovascular, cancer, diabetes, thyroid

This five year project includes all components needed to improve Wisconsin's fish consumption advisories: assessment of essential nutrients and contaminants in Great Lakes fish; consumer focus groups; serial evaluation of advisory awareness and fish consumption; contaminant body burdens and health status among elderly men who eat frequent meals of Great Lakes fish; and the development of interactive web pages and electronic media outreach tools. Fish and human tissues will be analyzed for selenium, omega-3 fatty acids, polychlorinated biphenyls (including PCB11), brominated flame retardants, perflourinated organic acids, toxaphene, DDE, and toxic metals.

7. Project Location: Portions of Great Lake and Upper Mississippi regions in the State of Wisconsin including Lakes Michigan and Superior
HUC code: Parts of 07 and 04
Lat Long: 43.09°N 89.37° W
State: Wisconsin

8. Full Project Description:

Primary Study Goal: Increase protection of Great Lakes fish consumers through scientifically-sound consumption advice which will lower human tissue concentrations of mercury, PCBs, DDE and other persistent pollutants while encouraging consumption of fish high in beneficial nutrients.

Fish has long been recognized as a nutritious, low-fat source of dietary protein and essential fatty acids and several studies have confirmed a protective effect of fish consumption against heart disease (Kris-Etherton et al., 2003). As a result of this finding, adults, especially those who have a family history or underlying risk factor for cardiovascular disease, are encouraged to reduce their consumption of red meats and to eat fish at least twice a week (AHA, 2008). As a result of these recommendations, fish consumption has increased over the past decade. Aggressive promotion of this change in the American diet has raised concerns among some experts because regular consumption of older predatory fish, such as walleye, northern pike, shark and swordfish currently constitutes the single largest source of human exposure to methylmercury (Knobeloch et al. 1995; Mahaffey et al, Hightower and Moore, 2003). The Wisconsin DNR has monitored fish from the Great Lakes basin since the 1970s and high concentrations of PCBs and other contaminants have been documented in several species of fish. In addition to the historic contaminants such as PCBs and mercury, other chemicals of concern have recently emerged, further complicating communication with the public. For example, perfluorinated chemicals used to coat cookware and protect fabrics against stains have been detected in fish harvested from the Mississippi River. Brominated flame retardants and persistent pesticides are also of concern to public health officials and fisheries managers who share responsibility for ensuring the safety of local sportfish.

To achieve measurable human behavior modification requires commitment and persistence and a long term, multi-pronged strategy. Over a five year period Wisconsin will engage multiple partner communities and employ a logical progression of activities which will strengthen the scientific basis for fish consumption advisories, help achieve a better understanding of the risks and benefits of sport fish consumption and employ modern risk communication strategies to effectively elicit fish consumption behavior changes which will result in reduced human body burdens of persistent, bioaccumulative contaminants found in the Great Lakes fishery. In addition to comparing the association between ingestion of Great Lakes fish with angler body burdens for mercury and polychlorinated biphenyls which has already been well established, we will compare fish ingestion rates - considering species, size and location of catch - to human body burdens of several recently detected environmental contaminants including perflourinated organic acids, flame retardants, and PCB11 for which the role of fish consumption is less certain. We will work with the Great Lakes Consortium for Fish Consumption Advisories (Consortium) to translate our result into an improved advisory program. For example, study findings may support the development of outreach materials for newly identified contaminants of concern or to expand information about beneficial nutrient levels in various Great Lake sportfish.

Project Relevance

This proposal fits GLRI Action Plan focus areas of Toxic Substances and Areas of Concern and Accountability, Monitoring, Evaluation, Communication, and Partnerships and addresses the Great Lakes Regional Collaboration (GLRC) recommendation to protect human health through consistent and easily accessible basin-wide messages on fish consumption. It is also consistent with the priorities of Wisconsin's Great Lakes Strategy in that it will inform programs aimed at the protection of human health against adverse effects of toxic chemicals that have entered the Great Lakes ecosystem. Our goal is to improve human health by encouraging families to eat locally-caught fish as part of a varied, healthy diet. However, it is important for frequent consumers of these fish to eat species that are rich in beneficial nutrients and low in toxic contaminants that often bioaccumulate in the aquatic food chain.

Objective 1: Improve our understanding of the human health risks and benefits of eating sport fish from the Great Lakes

Sport fish consumer surveys

In Year 1, in collaboration with Cornell University and the Consortium, Wisconsin will participate in the design, implementation and analysis of a mailed survey that will include at least 1,000 Wisconsin fishing license holders who regularly consume sport-caught fish. The Consortium basin-wide survey of 8,000 anglers will provide uniformly collected core information allowing comparison of all eight Great Lakes states and provide a baseline (snapshot) measure of Wisconsin advisory effectiveness. Once the Consortium survey is finalized, Wisconsin will assure that our state's sample size is large enough to estimate population parameters at a reasonable level of accuracy for key subgroups such as our proposed emphasis on older male anglers. The core Consortium survey will collect information about current fish consumption behaviors and factors influencing those behaviors (informed by the Theory of Planned Behavior). These factors include:

- Current and preferred sources of information about fish consumption and health.
- Awareness of fish consumption advisories.
- Beliefs about the outcomes associated with following advisories and evaluation of the desirability of these outcomes.
- Other individuals or groups who have an influence on respondents' fish consumption behaviors.
- Constraints on following fish consumption advisories.
- Demographic variables such as age, gender, residence, income, education, and race.

