

Fisheries and Illinois Aquaculture Center



**ANNUAL REPORT OF ACTIVITIES
JANUARY 1 - DECEMBER 31, 2009**

**SOUTHERN ILLINOIS UNIVERSITY
CARBONDALE**

ANNUAL REPORT OF ACTIVITIES

**THE FISHERIES AND ILLINOIS AQUACULTURE CENTER
AT SOUTHERN ILLINOIS UNIVERSITY CARBONDALE**

for

January 1, 2009 – December 31, 2009

Prepared by

Dr. James E. Garvey
Director

March 2010

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
PERSONNEL	4
CURRENT RESEARCH PROJECTS	
Conservation Biology	6
Fisheries Ecology and Management	8
Genetics	13
Nutrition	16
Physiology	22
Toxicology	24
PUBLICATIONS	
Articles	28
Book Chapters	31
Reports	31
CONFERENCE/MEETING PRESENTATIONS	32
DISSERTATIONS AND THESES COMPLETED	37
DISSERTATIONS AND THESES IN PROGRESS	37
PROFESSIONAL MEETINGS ATTENDED	39
GRANTS AND CONTRACTS AWARDED	40
UNIVERSITY AND EXTRA UNIVERSITY SERVICES, ACTIVITIES AND HONORS	42
AWARDS	44

EXECUTIVE SUMMARY



The expressed goal of the Fisheries and Illinois Aquaculture Center (FIAC) is the achievement of excellence in the disciplines of fisheries, aquaculture, and applied aquatic sciences. We serve the university, state, region, and nation by providing a broad range of expertise in aquatic resource management and research, with well-recognized research programs in ecology, policy and management, fish culture, toxicology, conservation biology, nutrition, physiology, and genetics. The number of successful grant applications, peer-reviewed publications, and aptitude of graduate students advised all indicate that we are meeting these goals and successfully providing our services abroad.

The FIAC continued to flourish nationally and internationally in 2009. Graduate student Tyler Mehler is now in China, participating in collaborative toxicology research with Jing You, one of our postdoctoral alumni. Researcher Paul Hitchens provided VHS testing and surveillance in Illinois waterways for the Illinois Department of Natural Resources, and continued to provide aquaculture extension for Illinois fish farmers. The Center hired Brian Small from the USDA's ARS Catfish Genetics Research Unit to replace Chris Kohler. Brian's appointment is supported in part by the Department of Animal Science and Nutrition, cementing the Center's strong cooperative ties with the College of Agricultural Sciences. All of our faculty, students, and staff continue to make us proud with their high productivity and "can do" spirit. This served us especially well when weathering the devastation caused by the historic May 8, 2009, derecho storm.

In 2009, FIAC staff taught twenty classes through the Department of Zoology, College of Science, with a composite enrollment of 182 students. Twenty-one M.S. and eight Ph.D. students were advised with faculty sitting on a total of sixty-two graduate student committees. In addition, FIAC faculty advised eight undergraduate zoology majors interested in aquatic sciences. Six students completed a M.S. degree.

Faculty and staff published seven book chapters in 2009, and have another one in review and one in press. Additionally, we produced thirty-eight peer-reviewed journal articles (plus seventeen in press and thirty-three in review) and one symposium publication. FIAC staff prepared fourteen annual or final agency reports and presented sixty-six papers at professional meetings. The Center has maintained a high level of grant-funded activities with sixteen federal, eight state, and seven industry grants totaling in excess of 4.7 million dollars.

Staff served on seven Zoology departmental committees, two committees for the College of Science, fifteen university committees, and fifty-six professional society and technical committees in 2009. They peer-reviewed seventy-three manuscripts/articles and eleven research proposals. Staff provided service to nine additional state/regional organizations and consultation to local individuals regarding pond and ecosystem management. They advised six student groups. Our faculty and graduate students received a total of fifteen awards in 2009.

Challenging budgetary times loom in the near future, but the FIAC will continue to thrive due to our diverse and talented group of fisheries and aquatic scientists.

A handwritten signature in black ink, appearing to read "James E. Garvey". The signature is fluid and cursive, with a large initial "J" and "G".

James E. Garvey
Director
Fisheries and Illinois Aquaculture Center

PERSONNEL

FACULTY

James E. Garvey, Associate Professor & Director, Fish Ecology	75%, 12.0 months
Roy C. Heidinger, Professor Emeritus & former Director	7.5%, 12.0 months
Edward J. Heist, Associate Professor, Genetics	75%, 12.0 months
Christopher C. Kohler, Professor Emeritus & former Director, Aquaculture	15.7%, 12.0 months
Michael J. Lydy, Professor, Fish Toxicology	75%, 12.0 months
Brian C. Small, Associate Professor, Aquaculture	75%, 12.0 months
Jesse T. Trushenski, Assistant Professor, Fish Physiology	49%, 12.0 months
Matt R. Whiles, Professor & Director, Middle Mississippi River Wetland Field Station	100%, 3.0 months
Gregory W. Whitledge, Assistant Professor, Fish Management	75%, 12.0 months

RESEARCH STAFF

David Bergerhouse, Ph.D., Research Assistant Professor	100%, 12.0 months
Ronald Brooks, Researcher III	100%, 4.0 months
Andrew Coursey, Researcher I	100%, 11.5 months
Michael Hill, Researcher I	100%, 12.0 months
Paul Hitchens, Researcher II	100%, 12.0 months
Ruthann Homeyer, Laboratory Animal Caretaker	100%, 12.0 months
Rebecca Myers Kelley, Researcher II	100%, 12.0 months
Jerome Laporte, Ph.D., Researcher II	100% 12.0 months
Sara Tripp, Researcher II	100%, 7.5 months
Dongli Wang, Ph.D., Post-Doctoral Fellow	100%, 2.5 months

SUPPORT STAFF

Kristen Burton, Office Administrator	100%, 12.0 months
Mary Janello, Accountant II	100%, 12.0 months

GRADUATE RESEARCH ASSISTANTS 2009

Patrick Blaufuss, M.S.	50%, 7.5 months
Ryan Boley, M.S.	50%, 12.0 months
Heather Calkins, M.S.	50%, 7.5 months
Andy Coursey, M.S.	50%, 12.0 months
YuPing Ding, Ph.D.	50%, 12.0 months
Jennifer Eichelberger, Ph.D.	50%, 12.0 months
Brian Gause, M.S.	50%, 12.0 months
Amanda Harwood, Ph.D.	50%, 4.5 months
William Hintz, Ph.D.	50%, 4.5 months
Jennifer Johnson, M.S.	50%, 4.5 months
Matthew Krampe, M.S.	50%, 12.0 months
Heidi Lewis, M.S., Ph.D.	75%, 12.0 months
W. Tyler Mehler, M.S.	50%, 7.5 months
Bonnie Mulligan, M.S.	50%, 12.0 months

David Myers, M.S.....	25%, 1.0 months
Matthew Noatch, M.S.....	50%, 12.0 months
Quinton Phelps, Ph.D.	50%, 12.0 months
Amanda Rother, M.S.	25%, 12.0 months
Neil Rude, M.S.	50%, 11.5 months
Melody Saltzgiver, M.S.	50%, 8.0 months
Dawn Sechler, M.S.	50%, 12.0 months
Kurt Smith, M.S.....	50%, 12.0 months
Elizabeth Tripp, M.S.....	50%, 9.0 months
John Zeigler, M.S.....	50%, 4.25 months

GRADUATE TEACHING ASSISTANTS

Aubrey Bunch.	50%, 4.5 months
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FELLOWSHIPS

Patrick Blaufuss, M.S. Fellowship.....	50%, 4.5 months
Sara Mueiting, Doctoral Fellowship	50%, 4.5 months
Andrew Trimble, Ph.D., EPA GRO Fellowship.....	50%, 5.0 months

UNDERGRADUATE ASSISTANTS

John Boesenberg, Aquaculture.....	50%, 3.75 months
Alyse Cunniff, Genetics.....	37.5%, 3.75 months
Darcy Ernat, Fish Management	25%, 3.75 months
Charlee Forson, Genetics	37.5%, 3.25 months
Heather Foslund, Toxicology	25%, 3.5 months
Jennifer Swan, Toxicology	37.5%, 3.5 months
Andrew Yung, Aquaculture	50%, 3.75 months

OTHER AFFILIATES

Dustin Belt, Laboratory Assistant.....	3.5 months
Lance Coers, Laboratory Assistant.....	3.5 months
Luke Coers, Laboratory Assistant.....	3.0 months
Colin Mix, Laboratory Assistant	4.5 months
Quinn Robinson, Laboratory Assistant.....	3.0 months
Brianna Roggendorf, Laboratory Assistant	3.0 months
Joseph Thomas, Laboratory Assistant.....	4.5 months
Sara Tripp, Research Assistant	9.0 months
Charles Weber, Laboratory Assistant	2.0 months
Jing You, Assistant Scientist.....	1.5 months

STUDENT WORKERS

Chris Dojutrek	Kenson Kanczuzewski	Justin Rosenquist
Charles Foxx	Luke Nelson	Seth Turner

CONSERVATION BIOLOGY

MONITORING POPULATION STATUS AND MOVEMENT OF NATIVE AND NON-NATIVE FISHES IN THE MISSISSIPPI RIVER (FISH PASSAGE)

Staff/Graduate Assistant: Ronald Brooks, Michael Hill, Sara Tripp, Heather Calkins

Funding: U. S. Army Corps of Engineers

Graduate Advisor(s): James Garvey

Duration of Study: Continuing - 7 years

Objective(s): Determine fish passage through locks and dams

Project Summary: This project is in the pre-construction phase for fish passways to be built by the USACOE. The objective is to determine the relative frequency of fish passage among pools on the upper Mississippi River (UMR) and compare river conditions when passage occurs. We use sonic telemetry methods to determine passage. Transmitters are surgically inserted into paddlefish, silver carp, blue catfish, shovelnose sturgeon, and white bass. The fish are collected, tagged and released in four UMR pools that encompass lock and dams 26 and 22. Stationary receivers are deployed in each study pool to detect fish passage. The current fish passage results will be compared to passage data collected post fishway construction.