In addition to older male anglers, Wisconsin's emphasis will include the role of health status and outcomes as they influence consumption behavior. If necessary, Wisconsin we will augment the Consortium survey with funds from this grant to increase sample size and include health status questions concerning cardiovascular disease, diabetes, and cancer. In the survey design for Wisconsin we will emphasize collecting information on older men since previous studies have found higher sportfish ingestion rates and higher mercury and PCB levels among men over the age of 60 years (Knobeloch et al. 2005). Although not unique to Wisconsin, this group has received little emphasis in the existing Wisconsin advisory program. In addition, the collection of health status information is justified because the prevalence of cardiovascular disease, diabetes and cancer will be more common in this age group and is likely to influence their behavior.

In parallel with the Consortium mail survey development, Wisconsin will develop a more comprehensive internet based, Wisconsin specific on-line electronic survey tool that we will maintain throughout the duration of the program. Our goal will be to survey and enroll up to 5,000 additional anglers by the end of the third year. Recruitment methods may include a combination of mailings to licensed anglers and/or press releases, fliers, or links posted on Wisconsin sport fishing websites. Enrollment efforts will be focused on the Wisconsin AOCs and the survey may also prove a useful tool to those implementing the Health Care Provider education GLRI programs in Wisconsin. Study volunteers will complete the online survey that will collect demographic and health information as well as information about the number of years they have fished on the Great Lakes and other water bodies, the locations on the water bodies where they regularly fish, the species and length of the fish they regularly catch and the number of sport fish they eat in a typical year. Upon completion of the survey, participants will be provided links to advisory communication materials, e-mail news sign-up, and other interactive tools in an effort to encourage ongoing awareness of state-issued advice to anglers.

Human biomonitoring

Utilizing the information available from the Consortium survey and the internet survey system collected during year 1, in Year 2, a small number of volunteers (up to 100) will be selected and invited to provide scalp hair samples for methylmercury analysis and a blood sample to be analyzed for mercury, polychlorinated biphenyls, polybrominated diphenyl ethers, perfluorinated compounds, selenium and omega-3 fatty acids. Ideally we would annually draw a biomonitoring sample from the survey data base during year 3 and 4 consisting of individuals with characteristics similar to those in the initial sample. This would allow us to monitor body burden trends.

Wisconsin has a unique resource in the Survey of the Health of Wisconsin (SHOW) program which is an ongoing, health survey modeled after the US National Health and Nutrition Examination Survey (NHANES) The SHOW has been operational for more than a year and examines a representative sample of Wisconsin adults. The survey includes questions on fish consumption. Biologic specimens are collected and stored. We propose to analyze up to 50 stored serum samples for fatty acids (omega-3s and 6s) in order to assess the adequacy of Wisconsin resident dietary omega 3s. If the existing samples prove insufficient, during year 1, SHOW will prospectively collect the necessary biologic specimens to allow characterization of Wisconsin and the prospectively collected samples analyzed.

This project is intended to address questions that have been raised regarding the risks and benefits associated with long-term ingestion of sport fish from the Great Lakes basin. Currently, fish intake is encouraged as a healthy, low-fat source of dietary protein. The American Heart Association and most nutritionists and health care providers advise adults to eat fish at least twice a week. However, in addition to essential nutrients, older predatory fish often contain a mixture of toxin chemicals that are persistent and bioaccumulative. Our study of a large cohort of Great Lake Charter captains and community-matched controls found higher levels of DDT and PCBs in blood samples collected from those who had consumed sportfish from these lakes over a period of many years (Knobeloch et al., 2009). Assessment of mortality among this cohort found that fish consumption was protective against cardiovascular disease among the control population, which ate primarily purchased marine species, but was not protective among consumers of fish from the Great Lakes (Tomasallo et al., 2009). A protective effect of marine fish - but not freshwater fish - on cardiovascular disease was also recently reported by Levitan et al., (2009). The differential effects of marine versus freshwater fish on cardiovascular disease prevention is thought to be due to higher levels of selenium and omega-3 fatty acids in oily marine species such as salmon, sardines and other cold-water fatty species of fish (National Forum on Contaminants in Fish, 2009). A 1990 study by the Minnesota Sea Grant found high levels of omega-3 fatty acids in several species of Lake Superior fish (Addis, 1990). However, little data is available on levels of these nutrients in fish harvested from other Great Lakes or from inland lakes and streams.

This study will provide valuable information to state agencies and the clinical community regarding omega-3 fatty acid and selenium intake among Wisconsin residents. It will also assess angler awareness of consumption advisories that have been issued for commonly eaten fish from these waters. In addition, biomonitoring, in conjunction with consumption histories will allow us to evaluate the protectiveness of advisories against exposure to known and selected emerging chemicals that continue to affect the Great Lakes fishery and are known to pose serious health risks. By assessing fish intake, contaminant body burdens, omega-3 fatty acid and selenium levels and health indicators in a large cohort of older men, investigators will be able to assess the risks and benefits associated with consumption of fish from the Great Lakes basin.

Biomonitoring findings from this study will be relevant to the informational needs and priorities of the Great Lakes Restoration Initiative which has targeted several toxic substances found in the Great Lakes Basin and the Areas of Concern including mercury, PCBs and organochlorine pesticides. Defining human

exposure to these substances and establishing the relationship between individual exposure levels and ingestion of fish from identified areas on the Great Lakes or from lakes and rivers located near the Areas of Concern will help the GLRI assess progress toward The Great Lakes Strategic Plan goals of reducing contaminant levels in the Great Lakes fishery.

Objective 2: Expand the monitoring of GL fish to include chemicals of emerging toxicological concern as well as nutritional elements.

The Consortium will collaborate with the Clarkson University Research Team (Clarkson), or the current Great Lakes Fish Monitoring and Surveillance Program grantee, to produce comparable contaminant and omega-3 fatty acid data in fish across the basin by having a shared quality assurance project plan (QAPP). Clarkson will provide quality assurance/quality control oversight and coordinate technology transfer to state laboratories. The Wisconsin State Laboratory (WI SLH) of Hygiene will participate in that collaboration. Clarkson will develop standardized fish reference material (SRM) and experimental protocols for inter-laboratory validation of new methodology for selected analyses between participating state laboratories and Clarkson. This could include some assistance of analytical staff from Clarkson onsite as needed. Participating state laboratories will receive the pseudo SRM from Clarkson by month 5 of the project. Clarkson will transfer the method for analysis of omega-3 fatty acids to interested states and determine comparability by September 2010. Clarkson will work with the Minnesota Public Health Laboratory and the Wisconsin State Laboratory of Hygiene to determine comparability of perfluorochemical (PFC) methods by October 2010. Clarkson will work with the Michigan Bureau of Laboratories to determine comparability of toxaphene methods by July 2010.

Funding from this Wisconsin proposal will support the addition of several new environmental contaminants including perflourinated chemicals (PFCs), polybrominated diphenyl ethers (PBDEs), and other chemicals pending results of human biomonitoring; as well as selenium and omega-3 fatty acids to the suite of chemicals that are analyzed in samples from Wisconsin's routine fish monitoring program. Our budget request reflects only chemical analysis cost and not collection and processing costs which are covered by Wisconsin's fish contaminant monitoring program. PFCs and PBDEs will be examined in indicator species collected per routine collection schedule from Lakes Michigan and Superior, Wisconsin Areas of Concern, and inland comparison sites.

During the final years of the contract, fish tissue analysis may be expanded based on survey and biomonitoring findings to include the most popular Great Lakes sportfish and any newly-identified contaminants found in anglers. Limited information is currently available on beneficial nutrients such as selenium and essential fatty acids in Wisconsin sport fish so several species will be tested the first year and spatial and temporal variation will be examined in latter years of the project. This work will identify species of Wisconsin sport fish that are a significant dietary source of selenium and omega-3 fatty acids.

Objective 3. Enhance Wisconsin's advisory programs to reflect Consortium and Wisconsin project findings to improve outreach

Utilizing the resources provided by the Consortium, Cornell University will complete an assessment of Wisconsin's current fish consumption health advisory communication program activities in and provide a written report by March 31, 2011. This work will focus on identifying: (1) messages, means of communication, and target audiences; and (2) opportunities for and barriers to greater coordination within Wisconsin and between states.

Working in partnership with the Consortium and Cornell Team will provide Wisconsin the opportunity to move beyond individual intuition and experience to more thoroughly assess needs of specific subpopulations, develop new materials, and evaluate effectiveness. Given the differences in information

needs of different at-risk groups, gathering background and contextual information about key audiences and field testing fish consumption advisory materials play a critical role in the success of risk communication efforts. Working with the Cornell Team Wisconsin will gain information needed to improve the effectiveness of our advisories to reduce the exposure of at-risk groups to toxic substances.

Wisconsin will host Consortium focus group sessions conducted by Cornell. A series of focus groups with key audiences will take place beginning in June 2010 and continue through March 2011. The purpose of these focus groups will be to identify factors that influence consumption of Great Lakes basin fish. Each focus group will be led by a Cornell researcher with the assistance of a Wisconsin staff member. In addition to leading the focus groups, the Cornell researcher will provide Wisconsin staff with training on how to conduct focus groups. Focus group discussions will be audio recorded, and these recordings will be transcribed. A content analysis of the transcripts will be conducted to categorize the factors influencing fish consumption for each group.

In year 2 Wisconsin will use the Cornell template to conduct additional focus groups in Wisconsin communities and will participate in the Consortium proposed New Mothers survey.