EVALUATING HABITAT USE OF AGE-0 SCAPHIRHYNCHUS STURGEON WITH TELEMETRY

Staff/Graduate Assistant: Jennifer L. Johnson

Funding: Fisheries and Illinois Aquaculture Center (internally funded)

Graduate Advisor(s): Dr. Garvey

Objective(s): 1) Determine the feasibility of tagging age-0 *Scaphirhynchus* sturgeon, 2) Determine the growth and survival rates of age-0 *Scaphirhynchus* sturgeon which have been tagged with 0.2 gram radio telemetry tags, 3) Determine movements and habitat use of age-0 *Scaphirhynchus* sturgeon in side channels of the Middle Mississippi River using radio telemetry

Project Summary: Some sturgeon have been obtained for the laboratory portion of this project. We are currently looking into obtaining more sturgeon, and hope to begin research by the spring.

ST. JOHNS/NEW MADRID FLOODWAY – FISHERY EVALUATION

Staff/Graduate Assistant: James Garvey, Mike Hill, Sara Tripp

Funding U.S. Army Corps of Engineers, ERDC

Graduate Advisor(s): James Garvey

Duration of Study: 2 years

Objective(s): Evaluate fish passage through the existing culverts in St. Johns Basin and use this information to predict fish passage opportunities and extent for the proposed culverts in the New Madrid basin.

Project Summary: We have collected and floy tagged over 1,500 fish including 38 species in conjunction with the ERDC field crew. While tag returns have been minimal we have posted flyers with information about the project to inform fishermen and increase awareness of the project which has increased returns. This year we are proposing to incorporate a telemetry effort to more closely monitor fish movement through the water control structure and determine if these structures deny fish access to key spawning and rearing habitats.

MAINTENANCE OF A TELEMETRY FISH MONITORING SYSTEM IN THE UPPER MISSISSIPPI RIVER SYSTEM

Staff/Graduate Assistant: Mike Hill, Sara Tripp, Heather Calkins

Funding Source(s): U.S. Army Corps of Engineers, Rock Island District

Graduate Advisor(s): James Garvey

Duration of Study: 4 years

Objective(s): 1) Emplace a prototype ultrasonic monitoring array around potential barriers in the UMRS. 2) Surgically implant common native and non-native fishes with ultrasonic transmitters above and below barriers 3) Quantify frequency and extent of movement 4) Refine methodology and experimental design 5) Determine the effects of lock and dam complexes on the movement of fishes under differing river conditions 6) Set baseline conditions before implementation of fish passage improvements 7) Develop framework for basin-wide monitoring network for fishes 8) Provide management guidance for fishes in the UMRS

Project Summary: As of September 2009, we have collected a substantial amount of simultaneous data about multi-species movements and fish passage in the Mississippi River. As the number of fish passages recorded increases, our understanding of how locks and dams affect our study species' ability to negotiate the structures increases. Although we predicted that upriver movement would be impeded by structures, this varied among species. The most striking result to date is for lake sturgeon and paddlefish; we are reaching a consensus that lake sturgeon and paddlefish may be more restricted from upriver passage during closed gate positions than other study species. In general, the majority of the fish passages occurred upriver during spring and summer, presumably encompassing periods of spawning migrations, and it is during those periods when dam gates are most often in open river positions. However, we do not know how

these upriver movements might be enhanced once passage enhancing structures are emplaced (i.e., will the percentage or frequency of upriver passages increase, facilitating purported spawning?). Also, how gate configuration may affect behavior of these species is unknown. For example, perhaps different combinations of gate openings may differently affect passage of these species.

PALLID STURGEON HABITAT IDENTIFICATION AND RECRUITMENT

Staff/Graduate Assistant: Mike Hill, Sara Tripp, Quinton Phelps, Ryan Boley

Funding Source(s): U.S. Army Corps of Engineers, St. Louis District

Graduate Advisor(s): Dr. James Garvey, Dr. Edward Heist

Duration of Study: 10 years

Objective(s): 1) Intensive trawling data for YOY sturgeon across a mosaic of areas that may interact with channel cross-overs to influence sturgeon abundance and distribution. This will complement the historical YOY sturgeon data set, filling important gaps in knowledge about habitat use. 2) Detailed bathymetric and hydraulic information in the study reach will provide fine-scale resolution by which we may determine the appropriate habitat classification scheme by which restoration and monitoring efforts may be organized. 3) Genetics will allow us to determine whether differences exist in the distribution of pallid sturgeon, shovelnose sturgeon, and intermediates. These data will be combined with those collected in 2008. In addition, we will process sturgeon larvae collected pre-2008 when possible to determine species-specific habitat associations.

Project Summary: The data we have collected in the last 10 years has added a wide range of information about shovelnose and pallid sturgeon early-life history, filling in information gaps in the literature. We have documented that

age-0 sturgeon congregate at certain locations in the river that have a combination of "features" including islands, side channels, wing dikes, etc. Thus it is critical for recovery to ensure that habitat needs are met to ensure high growth and survival in these locations. Because river conditions and sturgeon reproduction (i.e., the number of offspring produced by adults) varies greatly among years, we will need to quantify these patterns in the MMR during multiple years to bracket this variation. "Quality" or "suitability" of the habitat around each MMR feature at each location may depend on a host of factors including river stage, season, and temperature. We currently have only definitively identified a few age-0 pallid sturgeon in our samples. For us to assess habitat quality for young pallid sturgeon in these locations, we need to greatly enhance the frequency and intensity of our sampling at features at each location where catch rates should be high and young pallids have been identified in the past. We also can create some index of sediment load at these locations using echosounding, which may be important for foraging (and perhaps survival of very small sturgeon).



FISHERIES ECOLOGY AND MANAGEMENT

QUAD CITIES FISHERIES INVESTIGATIONS

Staff: David Bergerhouse, Roy Heidinger, Ruthann Homeyer

Funding: Exelon Corporation

Duration of Study: Continuing

Objective(s): Produce advanced sport fish fingerlings for stocking Pool 14 of the Mississippi River.

Project Summary: The Quad Cities Spray Canal Project has been in continuous operation since 1984 and is located at the Quad Cities Nuclear Generation Station near Cordova, Illinois. The Spray Canal is a deactivated cooling canal that surrounds the Quad Cities Station and was once used to cool the condensers for the station. The purpose of the project is to investigate and develop methods to utilize the spray canal to produce advanced sport fish fingerlings for stocking Pool 14 of the Mississippi River. The project is currently focused on producing about 175,000 advanced walleye fingerlings each year. Approximately 25% of these fish are marked with a freeze brand to allow the stocking program to be evaluated. Past years have shown that the project had contributed significantly to the walleye population and to the angler catch. In addition, about 1,000 walleye are trained to artificial diets to allow them to over-wintered in indoor tanks and made available as host fish for freshwater mussel propagation efforts. The project also produces about 6,000 yearling hybrid striped bass each year that are stocked in the spring. Stocking relatively low numbers of hybrid striped bass yearling has proved more effective at creating a trophy fishery than stocking large numbers of fingerlings.

DIET COMPOSITION OF YOUNG-OF-YEAR (YOY) STURGEONS (*SCAPHIRHYNCHUS ALBUS* AND *S. PLATORYNCHUS*) IN THE MIDDLE MISSISSIPPI RIVER

Staff/Graduate Assistant: Dawn Sechler

Funding Source(s): U. S. Army Corps of Engineers

Graduate Advisor(s): James Garvey

Duration of Study: June 2007 – May 2010

Objective(s): Determine the effects of water temperature, stage height, water velocity,

macrohabitat, and fish size selectivity on diet composition of age-0 sturgeon (*Scaphirhynchus* spp.).