This proposal will improve Wisconsin's outreach to anglers and people who eat fish. We will evaluate and will anticipate being able to substantially improve the content of the Wisconsin Department of Natural Resource's fish consumption advisory webpage by increasing interactivity and specificity. The improvements will be implemented on the DNR fish consumption advisory website which will act as the hub and link to other important and pertinent websites. The project will investigate and pilot electronic outreach campaigns to increase awareness of fish consumption advice and utilize electronic media including audio, video, Govdelivery and approved social networking sites. Outreach improvements will be developed by assessing current website usage, external mentions, and electronic subscriptions to fish advisory messages. This project will evaluate and pilot the use of a Wisconsin fish advisory blog or a series of discussions focusing on advice for particular areas of the state or water bodies and with participants in the biomonitoring portion of this project. Leading and important bloggers, websites, and social networking websites will be identified and links to Wisconsin DNR's fish advisory homepage will be developed as appropriate. For example, we will increase the information on advice for local waterbodies on appropriate websites, blogs, and social media venues. The Consortium is submitting a complementary basin-wide proposal that will include monitoring, evaluation of outreach and communication, and advisory protocol needs (for example, how to incorporate data on beneficial omega fatty acids or determine the need for advice for PFCs and PBDEs).

Project Activities

Year 1 funds will be used to:

1. Expand Wisconsin's ongoing fish tissue monitoring program to include several new contaminants of emerging concern as well as essential nutrients that protect against cardiovascular disease;
2. Participate in the leadership and implementation of the *Great Lakes Consortium for Fish Consumption Advisories* and assist the Consortium-supported program at Cornell University to complete an inventory and assessment of our existing program and conduct focus groups with three target "at risk" audiences;
3. Conduct a survey of up to a 1,000 licensed older, male Wisconsin anglers who eat frequent meals of fish from the Great Lakes or from inland lakes and rivers to assess advisory awareness, sportfish intake, and health status;
4. Develop and deploy an electronic, web-based survey tool to collect information about the quantity and type of sportfish anglers include in their diets, their awareness of and compliance with

Wisconsin's consumption advisory, and their health status including any history of cardiovascular disease, hypertension, diabetes, thyroid disorders, or cancer.

5. Analyze stored blood specimens of older Wisconsin residents who have participated in the Survey of the Health of Wisconsin (SHOW) study for selenium and omega 3 fatty acids.
6. Improve Wisconsin DNR's outreach to anglers by developing and maintaining interactive web pages and electronic media outreach tools.

Year 2 – 5 funds will be used to:

1. Use recommendations from Cornell University's focus group report to make our advisory program more effective;
2. In conjunction with partner communities (including the AOCs), Consortium states and the USEPA, implement a revised advisory program and conduct annual reviews of other Consortium state advisory programs for activities to add to our "Advisory Tool Box";
3. Collaborate and coordinate with GLRI grantees addressing the GLRI focus area of *health care provider organization outreach*;
4. Participate in Consortium activities to develop protocols for emerging contaminants;
5. Use an online survey to collect and track advisory awareness and sportfish intake information from older men who are licensed anglers; and
6. Collect blood and hair samples from a subset of anglers and analyze for methylmercury, polychlorinated biphenyls (including PCB11 which has been detected in urban air in Chicago and Cleveland but was not previously been included in our analyses), perfluorinated organic acids, halogenated flame retardants, selenium and omega-3 fatty acids. This suite of nutrients and contaminants will be better defined based on year 1 findings and other studies and those found in humans also be analyzed in the most frequently consumed sportfish pending on analytical methodologies.
7. Continue to supplement Wisconsin's fish contaminant monitoring program by adding new contaminants of emerging toxicological concern as well as essential nutrients in a subset of fish samples.
8. Continue to improve Wisconsin DNR's outreach to anglers by further improvement of web pages and electronic outreach tools.

Progress reports and summaries will be prepared and submitted based on time schedules defined in the contract.

Project Outline with Milestones and Measures of Progress

Year 1	
Milestones	**Measure of Progress**
In cooperation with GL Consortium Fish Advisory Enhancement Proposal select and store samples for enhanced quantification of contaminants and nutrients	No. of samples collected and stored
Analyze stored fish tissue samples for selenium, omega-3 fatty acids, PBDEs and PFCs	No. of samples analyzed for each analyte
Analyze serum samples from SHOW participants for omega-3 fatty acids and selenium	No. of serum samples analyzed for each analyte
Survey 1,000 anglers who live in the Areas of Concern	No. of anglers who have completed the survey
Develop and pre-test an online survey tool	Completion of the survey
Submit study materials and methods to Human Subjects Review Committee	Application submission date and receipt of IRB approval for the study
Develop recruitment materials, mailings, fliers, press releases, etc.	% of required materials available at end of yr 1
Develop contracts with partners	No. of contracts that are finalized
Prepare and submit annual progress report	Date of submission
Year 2	
Deployan online survey for licensed anglers	Date of deployment
Collect hair and blood samples from study volunteers	No. of hair and blood samples delivered to the laboratory
Begin laboratory analysis of human tissue samples	No. of analyses completed
Continue fish tissue analysis	No. of fish tissue analyses completed
Publicize findings from year 1 fish tissue analysis	No. of publications
Participate in New Mother's Study	No. of mother's surveyed
Prepare and submit annual progress report	Submission date
Year 3	
Continue online survey	No. of completed surveys
Complete all hair and blood collection	No. of samples sent to laboratory
Complete all archiving of fish tissue samples selected for enhanced chemical and nutrient analysis	No. of fish samples sent to laboratory
Continue laboratory analysis of human and fish tissue	No. of analyses completed and verified
Prepare and submit annual progress report	Submission date
Year 4	
Complete laboratory analyses	No. of unfinished analyses
Analyze data from human and fish tissue analysis	Date of final summary report
Analyze data from the online survey	Date of final summary report
Prepare and submit annual progress report	Submission date
Publicize initial study findings	No. of publications and presentations
Year 5	
Complete all analyses	% of analyses not completed
Work with the Great Lakes Consortium to integrate findings into the uniform advisory	No of consortium states that have adopted the revised advisory
Publicize study findings	No of publications
Conduct outreach to disseminate findings to the general public and to anglers	No. of outreach activities completed and no. of Wisconsin households reached
Prepare and submit final report	Submission date

9. Outcomes, Outputs and Expected Results

This project will improve and enhance Wisconsin's fish advisory program by assessing exposure among people who eat fish, providing information on the relative risks and benefits of eating popular species of Wisconsin sport fish, and enhancing communications regarding fish consumption. Project outcomes include a more complete understanding of the nutritional and chemical content of freshwater fish from the Great Lakes Basin which will lead to increased awareness of Wisconsin and National fish consumption advice and better protection of the health of Wisconsinites who eat fish.

Fish are a traditional food for many Wisconsin families and is considered to be a healthy source of protein, selenium and other micronutrients. Recently, omega-3 fatty acids have been found to provide protection against cardiovascular disease and the American Heart Association and other groups encourages all adults to eat fish at least twice a week. However, while several species of marine fish are rich in omega-3 fatty acids, we know very little about levels of these nutritional oils in fresh water species. At the same time, there are concerns regarding the contamination of fish from the Great Lakes with persistent chemicals used for industrial processes or in household products. The literature is replete with articles that describe levels of PCBs, chlorinated pesticides, and mercury in fish harvested from the Great Lakes and other inland waters. At the same time, very little data is available regarding the presence of many of these chemicals in the Great Lake fishery although they are widely used and environmentally persistent.

Our study of a large cohort of Great Lakes anglers failed to confirm a beneficial effect of sport-caught fish intake on cardiovascular mortality rates (Tomasallo et al, 2009). In the past year, several other investigators have reported inconsistent findings regarding the cardiovascular benefits provided by dietary fish. Currently, the literature suggests that some fish are better than others at protecting against heart attacks and strokes and the best choice seems to be oily marine fish such as sardines and salmon. If it is true that fish from the Great Lakes are not rich enough in omega-3 fatty acids to protect older adults against heart disease, perhaps we should be even more concerned about the full array of industrial and household chemicals that are discharged to our waterways and accumulate in these fish.

Project Outputs

This project will provide the following deliverables:

1. Omega-3 fatty acid and selenium levels in a statistically valid subsample of Wisconsin residents.
2. Local fish intake patterns and advisory awareness among 1,000 licensed anglers who live in an Area of Concern.
3. Advisory awareness and compliance rates among approximately 5,000 older men who fish on the Great Lakes and on Wisconsin waters.
4. Omega-3 fatty acid and selenium levels in older men who consume primarily freshwater fish and the contribution of locally-caught fish to their omega-3 intake.
5. Cardiovascular disease, diabetes, thyroid disease, and cancer rates among a cohort of approximately 5,000 older men who regularly consume fish from the Great Lakes Basin.
6. Levels of several persistent contaminants in commonly eaten sportfish from the Great Lakes Basin.
7. Levels of selenium and omega-3 fatty acids in commonly eaten sportfish from the Great Lakes Basin.
8. Contribution of Great Lake fish to human body burdens of contaminants found in the lakes and tributaries.
9. An improved, more comprehensive advisory for Great Lakes fish that is based on information about a broader array of contaminants as well as beneficial nutrients.

10. Improved access to and use of Wisconsin's fish advisory websites and increased electronic-based communication of advisory information with anglers and others. A final report will document the efforts to improve communications and the final improvements that proved beneficial.

Expected Results

This project will result in an improved advisory for Great Lakes sportfish that is a based on current measurements of nutrients and a broad array of contaminants. Currently, there is an untested assumption that people who don't eat fish are deficient in these nutrients. Yet, a variety of other foods, such as nuts and legumes, can provide these nutrients if consumed in sufficient quantities. We need to understand whether it is appropriate to advise everyone, including vegetarians who typically have lower cardiovascular disease rates than omnivores, to eat more fish. In addition, this project will provide size- and location- specific information about nutrient and contaminant concentrations in the edible portion of several species of Great Lakes sport fish. This information will be used to assess the need for a more comprehensive and balanced consumption advisory. A secondary outcome is a more informed consumer and reduced risk of exposure to bioaccumulative toxins found in fish from these lakes.