Project Summary: A comprehensive understanding of early life history (ELH) traits of *Scaphirhynchus* spp. requires studying sturgeon in their natural environment. Differences in water temperature and water velocity across macrohabitats in the Middle Mississippi River were evaluated from March 2008 through September 2008 along with their effects on age-0 *Scaphirhynchus* sturgeon diet by dry mass. Diet was also evaluated by dry mass and mean cal/g across macrohabitats among small (<50 mm total length) and large (51-200 mm total length) age-0 *Scaphirhynchus* sturgeon. For further evaluation of sturgeon diet, macroinvertebrate selectivity was compared among small and large sturgeon across macrohabitats. It was expected that water temperature and water velocity would differ across macrohabitats and that an increase in water temperature and water velocity would result in a decrease of diet by dry mass in proportion to body size. Large age-0 *Scaphirhynchus* sturgeon were expected to contain higher caloric content with selection of larger macroinvertebrates in the diet potentially due to less gape limitations than their smaller counterparts.

EARLY-LIFE ECOLOGY OF SCAPHIRHYNCHUS STURGEON IN THE MISSISSIPPI RIVER

Graduate Assistant: Quinton Phelps

Funding Source: U. S. Army Corps of Engineers

Graduate Advisor: James Garvey

Duration of Study: Sept. 2006- Sept. 2010

Objectives: 1) To determine early-life environmental history of *Scaphirhynchus* sturgeon. 2) To quantify habitat use of young-of-year *Scaphirhynchus* sturgeon. 3) To evaluate the relative influence of biotic and abiotic factors

influencing early-life history of *Scaphirhynchus* sturgeon.

Project Summary: Most sturgeon populations are critically imperiled. The main factors behind these reductions are anthropogenic activities that pose deleterious effects to these species and their associated habitats. Similarly, the *Scaphirhynchus* sturgeon populations in the Mississippi and Missouri Rivers are imperiled and are in need of rehabilitation. In order to restore these populations, a thorough understanding of their early-life history is necessary. At the most basic level, evaluating early-life environmental history (i.e., determination of river origin) will help direct efforts to identify general spawning locations. Secondly, evaluating the nursery habitats used during early life will lend insight into the habitat needs of young *Scaphirhynchus* sturgeon. Although determining environmental history and habitat use are extremely important for recovery, these attributes must be coupled with young-of-year dynamics to thoroughly understand early life history. In the end this study will ultimately lay the framework for understanding early-life ecology of *Scaphirhynchus* sturgeon and will hopefully be used to begin to rehabilitate these imperiled sturgeon populations.

FACTORS LIMITING THE RECRUITMENT OF SCAPHIRHYNCHUS STURGEONS IN THE MISSISSIPPI RIVER BASIN

Staff/Graduate Assistant: William D. Hintz

Funding: U.S. Army Corps of Engineers

Graduate Advisor(s): James E. Garvey

Duration of Study: 3 years

Objective(s): Describe both biotic and abiotic factors affecting the recruitment of the endangered pallid sturgeon

Project Summary: I will first investigate the abiotic conditions that facilitate or suppress the hatching success of pallid sturgeon eggs. This will include the effects of substrate, flow, and

varying concentrations of toxic substances currently found throughout the pallid sturgeons home range. Upon completion of this evaluation, I will attempt to determine habitat preference of larval and juvenile pallid sturgeon. This is a key issue that has historically been ignored because of the difficulty of addressing small-scale habitat use in large rivers. We will construct large-scale habitat use experiments indoors to manipulate the abiotic environment. The next stage will involve biotic conditions required to facilitate the survival of age-0 pallid sturgeon to age-1 individuals. Diet studies evaluating food source preference will be conducted in large 50 gal. experimental tanks. Moreover, it is essential to evaluate potential interspecific competition dynamics in age-0 and age-1 individuals. Competition with other species could potentially decrease the survival of age-0 pallid sturgeon because often, juvenile fishes compete for the same food source. Another experiment will evaluate this competition dynamic among age-0 catfish and shovelnose sturgeon. This experiment will hopefully give us insight into the competition that may occur among several benthic, riverine species.



AN EVALUATION OF CHEMICAL, BIOLOGICAL, AND COMBINED CHEMICAL- BIOLOGICAL APPROACHES FOR CONTROLLING SNAILS IN AQUACULTURE PONDS

Graduate Assistant: Matthew Noatch

Funding: North Central Regional Aquaculture Center

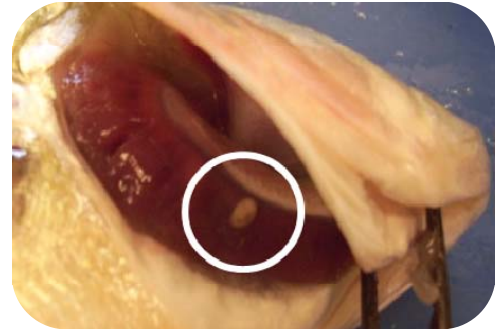
Graduate Advisor(s): Gregory Whittedge

Duration of Study: May 2008-October 2009

Objectives: 1) Determine if several snail management methods used in combination as an integrated pest management strategy are more effective at controlling populations of aquatic snails than a single method. 2)

Determine effects of snail control on abundance of digenetic trematodes in cultured fish.

Project Summary: Aquatic snails are a common pest problem in North American aquaculture ponds where they facilitate infestations of grub-like trematodes in crop fishes.



Many efforts to reduce or eliminate aquatic snails have previously focused on the use of non-bioaccumulating shoreline chemical treatments and the introduction of natural gastropod predators. The use of predator sunfish (redeer sunfish and hybrids of the redear and green sunfish) and hydrated lime slurry were evaluated separately as individual treatments against aquatic snails, and together as an integrated pest management strategy. Field work was conducted at the Touch of Nature Aquaculture Facility from April to September 2009. Treatments were tested in small research ponds stocked with hybrid striped bass under mock production conditions. Ponds stocked with predator sunfish (200/acre) were slow to display treatment effects, but eventually demonstrated a 95% reduction in snail densities by the trial conclusion. Ponds treated with hydrated lime (70 lb/100 feet shoreline) experienced a precipitous decline in snail densities, but rebounded by the end of the trial. Ponds treated with a combination of the two experienced a treatment effect more rapid than the biological group and more permanent than the chemical group. Examinations of the hybrid striped bass revealed that low abundances of trematodes coincide with very low densities of ram's horn snail, particularly during the first month of grow-out. Hydrated lime and predator sunfish appear to be complementary when used in tandem as an integrated strategy for controlling aquatic snails.



LINKING HABITAT USE OF SILVER CARP AND PHYTOPLANKTON CONSUMPTION IN THE MISSISSIPPI RIVER

Staff/Graduate Assistant: Heather Calkins

Funding: U. S. Army Corps of Engineers

Graduate Advisor(s): James Garvey

Duration of Study: July 2008-July 2009

Objective(s): 1) Quantify silver carp movement and identify habitat selection in areas of Pools 26 and 27 of the Mississippi River. 2) Quantify phytoplankton consumption by silver carp and its availability in the Mississippi River. 3) Examine the relationship between movement, habitat selection, phytoplankton abundance, consumption and abiotic factors.

Project Summary: In order to determine habitat use, silver carp were implanted with ultrasonic transmitters in May 2008 (N=40, total length 580-811 mm, weight 2.3-6.1 kg) in Pools 26 (N=12) and 27 (N=28) of the Mississippi River. Fish were located monthly for macrohabitat use. Available environmental chlorophyll was quantified across macrohabitat types monthly. Silver carp were collected seasonally to determine chlorophyll consumption and concentrations in the river across macrohabitat types were measured at this time as well.

VHS SURVEILLANCE IN ILLINOIS WATERSHEDS OF HIGH RISK OR UNKNOWN VHS STATUS

Staff/Graduate Assistant(s): Paul Hitchens, Neil Rude

Funding: USDA Animal and Plant Health Inspection Service

Investigator(s): Gregory Whittedge and Jesse Trushenski

Duration of Study: Sep. 2009-Aug. 2010

Objective(s): To determine the current distribution of VHS (presence/absence) in wild and/or feral fish species in key Illinois hydrologic units not previously known to be affected by VHS epizootics

Project Summary: This project coordinates and conducts surveillance sampling for viral hemorrhagic septicemia (VHS) among wild and feral fishes in Illinois waters. This program will target VHS-susceptible fishes within critical watersheds/hydrologic units to 1) determine the current status of VHS in the state, and 2) establish the foundational dataset for studying and managing the spread of VHS in Illinois. Paul Hitchens is certified by the IDNR to sample fish for VHS testing, and has been responsible for conducting APHIS-mandated VHS sampling at commercial aquaculture facilities in Illinois during the past year. Accordingly, Mr. Hitchens' efforts have been expanded to include wild and feral fish populations in accordance with APHIS VHS surveillance protocols. Data collected in the conduct of the proposed work will be compiled with any existing data from Illinois VHS sampling (IDNR, commercial aquaculture testing records, etc.) and provided to APHIS and the IDNR for the purposes of policy development and/or regulatory or enforcement actions.