This project is expected to result in:

- Better protection of fish consumers in the Great Lakes basin from harmful effects of environmental chemicals by improving the information on nutrient and contaminant levels in fish tissue and in people who eat locally-caught fish. This information will be valuable for determining how advisory protocols need to be improved or address emerging chemicals and beneficial nutrients
- Improved and increased communication of fish consumption advisories from Wisconsin DNR and DHS by enhancing our outreach program to facilitate public access to advisory information and encourage dialogue between the general public and health and environmental agencies
- A more informed advisory for Great Lakes fish that encourages consumption of fish that are high in nutrients and low in contaminants which will lead to enhanced protection of people who eat fish from the Great Lakes basin
- A more comprehensive protocol for revising advisories to reflect finding of fish and human tissue analyses that includes nutritional elements as well as legacy contaminants of the Great Lakes basin and chemicals of emerging concern
- Reduced exposure to PCBs, mercury and other persistent contaminants found in Great Lakes fish by better determining which legacy and emerging chemicals are of concern due to consumption of Great Lakes basin sportfish

10. Collaboration, Partnerships, and Overarching Plans

This proposal has been developed jointly by the Wisconsin Department of Health Services and the Wisconsin Department of Natural Resources and will be implemented in collaboration with numerous partners in including the Wisconsin State Laboratory of Hygiene, the University of Wisconsin Survey Center and the University of Wisconsin Survey on the Health of Wisconsin (SHOW). Principals of this study are supportive of and will collaborate with the Great Lakes Consortium Fish Advisory Enhancement project that is also proposed for GLRI consideration. In addition, we will work with the Great Lakes Consortium for Fish Consumption Advisories to share findings from this study with principals of other GLRI funded studies such as the Cornell and Clarkson components of the Great Lakes Consortium Fish Advisory Enhancement project.

The Consortium includes representatives from seven of the Great Lakes states who have been collaborating since the mid-1990s on tissue monitoring, consumption advisory (FCA) outreach/communications, survey design, protocol development, and evaluation of methods to incorporate quantitative integration of risks and benefits into fish advisory development.

This project is supportive of several overarching plans for the protection and restoration of the Great Lakes and addresses the Goal 6 of the Great Lakes Regional Collaboration (GLRC) to protect the general public from toxic substances through effective outreach and education, including protective fish consumption advice throughout the Great Lakes Basin Ecosystem. It is consistent with Wisconsin's Great Lakes Strategy in that it will promote programs to protect public health through monitoring and public information programs, enhance information on contaminants in humans and fish tissue, and improve the effectiveness of fish consumption advisories by evaluating and piloting the use of electronic outreach techniques and tools. The goal of this proposal is to improve our fish consumption advice by obtaining data to provide better information on the benefits of fish consumption, on the risks of fish consumption due to emerging pollutants, and by evaluating mediums for reaching anglers who eat Wisconsin's sport fish. The goal includes working with the Great Lakes Consortium to improve fish consumption advice and communication of advisories across the Great Lakes Basin. Lastly, the project would continue and expand on Wisconsin's fish contaminant monitoring and advisory programs which will forward the goals of Remedial Action Plans for the Areas of Concern in Wisconsin and the Lakewide Management Plan and Lake Superior Binational Plan.

11. Programmatic Capability and Past Performance

The Wisconsin Department of Health Services (DHS) Division of Public Health will be the fiscal agent for this agreement. DHS receives several million dollars in federal grants annually and has broad experience in grant administration as well as in environmental and public health research. Project staff are located within the DHS/DPH/Bureau of Environmental and Occupational Health. These investigators have many years of experience in the area of environmental health providing a solid background to conduct the proposed project. The bureau maintains grant agreements with and administers programs for several federal agencies including the CDC, EPA, HUD and ATSDR. Systems are in place for contracting and monitoring agreements for services with public and private, profit and non-profit entities.

The Principal Investigators for this grant have worked together for nearly 20 years and have administered numerous EPA and CDC grants. Dr. Knobeloch is currently conducting a statewide study to assess barriers to well water testing and recently completed work on an EPA Great Lakes Program Office grant that assessed current mercury levels, fish intake and advisory awareness among volunteers in a 2004 mercury exposure study. Dr. Henry Anderson has more than 30 years of experience as an environmental and occupational health investigator. He serves as PI on numerous federal grants including more than ten that were focused on sportfish consumption and exposure to Great Lakes contaminants. Both Dr. Knobeloch and Dr. Anderson have served on numerous federal advisory committees and are considered to be experts in the field of toxicology, epidemiology and biomonitoring.