MONITORING VHS IN CHICAGO AREA WATERWAYS TO IMPROVE EARLY DETECTION

Staff/Graduate Assistant(s): Paul Hitchens, Neil Rude

Funding: USDA Animal and Plant Health Inspection Service

Investigator(s): Gregory Whitledge and Jesse Trushenski

Duration of Study: Sept. 2009-Aug. 2010

Objective(s): To monitor VHS status (presence/absence) of fishes from the artificial waterways in the Chicago metropolitan area and Lake Michigan harbors near the entrances to the waterways.

Project Summary: The Fisheries and Illinois Aquaculture Center has conducted VHS sampling for

commercial largemouth bass and hybrid striped bass ventures in Illinois since December 2006. The cooperators also conducted VHS surveillance of wild and feral fishes in 25 watersheds in Illinois and additional surveillance at six locations in the Chicago area waterways during fall 2008-spring 2009. To date, no evidence of VHS in wild or cultured fishes has been observed in Illinois waters outside of Lake Michigan, including the Chicago area waterways. However, samples of rock bass and round goby (an invasive species) collected from Winthrop Harbor (along the Illinois shoreline of Lake Michigan) by IDNR biologists in June 2008 were confirmed to be VHS positive. Given the relative proximity of Winthrop Harbor to the entrances to the Chicago area waterways and the rapid expansion of VHS distribution within the Great Lakes in recent years, continued monitoring of VHS status of fishes in the Chicago area waterways and Lake Michigan



harbors near the entrances of these waterways is of particular importance given that these waterways represent the most likely conduit for VHS to spread naturally from the Great Lakes to the Mississippi River basin.

OUTREACH TO INCREASE AWARENESS OF VHS IN ILLINOIS WATERS AND TO ENHANCE PREVENTATIVE MEASURES AMONG INDIVIDUALS

Staff/Graduate Assistant(s): Paul Hitchens, Neil Rude

Funding: USDA Animal and Plant Health Inspection Service

Investigator(s): Jesse Trushenski, Mae Davenport, and Greg Whitledge

Duration of Study: Sept 2009-Aug 2010

Objective(s): To determine the current understanding and awareness of VHS control and containment among recreational boaters in Illinois, and, based on current knowledge, tailor an informational outreach program emphasizing practical strategies individuals can implement to minimize risk of VHS transfer to VHS-free waters.

Project Summary: As the issue of VHS and VHS management has developed over the past few years, several areas of potential, but unquantified risk have been identified. These include the relative risk of VHS transfer posed by individuals involved in recreational activities in Illinois waters. The risks of VHS transfer associated with interstate movement of fishes and the activities of public aquaculture facilities (i.e., state fish hatcheries) are understood and considered effectively managed by existing regulatory infrastructure. In contrast, the comparatively poorly understood influence of individuals may threaten the efficacy of current and future management of VHS in the State of Illinois. However, given 1) "low awareness of or

concern about VHS” among anglers (as determined by the VHS Education Alliance’s “Human Responses to Viral Hemorrhagic Septicemia Virus in the Great Lakes: Stakeholder Characterization” study), 2) the high activity of recreational boater activity in Illinois waters (more than 380,000 recreational watercraft are registered in Illinois), and 3) Illinois’s status as a ‘corridor state’ contiguous with the Great Lakes and Mississippi River watersheds, it is reasonable to assume that recreational boaters may pose a considerable VHS transfer risk in the State of Illinois. We are addressing these issues by implementing a VHS education and outreach program, targeting recreational boaters in the State of Illinois.

DEVELOPMENT AND IMPLEMENTATION OF TAILORED BIOSECURITY PLANS FOR ILLINOIS AQUAFARMS

Staff/Graduate Assistant(s): Paul Hitchens, Neil Rude

Funding Source(s): USDA Animal and Plant Health Inspection Service

Investigator(s): Jesse Trushenski and Greg Whittedge

Duration of Study: Sep 2009-Aug 2010

Objective(s): To develop a model biosecurity plan for Illinois aquafarms, and facilitate the tailoring and implementation of this plan to individual farms.

Project Summary: Since the discovery of viral hemorrhagic septicemia (VHS) in the Great Lakes in 2005, the State of Illinois has moved quickly to 1) initiate statewide surveillance activities, including partnerships between the USDA APHIS, Illinois Department of Natural Resources (IDNR), Southern Illinois University Carbondale (SIUC), and the Illinois private aquaculture industry; 2)



establish strict but logical rules governing intra- and interstate movement of fishes; and 3) oversee the implementation and enforcement of the aforementioned rules. Efforts are currently underway to determine the current status of VHS in Illinois waters, and plans are in place to increase awareness of VHS among recreational boaters and encourage activities to prevent the spread of VHS and other aquatic pathogens/ nuisance species throughout the state. To strengthen current and proposed prevention measures, we propose to develop a model biosecurity plan for aquafarms operating in the State of Illinois, and assist producers with adapting and implementing the model plan to their specific circumstance. Increasing awareness of biosecurity techniques at the farm level will reduce the likelihood of VHS or other aquatic pathogens being transferred to Illinois aquafarms, and will assist in containment efforts should any aquatic livestock test positive for VHS within the state.

GENETICS

GENETIC MANAGEMENT PLAN FOR ENDANGERED PALLID STURGEON CAPTIVE BROODSTOCK MAINTAINED AT GAVIN’S POINT NATIONAL FISH HATCHERY

Staff/Graduate Assistant: Melody Saltzgiver

Funding Source(s): Gavin’s Point National Fish Hatchery

Graduate Advisor(s): Edward Heist

Duration of Study: 2 years (Fall 2007- Spring 2009)

Objective(s): 1) Collect fin clips from all captive broodstock pallid sturgeon at Gavin’s Point National Fish Hatchery. 2) Determine the genotypes for all available parents of the captive broodstock, and use this information to identify the parentage of the

individuals that shed their PIT tags. 3) Determine the number of offspring present for each of the parents based on hatchery records and reconstruct parentage using microsatellite data. 4) Identify the family relationships in order to create a pedigree that prevents inbreeding. 5) Determine the effective population size of the captive broodstock founding generation.

Project Summary: The aim of this project is to develop a management plan for the pallid sturgeon (*Scaphirhynchus albus*) broodstock at Gavin's Point National Fish Hatchery (GPNFH) using DNA microsatellite analysis. Thirteen microsatellites are being used to determine family relationships to construct a pedigree that will yield highest effective population size and the least inbreeding.

ABUNDANCE AND MICROHABITAT PREFERENCES OF LARVAL SCAPHIRHYNCHUS STURGEON IN THE LOWER MISSOURI AND MIDDLE MISSISSIPPI RIVERS

Staff/Graduate Assistant: Ryan Boley

Funding Source(s): U.S. Army Corps of Engineers

Graduate Advisor(s): Edward Heist

Duration of Study: Fall 2008-Spring 2010

Objective(s): Determine abundance, microhabitat preferences, as well as hybridization rate among larval pallid and shovelnose sturgeon.

Project Summary: Pallid and shovelnose sturgeon are riverine fish, which occur sympatrically throughout most of their range. Pallids were listed as an endangered species in 1993 whereas shovelnose continue to be commercially fished throughout most of the middle and lower Mississippi River. The current study investigated abundance as well as microhabitat preferences of pallid, shovelnose and hybrid larvae. Since larval pallid and shovelnose sturgeon are virtually identical

morphologically, the use of DNA markers was required for species designation. Of the 583 larval specimens collected, 581 were identified as shovelnose, one was a pallid, while another was a hybrid. This study confirms the presence of pallid sturgeon reproduction in the lower Missouri and middle Mississippi Rivers.



DEVELOPMENT OF SINGLE NUCLEOTIDE POLYMORPHISM (SNP) MARKERS FOR RAPID, INEXPENSIVE, AND STANDARDIZED IDENTIFICATION OF PALLID (SCAPHIRHYNCHUS ALBUS) AND SHOVELNOSE (S. PLATORHYNCHUS) STURGEON

Staff/Graduate Assistant(s): Jennifer Eichelberger and Matthew Krampe

Funding Source(s): U.S. Geological Survey

Graduate Advisor(s): Edward Heist

Duration of Study: January 2008 – September 2010

Objective(s): 1) Create *Scaphirhynchus* cDNA library to sequence and characterize expressed gene sequences. 2) Sequence gene fragments from pallid and shovelnose sturgeon throughout the range of pallid sturgeon. 3) Identify single nucleotide polymorphisms (SNPs) that are informative in discriminating species. 4) Develop rapid, cost-effective screening assays for SNP markers. 5) Evaluate sequence data from homologous genes to better understand genetic relationships between pallid and shovelnose sturgeon.

Project Summary: Pallid sturgeon (*Scaphirhynchus albus*) is listed as a federally endangered species, and the ability to discriminate between pallid and the closely related and more abundant shovelnose sturgeon (*S. platorhynchus*) is critical to successful management and conservation of these species. Adult pallid and shovelnose sturgeon are known to hybridize and can be difficult to identify due to allometric growth, regional variation, and the presence of morphological intermediates. Larval sturgeon cannot be reliably identified without the use of genetic markers. Microsatellite DNA markers have been employed to discern relatedness within and between pallid and shovelnose sturgeons. Microsatellites, however, present several disadvantages as genetic markers, including difficulty in standardizing data between labs, cost of scoring, and lack of association with functional genes. The development of SNP markers is time-consuming, but once developed, SNP assays will provide a faster and more cost-effective means of genotyping specimens. In addition to providing powerful genotyping tools, sequence data generated in the process of developing SNP markers may provide valuable insight into the evolutionary relationships of pallid and shovelnose sturgeon and may also allow better characterization of the history and extent of hybridization between species.

DEVELOPMENT OF MICROSATELLITE MARKERS IN PADDLEFISH

Staff/Graduate Assistant(s): Ryan Boley and Matthew Krampe

Funding Source(s): US Fish and Wildlife Service

Graduate Advisor(s): Edward Heist

Duration of Study: 1 year

Objective(s): Development of microsatellite markers in paddlefish

Project Summary: Paddlefish are primitive native North American fishes that support

commercial fisheries for caviar. Stocking is used to replenish paddlefish where reproduction is not sufficient to support harvest and where paddlefish have been extirpated and are being re-established at the periphery of their range. Microsatellite markers are highly polymorphic DNA-based markers that can be used to ensure that sufficient genetic diversity is maintained in hatchery stocks.

GERM CELL TRANSPLANTATION BETWEEN ICTALURID CATFISH

Staff: Josh Boyce (postdoc)

Funding Source(s): USDA Agricultural Research Service

Graduate Advisor(s): Brian Small

Duration of Study: 2 years

Objective(s): Develop and validate spermatogonial germ cell transplantation from blue catfish to channel catfish

Project Summary: Addresses the problem of hybrid catfish production in ponds through the development of a novel technique of stem-cell xenotransplantation (the transplantation, implantation or infusion into one animal species of live cells, tissues, or organs from a different animal species) to overcome reproductive barriers preventing spawning between species.



MECHANISMS FOR IMPROVING PRODUCTION EFFICIENCY OF CATFISH

Graduate Advisor(s): Brian Small

Duration of Study: 3 years

Objective(s): Identify genetic markers for use in genetic breeding programs to improve catfish production efficiency

Project Summary: This project is broad-based and seeks to identify genetic markers for improving growth, stress response, and reproduction in channel catfish. Several genes have been identified and are currently being characterized. Preliminary data for a federal grant on feed regulation, growth, and carbohydrate metabolism is being generated.

NUTRITION

SOY OILS IN ESSENTIAL FATTY ACID AND LIPID NUTRITION OF COBIA

Funding Source(s): Illinois Soybean Assoc

Investigator(s): Jesse Trushenski and Mike Schwarz

Duration of Study: Jan 2010-Dec 2011

Objective(s): 1) Determine the DHA and EPA requirements of cobia fed soy oil-based feed formulations. 2) Providing DHA and/or EPA supplements to meet the dietary requirements, evaluate various soy-derived lipids as alternatives to FO in cobia feeds and the impact of phospholipid supplementation on utilization of these fish oil alternatives.

Project Summary: There are relatively few studies which have addressed the specific nutrient requirements of cobia in a quantitative manner. Although studies have been conducted to determine the ideal amount of lipid to include in cobia rations, essential fatty acid requirements have not been directly investigated. Though there is some information available regarding estimated combined

requirements, fish oil replacement in cobia feeds will be limited until the individual requirements for DHA and EPA are quantitatively determined. Once the DHA and EPA requirements are determined, nutritionists can formulate diets accordingly and accurately assess the suitability of alternative lipids. Without this critical information, investigations of lipid nutrition will continue to be hampered by the confounding effects of essential fatty acid deficiency on the interpretation of results. Fish oil replacement studies in other species are similarly limited—if the minimum dietary requirements for DHA and EPA are not known, it is impossible to clearly determine whether an alternative oil-based diet is problematic because of its fatty acid composition or some other characteristic. Furthermore, without this information, it is impossible to determine how a formulation might be amended to make it successful in yielding acceptable production performance.

TESTING CONSUMER ACCEPTABILITY AND NUTRITIONAL VALUE OF HYBRID STRIPED BASS RAISED ON SOY-BASED FEED

Funding: Illinois Soybean Association

Investigator(s): Sylvia Smith and Jesse Trushenski

Duration of Study: Jan 2010—Oct 2010

Objective(s): 1) Compare production performance of hybrid striped bass raised to market size on a soy-maximized feed vs. a fish meal and oil-based feed in ponds, and 2) Assess the acceptability of these two distinct products in professional culinary setting.

Project Summary: Hybrid striped bass are a lean, mild-flavored, and versatile product, and are equally popular with culinary professionals and home cooks. Unfortunately, like many other high-value cultured fish, hybrid striped bass are carnivores, and their feeds contain considerable amounts of fish meal and fish oil to meet nutritional requirements and maximize production performance. Fish meal and fish oil are costly, linked with the accumulation of

environmental contaminants in farm-raised seafood, and, at current use patterns, not a sustainable source of raw materials for the growing aquaculture industry. As a result, the aquaculture and aquafeed industries are looking for more sustainable alternatives to marine-derived feedstuffs. With support from the Illinois Soybean Association, Dr. Trushenski's research team has been investigating "soy-maximized" aquafeeds for hybrid striped bass. These studies are generating information that is being used to reformulate and refine feeds to maximize environmental and economic sustainability for the hybrid striped bass industry in Illinois and elsewhere. Although a soy-maximized formulation is coming together at an experimental scale, these diets have not been validated at a commercial production scale. Further, the acceptability of hybrid striped bass reared on soy-based feeds has not been assessed. Our study will address both of these issues, and increase awareness of farm-raised hybrid striped bass among Chicago-area culinary professionals.

FATTY ACID PROFILING IN A MODEL OF ALZHEIMER'S DISEASE

Funding: SIUC Office of Research Development and Administration

Investigator(s): Greg Rose, Jesse Trushenski, and Peter Patrylo

Duration of Study: 2009-2010

Objective(s): Characterize age-related changes in levels of LC-PUFA and cognitive performance, as well as to determine the effect of emerging AD on these variables.

Project Summary: With respect to lipid metabolism, two important observations have been made: 1) fatty acid/lipid composition is altered in AD subjects (e.g., DHA and ARA levels are decreased in AD patients) and 2) dietary manipulation with LC-PUFA affects both cognition and brain neuropathology in animal models of AD. The current data linking AD with fatty acid (FA) metabolism/composition is

descriptive, and cannot address whether there is a causal relationship between altered FA metabolism, anatomical benchmarks of AD pathogenesis, and cognitive decline. However, definitive studies can be performed in animal models. While no animal model can completely mimic AD, transgenic mice expressing human genes for mutant amyloid and tau proteins develop two key aspects of the disease: age-related brain pathology and cognitive impairment. Thus, such a model is well suited to exploring the role of FA metabolism in these phenomena. Our proposed study will be the first to characterize age-related changes in levels and biosynthetic capacity of LC-PUFA, as well as to determine the effect of emerging AD on these variables.

INFLUENCE OF DIETARY FATTY ACIDS ON WHITE BASS REPRODUCTIVE PERFORMANCE AND QUALITY OF PROGENY

Staff/Graduate Assistant(s): Heidi Lewis, Andy Yung, Jerome Laporte

Funding Source(s): U. S. Department of Agriculture National Research Initiative

Investigator(s): Christopher Kohler and Jesse Trushenski

Duration of Study: July 2005 - June 2009

Objective(s): 1) Determine an efficacious quantity of highly unsaturated fatty acids, principally the n-3 and n-6 series, required in a prepared diet to increase reproductive performance of female white bass *Morone chrysops* as well as seed quality. 2) Evaluate graded levels of docosahexaenoic acid (DHA) in broodstock diets to improve egg quality and survivability of seed produced by white bass females. 3) Evaluate graded levels of arachidonic acid (AA) in relation to eicosapentaenoic acid (EPA) and total n-3 fatty acids in white bass reproduction, to allow for near optimization of essential fatty acids (EFA) composition of broodstock diets to achieve enhanced spawning success and seed quality

Project Summary: The goal is to establish dietary essential fatty acid (EFA) requirements for female white bass *Morone chrysops* to improve reproductive performance and quality of progeny. The goal will be accomplished through the evaluation of dietary fatty acids on reproductive performance of female white bass broodstock as well as quality and survivability of resulting eggs and fry. Specifically, the supporting objectives of this goal will be to: 1) determine an efficacious quantity of highly unsaturated fatty acids (HUFA), principally of the n-3 and n-6 series, required in a prepared diet to increase reproductive performance of female white bass as well as enhance quality of progeny; 2) evaluate graded levels of docosahexaenoic acid (DHA) in broodstock diets to improve egg quality and survivability of progeny produced by white bass females; and 3) evaluate graded levels of arachidonic acid (AA) in relation to eicosapentaenoic acid (EPA) and total n-3 fatty acids in white bass reproduction to allow for near optimization of essential fatty acid (EFA) composition of broodstock diets to achieve enhanced spawning success and survivability of progeny. A 3-year investigation will be conducted, with each experiment progressively providing the requisite information to accomplish the project goal. The potential of this research is long-range in the improvement



and sustainability of U.S. agriculture by supplying quality progeny for the hybrid striped bass industry.