Ms. Schrank has worked in the Department of Natural Resources Bureau of Fisheries Management for more than 25 years and has managed Wisconsin's fish contaminant monitoring and advisory program for the Department for the last eight years which allocates services and analysis supported by state funds and federal grants totally $100,000 to $150,000 annually. She is a participating member of the Great Lakes Consortium for Fish Consumption Advisories. Recently, Ms. Schrank was project manager for and successfully completed a five year grant from Wisconsin's Focus on Energy that examined the temporal trends of mercury in fish. Ms. Schrank has a Masters Degree in environmental toxicology from the

University of Wisconsin and is considered to be an experienced professional specialist in fish contaminants, aquatic toxicology, and water resources management programs.

These investigators have served or currently serve as PIs and Co-PIs on the following grants and contracts are related to the Great Lakes initiative:

Henry Anderson

Protocol for a Uniform Advisory for Great Lakes Fish Consumption
Henry Anderson, MD, PI
USEPA/GLNPO Assistance no. GL-965527-01
Award amount: $125,000
Contract dates: 10/01/2007-12/31/2010
Project status: This grant was extended. State-sponsored outreach projects have been collected to create a Fish Advisory Toolbox. All progress reports have been submitted on time and project goals been met. The grant was extended to allow full implementation of the toolbox by consortium states.

Endocrine Disrupting Chemicals and Thyroid Outcomes
US EPA STAR Grant no. RD-83025401-1
Award amount: $2,288,208
Contract Period: 3/01/03 to 6/28/09
Project Status: Completed. The funding period for this project was extended through March 2009 to support follow-up studies of PBDE exposure pathways. All progress reports were submitted on time and all program objectives and goals have been met. Project findings have resulted in several publications in peer-reviewed journals.

Lynda Knobeloch

Surveillance of Harmful Algal Blooms Contract
CDC grant no. 1U38EH000332-01
Contract amount: $750,000
Current contract dates: 10/01/2008 -09/29/2013.
Project status: Ongoing
This contract was awarded in October of 2008. To date, all progress reports have been completed on time. Our program accomplishments have exceeded CDC's requirements and many of our electronic case ascertainment methods are being proposed for use by other contractors. A manuscript summarizing human and animal case reports for 2009 is in preparation.

Follow-up Study of Volunteers in a 2004 Mercury Exposure Study
USEPA/GLNPO Assistance no. GL-00E358-01-2
Contract period: 10/01/2007-12/31/2009
Award amount: $100,000
Project status: Completed. All progress reports were submitted on time and the proposed goals and objectives have been met. A manuscript summarizing our findings has been submitted to Environmental Research and is currently in review status.

Great Lakes Charter Captain Mortality Study
Lynda Knobeloch, PhD, PI
Great Lakes Commission, Great Lakes Air Deposition Program
Contract dates: 03/29/2006-07/31/2008

Award amount: $114,815
Project status: Completed on time with all objectives and goals met. Study findings were presented at the 5nd Annual Conference on Great Lakes Research and described in a publication by Tomasallo et al, 2009.

Facilities and Other Resources

The Wisconsin Department of Health Services

This state office building houses the department's six divisions (Public Health, Health Care Access and Accountability, Mental Health and Substance Abuse Services, Quality Assurance, Long Term Care, Enterprise Services) as well as it's executive offices and is equipped with a state-of-the art multiple password protected computer network with high speed T-1 line secure internet access. All electronic networks and file storage areas are HIPPA compliant, secure and approved for storage of vital records and confidential medical and research files. Project investigators and University of Wisconsin Population Health Sciences (UWPHS) employees, working on contract with the WDHS, will reside in the Bureau of Environmental and Occupational Health. This Bureau currently houses approximately 80 staff and provides office space, desks, telephones, computers, and IT support staff to all employees. The project investigators and UWPHS employees will have access to these same resources as well as printers and copiers, freezer space for blood specimens and a centrifuge.

Wisconsin Department of Natural Resources

Wisconsin DNR, in conjunction with Wisconsin Health Services, has issued fish consumption advice since 1976 initially due to the discovery of PCBs in some species of fish. Since the 1970s, Wisconsin Department of Natural Resources (DNR) has collected and tested fish from over 1,600 locations in the state and boundary waters. To date, testing has included mercury (over 22,000 records), total PCBs (over 15,000 records), banned pesticides, dioxin and furan congeners, other metals and persistent organic chemicals. Recent analyses have added records for perflourinated chemicals and polybrominated diphenyl ethers. In 2000, Wisconsin adopted a general advisory that applies to all waters but exceptions to this advice are necessary for 148 locations (2009 advisory update) due to higher concentrations of mercury, PCBs, dioxin/furans, and perflourooctane sulfonate. As new data is obtained at approximately 40 to 90 locations in recent years, fish consumption advice is updated. Fish advisory updates are posted on the DNR's fish advisory web site, in a booklet (28,000) available for public distribution. Outreach occurs via annual press releases highlighting the web site update and availability of the booklet. Information on the general fish consumption advice is also included in Wisconsin's fishing regulations booklet.

University of Wisconsin Survey Center

The University of Wisconsin Survey Center, a unit of the College of Letters & Science at the University of Wisconsin-Madison, has been working in the field of survey research since its inception in 1987. The Center conducts telephone, face-to-face, mail, and web surveys, and focus groups for clients on a cost-reimbursement basis. UWSC has the experience and capacity to conduct all forms of survey research. The Center completes thousands of interviews each year, often using long, complex, survey instruments.

UWSC has state-of-the-art interviewing and data processing equipment; employs a staff of well-trained, professional interviewers and uses advanced training, supervision, and interviewing procedures designed to produce research data of the highest quality. UWSC staff are skilled using CATI (Computer Assisted Telephone Interview) systems and are experienced in the preparation and analysis of complex data files.

The Center will provide the office space and technology needed to develop and deploy a web-based survey tool that can be accessed and completed from remote computers connected to the internet. Survey data will automatically be entered into an electronic database and will be analyzed using common software packages such as MS Access, MS Excel and SAS. The space, resources and personnel will be available for this project in Years 1 through 3. The proximity of the Center to the office of the Research Program Manager, located at the Wisconsin Department of Health Services is approximately 2 miles which facilitates communication and monitoring of the Center's work.

Wisconsin State Laboratory of Hygiene

The WSLH provides clinical, environmental, and industrial analytical services, specialized public health procedures, reference testing, training, technical assistance and consultation for private and public health agencies. WSLH is part of the University of Wisconsin-Madison through which they perform research and instruction related to public and environmental health laboratory services. The WSLH is certified by the U. S. Environmental Protection Agency and the Wisconsin Department of Natural Resources and the on an annual basis. The Wisconsin Department of Natural Resources certifies the WSLH under the provisions of the Wisconsin Administrative Code, ch. NR 149 for a number of environmental parameters, including PCBs. The laboratory is also accredited under the National Environmental Laboratory Accreditation Program. A complete Quality Assurance and Quality Control Program is maintained, including a sample tracking and LIMS system for sample and data management. The laboratory has participated in the ASTDR Great Lakes Research Program Quality Assurance/Quality Control Project. The WSLH has almost 20 years of experience in extracting and analyzing human serum for PCBs, DDT metabolites, and 4 years analyzing human serum for PBDEs. The organic chemistry staff includes 17 experienced environmental chemists. WSLH will provide laboratory and office space and computers in order to conduct specimen analysis. The WSLH will not have access to confidential data such as personal identifiers or residential address.

University of Wisconsin-Madison, Survey on the Health of Wisconsin (SHOW)

DHS will contract with SHOW to analyze stored serum from 2009 SHOW volunteers for omega-3 fatty acids and selenium. During years 1 and 2 of the project, SHOW staff will collect blood and hair samples from 100 elderly men who eat frequent meals of Great Lakes sportfish. These samples will be analyzed by the Wisconsin State Laboratory of Hygiene for omega-3 fatty acids, selenium and known and emerging contaminants. The Survey of the Health of Wisconsin (SHOW) is the first statewide research survey of its kind to measure information on critical health conditions in Wisconsin. Findings from SHOW will present a comprehensive picture of the health of Wisconsin residents, helping to identify needs and target resources where they are most needed. The SHOW team includes licensed phlebotomists and survey research experts from the UW department of Population Health Sciences

12. Projected Budget

Budget Item	Year 1	Year 2	Year 3	Year 4	Year 5
a. Personnel/Salaries	0	0	0	0	0
b. Fringe Benefits @ 45.4%	0	0	0	0	0
c. Travel $5,000/yr	$5,000	$5,000	$5,000	$5,000	$5,000
d. Equipment $3,000 in year 1 only	$3,000	0	0	0	0
e. Supplies $500/yr	$500	$500	$500	$500	$500
f. Contractual costs UW Survey on the Health of WI Department of Natural Resources 0.5 LTE Program Assistant UW Survey Center –online survey development and management State Laboratory of Hygiene 100 hair mercury analyses 100 Serum omega-3 FAs 100 Serum selenium levels 100 serum analyses for PCBs, PBDEs and PFOAs Fish tissue analysis UW Dept Population Health Sciences 1.0 FTE Program manager 1.0 FTE Project assistant Fringe @ 38.5% Indirect charges at 15%	$343,113	$395,682	$404,083	$322,370	$298,950
g. Internal Services	$12,000	$12,360	$12,731	$13,113	$13,506
h. Total Charges	$363,613	$413,542	$422,314	$340,984	$317,956

13. Acorn Statement

To the best of our knowledge, none of the parties involved in the proposed project are affiliated with ACORN or any of its affiliates, subsidiaries, or allied organizations nor will any of the funds for this project be used to fund ACORN or related organizations.

14. Attachments

Resumes for co-PIs

1. Henry Anderson
2. Lynda Knobeloch
3. Candy Schrank

Letters of Commitment

1. Department of Natural Resources
2. State Laboratory of Hygiene
3. SHOW
4. UW Survey Center
5. Great Lakes Consumption Advisory Consortium