REPLACEMENT OF FISH MEAL IN HYBRID STRIPED BASS DIETS WITH PROTEINACEOUS FERMENTATION BIOMASS

Staff/Graduate Assistant(s): Brian Gause

Funding: Illinois-Indiana Sea Grant

Investigator(s): Jesse Trushenski and Brian Gause

Duration of Study: Oct 2009-Sep 2010

Objective(s): Determine if full replacement of fish meal with proteinaceous fermentation biomass in hybrid striped bass feeds is possible with the addition of palatability enhancers

Project Summary: Decreasing the reliance of aquaculture on fish meal (FM) as a protein source will help to reduce the overall cost of producing the popular high value, carnivorous species that are in high demand throughout the United States. This will ultimately lead to the ability for culturists to increase production and profitability. With more foodfish being supplied by aquaculture, fishing pressure on wild foodfish populations, both marine and freshwater, may decrease. Reduced demand for FM in aquafeeds may also relieve some harvest pressure on reduction fisheries. Hybrid striped bass (HSB) are becoming an increasingly popular foodfish and sportfish around the United States. This is evident in Illinois where HSB are the leading foodfish in terms of production, and in both states where extensive stocking programs for sport fishing have taken place for many years. Implementation of a terrestrial protein source, like proteinaceous fermentation biomass (PFB), a coproduct of bioethanol production, in aquafeeds will not only benefit culturists but also farmers who supply the grains that are used in bioethanol production and the biofuel industry itself. Illinois, Indiana and other Midwestern states are currently leading suppliers and producers of corn and bioethanol in the United States, thus the successful implementation of PFB in aquafeeds will benefit other regional industries.

INCREASING THE AVAILABILITY OF VETERINARIANS FOR INDIANA AND ILLINOIS AQUACULTURISTS

Funding: Illinois-Indiana Sea Grant

Investigator(s): Jesse Trushenski

Duration of Study: November 2009-September 2010

Objective(s): To offer an educational workshop to veterinarians in Illinois and Indiana to increase their awareness of aquaculture in the region and to increase their confidence in assisting aquaculturists in managing the health of their livestock.

Project Summary: Promoting and maintaining fish health is one of the primary challenges facing aquaculturists today. Culturists must have effective preventative and therapeutic strategies in their fish health 'toolbox' in order to manage livestock health and well-being, minimize costs, and provide a quality product to human consumers worldwide. A crucial component of on-farm livestock health management is ready access to competent veterinary support—culturists need to establish effective working relationships with veterinarians for access to diagnostic services, therapeutants under veterinary feed directives (i.e., Aquaflor®) or available by prescription only, and most importantly, experienced guidance in maintaining aquatic animal health. Unfortunately, most veterinary schools do not offer coursework or 'hands-on' training in aquatic animal health, and specialized training in traditional livestock medicine is insufficient to prepare veterinarians for practicing in aquaculture. Without training in aquatic animal health and judicious use of approved aquaculture drugs, veterinarians are ill-equipped to serve the growing number of aquaculturists in the U.S. Due to lack of available and trained veterinarians, fish health and production are not optimized. We propose to offer continuing education training for veterinarian in the region to increase the availability of veterinary services for Illinois and Indiana aquafarmers.

USE OF ALTERNATIVE LIPID SOURCES AND FINISHING FEEDS TO IMPROVE THE NUTRITIONAL VALUE AND SAFETY OF AQUACULTURE PRODUCTS

Staff/Graduate Assistant(s): Rebecca Kelley, Curtis Crouse

Funding: Ntnl Oceanic & Atmospheric Admin.

Investigator(s): Jesse Trushenski, Mike Lydy, and Chris Kohler

Duration of Study: August 2009-July 2011

Objective(s): 1) Identify grow-out feed formulations that minimize FO inputs to aquafeeds for sunshine bass while maximizing fillet HUFA content at harvest. 2) Assess resulting concentrations of various POP in fillets and determine compound-specific patterns of accumulation and practical consumer exposure levels.

Project Summary: Aquaculture accounts for approximately half of seafood consumed worldwide, a share projected to increase in the future. However, the health benefit and safety of aquaculture products has been called into question, after cultured fillets were demonstrated to contain considerably higher concentrations of persistent organic pollutants (POPs) compared to fillets from capture fisheries. Unfortunately, beneficial long-chain polyunsaturated fatty acids (LC-PUFA) and POPs are transferred to cultured seafood via the same mechanism: consumption and bioaccumulation of LC-PUFA and POPs via fish oil (FO) based aquafeeds. Though cultured seafood produced using alternative lipids sources pose a lower health risk, they are also substantially less valuable in terms of providing beneficial LC-PUFA to human consumers. To balance the conflicting demands of increasing fillet LC-PUFA content while limiting POP accumulation, we propose to evaluate alternative lipid sources in conjunction with finishing feeds in culture of a model finfish, sunshine bass *Morone chrysops* x *M. saxatilis*. Completion of our objectives will delineate means to advance fish culture and the ability of cultured seafood to improve the health and well-being of the American public.

IMPLEMENTATION OF MICROBIALLY-DERIVED PRODUCTS IN AQUAFEDS TO ENHANCE PRODUCTION PERFORMANCE IN AQUACULTURE

Staff/Graduate Assistant(s): Kenson Kanczuzewksi

Funding: Archer Daniels Midland

Investigator(s): Chris Kohler and Jesse Trushenski

Duration of Study: March 2007-February 2009

Objective(s): Evaluate the effect(s) of levels of Citristim™ on production performance, stress tolerance and immunocompetence of Nile tilapia

Project Summary: β -Glucans have considerable potential to improve disease resistance and production performance of aquaculture species. Published results are promising. However, most studies fail to incorporate clinical measures of immunity and practical immunological challenges such as stressor or pathogen exposure. Accordingly, our first objective (experimental approach described below) will be to evaluate the effect(s) of graded levels of Citristim™ (a mannan oligosaccharide/ β -glucan blend) on production performance, stress tolerance, and disease resistance of Nile tilapia (Objective 1). Objective 1 will address applied and basic aspects of Citristim™ as a feedstuff for Nile tilapia culture, and will generate a complete, cohesive data series establishing its effect(s) as a dietary constituent under ideal and suboptimal culture conditions. The purpose of this study is to quantify practical benefit associated with Citristim™ supplementation, and, assuming positive results, to rapidly identify effective supplementation levels. Successful completion of Objective 1 will also lay the foundation for further experimentation to be conducted in accordance with the overall project goal, to enhance robustness of Nile tilapia in the aquaculture setting.

INCREASED UTILIZATION OF SOY-DERIVED PROTEIN SOURCES IN AQUACULTURE FEEDS

Staff/Graduate Assistant(s): Charley Foxx, Jerome Laporte, Patrick Blaufuss

Funding: Illinois Soybean Association

Investigator(s): Jesse Trushenski and Chris Kohler

Duration of Study: August 2008-February 2010

Objective(s): 1) Evaluate the extent to which soybean meal may spare fish meal in feeds for hybrid striped bass without impairing production performance. 2) Identify the extent to which a reduced fish meal feed can be amended by inclusion of soybean protein concentrate to further reduce fish meal 3) Further reduce or eliminate remaining dietary fish meal by implementing soybean protein isolate

Project Summary: Aquaculture is the single largest consumer of fish meal (FM), and the industry must reduce its reliance on FM to maintain economic viability. A wide variety of alternative protein sources have been evaluated in aquaculture feeds, however, success has varied among products and species. Most of the FM replacement research has focused on grain products commonly used in other livestock feeds, i.e. corn, wheat, and soybean meals. Soybean meal (SBM) has not replaced FM to the extent that nutritionists had originally hoped. However, SBM was initially targeted primarily because of its ready availability and low cost, not necessarily because of its suitability for aquatic livestock. Other soy derivatives, such as soy protein concentrate (SPC) and soy protein isolate (SPI), were not previously considered because at the time they were cost-prohibitive. As the price of FM continues to climb, SPC and SPI are becoming increasingly competitive alternative protein sources. SPC and SPI offer many advantages over SBM, i.e. higher protein:carbohydrate ratio, reduced antinutritional factors, etc., and may be better utilized by carnivorous livestock.

IMPLEMENTATION OF 'TRADITIONAL' AND 'DESIGNER' SOY OILS IN AQUACULTURE FEEDS

Staff/Graduate Assistant(s): Charley Foxx, Justin Rosenquist, Bonnie Mulligan, Jerome Laporte

Funding: Illinois Soybean Association

Investigator(s): Jesse Trushenski and Chris Kohler

Duration of Study:

January 2009-December 2011

Objective(s):

1) To assess traditional, low saturated fatty acid, low alpha-linolenic acid, high oleic acid, and hydrogenated soy oils as partial substitutes for fish oil in grow-out feeds for hybrid striped bass, rainbow trout, and Nile tilapia. 2) Employing the ideal soy oil identified in Objective #1, evaluate increasing fish oil replacement rates and determine the responsiveness of hybrid striped bass, rainbow trout, and Nile tilapia fillets to long-chain polyunsaturated fatty acid restoration during finishing

Project Summary: Nutritional and medical communities have recommended increasing human consumption of long-chain polyunsaturated fatty acids (LC-PUFA). Seafood remains the most effective means of incorporating these nutrients into our diet. Cultured fish can be an excellent source of LC-PUFA, however, use of alternative lipids in aquafeeds can reduce the level of LC-PUFA in the fillet. Using fish oil (FO)-based 'finishing' feeds, fillet LC-PUFA content can be restored to fish that have been raised on alternative lipid-based grow-out feeds. Finishing strategies hold great promise to balance the need for high LC-PUFA-content seafood in the American diet with



the need to reduce aquaculture's reliance on FO. We selected three taxa—hybrid striped bass, rainbow trout, and Nile tilapia—to use as models in conducting the aforementioned research. Completion of the proposed objectives will delineate means to reduce aquaculture's reliance on marine-derived resources while maintaining the nutritional value of cultured seafood. Identification of soy-derived lipid sources that are suitable substitutes for FO may reduce aquafeed costs and increase and diversify utilization of traditional and designer SO throughout the aquafeed industry.

IMPLEMENTATION OF RENDERED FATS IN AQUACULTURE FEEDS—MAXIMIZING ABILITY TO TAILOR NUTRITIONAL VALUE OF CULTURED FINFISH WHILE MINIMIZING RELIANCE ON MARINE RESOURCES

Staff/Graduate Assistant(s): John Boesenberg, Justin Rosenquist

Funding: Fats and Proteins Research Foundation, Inc.

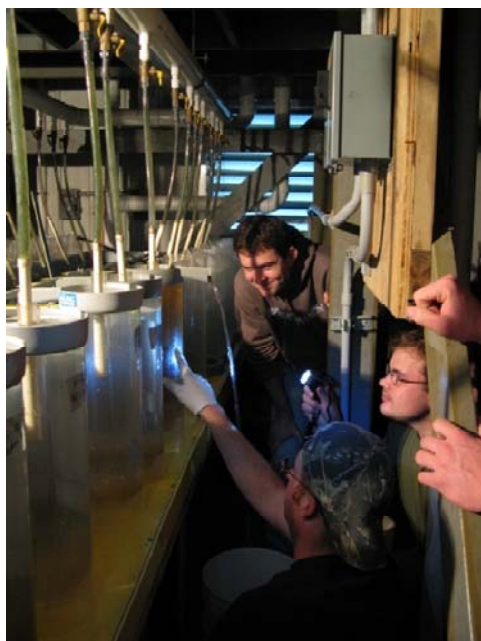
Investigator(s): Jesse Trushenski

Duration of Study: Jan 2009-Dec 2010

Objective(s): 1) To assess the relative suitabilities of beef tallow, pork lard, poultry fat, and yellow grease as partial substitutes for fish oil in rainbow trout grow-out feeds in terms of production performance and responsiveness of fillet tissue to FA profile restoration during finishing 2) Employing the ideal rendered lipid identified in Objective #1, determine the relationship between fish oil substitution level and duration of finishing period in order to maximize utilization of the ideal rendered lipid throughout the production cycle of rainbow trout.

Project Summary: The aquaculture industry must reduce its consumption of fish oil or risk future exhaustion of this resource. The inherent conflict between production of fillets with the greatest nutritional value (FO-based feeds) and the lowest feed costs (alternative lipid-based

feeds) may be overcome through the use of 'finishing' feeds to augment fillet LC-PUFA content of fish raised on alternative feeds prior to harvest. The fatty acid (FA) composition of fish tissues is plastic, and will change in response to altered dietary composition. By feeding high-LC-PUFA content, finishing feeds



at the end of the production cycle, fillet LC-PUFA content can be restored immediately prior to harvest. We have demonstrated that provision of alternative lipids rich in saturated fatty acids optimize fillet profile restoration during finishing.

These results represent a dramatic step forward in refinement of finishing strategies for aquaculture, and suggest a new role for saturated lipid sources such as rendered fats in aquaculture nutrition. Completion of the proposed objectives will delineate means to reduce aquaculture's reliance on marine-derived resources while maintaining the nutritional value of cultured seafood. Further, identification of rendered lipid sources that are suitable substitutes for FO may reduce aquafeed costs and increase and diversify utilization of rendered products throughout the aquafeed industry.

DEVELOPMENT OF SOY-BASED DIETS FOR SHOVELNOSE STURGEON

Funding: Illinois Soybean Association

Graduate Advisor(s): Brian Small

Duration of Study: 3 years

Objective(s): Define gross nutrient requirements and test soy-based feeds

Project Summary: Shovelnose sturgeon will be spawned and juvenile feed trials conducted. Mature sturgeon will be maintained and feed trials conducted during recrudescence to determine effects on spawning and roe production.

PHYSIOLOGY

DEVELOPMENT OF STABLE ISOTOPE MARKING TECHNIQUES FOR EARLY LIFE STAGES OF LAKE STURGEON

Staff/Graduate Assistant: Kurt Smith

Funding: Great Lakes Fishery Commission

Graduate Advisor(s): Greg Whitedge

Duration of Study: 10/1/2008-12/31/2009

Objective(s): 1) Determine concentration of strontium carbonate (SrCO_3) enriched with the stable isotope ^{86}Sr ($^{86}\text{SrCO}_3$) and immersion time in $^{86}\text{SrCO}_3$ required to incorporate distinct $^{88}\text{Sr}/^{86}\text{Sr}$ marks in pectoral fin rays of age-0 lake sturgeon, 2) Verify that multiple differentiating batch marks can be produced in pectoral fin rays of age-0 lake sturgeon using $^{86}\text{SrCO}_3$ labeling, and 3) Determine retention time and retention rate for $^{88}\text{Sr}/^{86}\text{Sr}$ marks in pectoral fin rays of age-0 lake sturgeon up to 120-d post-labeling.

Project Summary: Lake sturgeon were historically plentiful in the Great Lakes, but are currently listed as endangered or as a species of conservation concern by multiple agencies. Stocking has become a significant component of rehabilitation plans developed for Great Lakes lake sturgeon. Important research needs to support lake sturgeon rehabilitation have been identified, such as assessments of habitat use and dispersal for early life stages, evaluation of the most suitable life stages for stocking and differentiation of stocked from wild fish.

Evaluating stocking success and tracking fish dispersal requires appropriate tagging methods, but previously applied tags are limited in their application to early life stages or do not provide the possibility for multiple differentiating marks. The ultimate goal of this study is to develop a technique for marking age-0 lake sturgeon pectoral fin rays with stable strontium isotopes ($^{88}\text{Sr}/^{86}\text{Sr}$) and to evaluate retention of isotopic marks. The ability to mark lake sturgeon fry that can be recovered non-lethally will facilitate future assessments of stocking success and stocked fish dispersal and habitat use.

FIN RAY CHEMISTRY AS A NATURAL TAG FOR SMALLMOUTH BASS IN ILLINOIS STREAMS

Staff/Graduate Assistant: Kurt Smith

Funding Source(s): Illinois Smallmouth Alliance

Graduate Advisor(s): Greg Whittledge

Duration of Study: 6/1/2008-5/31/2009

Objective(s): Evaluate chemical composition of pectoral fin rays as a natural marker of smallmouth bass environmental history in Illinois streams by determining whether natural differences in fin ray chemistry are present in smallmouth bass from different streams and rivers.

Project Summary: Smallmouth bass were obtained from ten northern Illinois rivers and streams. A pectoral fin ray sample was obtained from 10 fish from each location, sectioned, and analyzed for a suite of trace elements (including strontium, barium, magnesium, and other metals) using laser ablation-inductively coupled plasma mass spectrometry (LA-ICPMS). These data are being used to characterize chemical "signatures" of smallmouth bass that inhabit different streams and rivers in northern Illinois. Differences in fin ray chemical composition (which are reflective of differences in water chemistry among streams) could be used as natural tags of smallmouth bass natal origins and movement among rivers and streams in

Illinois. By associating changes in the chemical composition of material across sectioned fin rays in relation to locations of annual growth rings, it is possible to reconstruct environmental history of individual fish.

TRACING ENERGY FLOW PATHWAYS TO FISH USING STABLE HYDROGEN ISOTOPES AND FATTY ACIDS

Staff/Graduate Assistant: Neil Rude

Graduate Advisor(s): Gregory Whittledge, Matthew Whiles, Jesse Trushenski

Duration of Study: 2009 - 2010

Objective(s): 1) Determine if fatty acid profiles of fish, zooplankton and macroinvertebrates are different among sites and site types (lentic vs. lotic). This objective will test the hypothesis that there will be no effect of site or site type on the fatty acid profiles of aquatic organisms. 2) Determine if δD signatures found in water sources correspond to δD found in bulk lipids of zooplankton, macroinvertebrates and fishes in various aquatic ecosystems. This objective will test the hypothesis that there will be no effect of water δD signatures on the δD signatures of lipids of aquatic organisms. 3) Determine if δD signatures found in water sources correspond to δD of individual fatty acids of zooplankton, macroinvertebrates and fishes in various aquatic ecosystems. This objective will test the hypothesis that there will be no effect of water δD signatures on the δD signatures of fatty acids of aquatic organisms.

Project Summary: Biochemical tracer technologies, such as fatty acid biomarkers and stable isotope ratios, have emerged as powerful tools for identifying energy sources that support consumers in aquatic ecosystems. Recent research has begun to use both stable isotopes and fatty acids as food web tracers, as the two methods often provide complementary information about energy sources and trophic pathways supporting consumers. This research project will utilize a unique method that analyzes hydrogen isotopes found in fatty acids. Given

that hydrogen isotopes have been shown to differ among water bodies (e.g., rivers vs. backwater), aquatic primary producers obtain their hydrogen from water, and essential fatty acids (which contain large amounts of hydrogen) are transferred relatively unchanged from primary producers to consumers, it is likely that hydrogen isotopes of fatty acids in fishes will reflect water hydrogen isotope signatures of the environment in which the primary producer lived. This analysis could be used to determine where fishes are obtaining their energy from in terms of location based on differences of hydrogen isotope signatures from the river and its associated backwaters. Application of this new technique is expected to give aquatic ecologists a greater understanding of how riverine food webs function and provide insight into the importance of restoring connectivity between rivers and their floodplain lakes to support growth of large river fishes.

UTILITY OF OTOLITH MICROCHEMISTRY AND STABLE ISOTOPIC COMPOSITION FOR DETERMINING FISH ENVIRONMENTAL HISTORY IN THE MISSISSIPPI AND ILLINOIS RIVERS

Staff/Graduate Assistant: John Zeigler

Funding: SIUC Fisheries and Illinois Aquaculture Center and the SIUC Office of Research Development and Administration

Graduate Advisor(s): Gregory Whittedge

Duration of Study: 2006-2009

Objective(s): 1) Determine whether water bodies (rivers, tributaries, and floodplain lakes) possess distinct chemical signatures (Sr/Ca, Ba/Ca, Mg/Ca, $^2\text{H}/^1\text{H}$, $^{18}\text{O}/^{16}\text{O}$, etc.) and if those signatures persist over time. 2) Determine if those differences in water chemistry among water bodies are reflected in fish otoliths. 3) Determine if there are differences in relationships between water and otolith chemistry among species. 4) Determine if fish may be accurately classified back to their site of capture based on otolith elemental and stable isotopic compositions.

Project Summary: Tracking the environmental history of a fish species is an important part of understanding and managing that species. Electronic tagging is one effective way of tracking fish movements. However, tracking tagged fish can be expensive and time consuming. This study aims to test the viability of the use of fish otoliths (earstones) in determining the life history of fishes in rivers, tributaries, and related lakes in the midwestern United States. Water and otolith samples will be taken from the Mississippi and Illinois Rivers, their tributaries, and related lakes. Water samples will be taken seasonally to determine if the given water bodies possess a stable persistent signature over time. Otolith samples will be analyzed to determine if their chemical makeup is reflective of the chemical signature of the bodies of water they were taken from. The results of this study should set a basis for future research using these methods in midwestern streams and lakes.

TOXICOLOGY

BIOAVAILABILITY OF SLOWLY DESORBING FRACTIONS OF SEDIMENT-ASSOCIATED HYDROPHOBIC CONTAMINANTS

Staff/Graduate Assistant: Amanda Rothert

Graduate Advisor(s): Michael Lydy and Matthew Whiles

Duration of Study: August 2007 – May 2010

Objective(s): The overall objective is to determine the bioavailability of slowly desorbing fractions of sediment-associated permethrin to the benthic invertebrate species *Hyalella azteca*, *Lumbriculus variegatus*, and *Hexagenia* sp. This includes six parts: (1) Determine the effect of total organic carbon on the amount of slowly desorbing fractions. (2) Determine the bioaccumulation of slowly desorbing fractions via aqueous uptake and ingestion of sediment particles. (3) Determine the proportion that slow fractions contribute to total bioaccumulation. (4) Determine the amount of compound made

bioavailable through ingestion of sediment particles via synthetic digestive fluid extraction. (5) Determine the proportion that bioaccumulation via ingestion contributes to total bioaccumulation. (6) Determine if slowly desorbing fractions redistribute into newly formed rapidly desorbing fractions when rapidly desorbing fractions are removed.

Project Summary:

Studies have suggested that only a fraction of sediment-associated contaminants are bioavailable, and that the bioavailable compound must be dissolved in an aqueous phase before it can be bioaccumulated.



Contribution from slowly desorbing fractions in pore water is small compared to rapidly desorbing fractions, so rapidly desorbing fractions are generally considered to be the bioavailable fraction (Leppänen et al. 2003). However, ingestion of sediment particles provides another route of contaminant exposure, but the importance of ingestion as an uptake route may vary depending on the size of the rapidly desorbing pool and the rate of desorption for the slowly desorbing fractions. Ingestion of sediment particles may increase the bioavailability of sediment-associated hydrophobic contaminants because gastrointestinal fluids may increase the rate of desorption (Gobas et al. 1993). The desorbing fractions will be quantified with Tenax extraction. Bioavailability of slowly desorbing fractions will be determined through bioaccumulation tests with sediment containing the pyrethroid insecticide permethrin. The rapidly desorbing fraction will be removed from the sediment with an adsorbent polymer bead, XAD-4. Solid phase membrane extraction (SPME) fibers will be placed in the sediment during the test to quantify compound in the freely dissolved phase. Compound desorbed via ingestion will be determined with a synthetic digestive fluid extraction. The species for study include *Hyalella azteca*, *Lumbriculus variegatus*, and *Hexagenia* sp. All three species represent

benthic biota that feed on sediment particles, but each has a different interaction with the sediment matrix, providing different routes of contaminant exposure.

FATE, TRANSPORT AND MIXTURE TOXICITY OF TRANSGENIC *BACILLUS*

***THURINGIENSIS* CORN (*ZEA MAYS*) AND ASSOCIATED INSECTICIDES**

Staff/Graduate Assistant:
Sara Mueeting

Graduate Advisor(s):
Michael Lydy

Duration of Study:
Fall 2009- Spring 2013

Objectives: Evaluate the mixture toxicity of *Bt* insecticides from transgenic corn, the pyrethroid insecticide, tefluthrin, and the neonicotinoid insecticide, clothianidin, to non-target species in the laboratory. Fate and transport of these compounds will be evaluated in the field at two sites in Illinois.

WHAT IS THE BEST CHEMICAL APPROACH TO ESTIMATE THE BIOAVAILABILITY OF SEDIMENT ASSOCIATED INSECTICIDES TO BENTHIC INVERTEBRATES

Staff/Graduate Assistant: Amanda Harwood

Graduate Advisor(s): Michael Lydy

Duration of Study: 2008 - 2013

Objectives: The overall project objective is to evaluate and compare two chemical techniques for estimating the bioavailability of sediment-associated insecticides. The representative species for study include *Hexagenia limbata*, *Hyalella azteca*, and *Lumbriculus variegatus*. Specific objectives of this project include: 1) Determine under what conditions SPME fibers and Tenax can accurately estimate total body residues; 2) Evaluate the effect of

biotransformation on the ability of Tenax and SPMEs to predict exposure; 3) Compare the potentially bioavailable concentration as predicted by Tenax and SPME to other standard measures of toxicity including whole sediment concentration, organic carbon normalized sediment concentration, and either total or toxic form body residues; and, 4) Validate these methods using field-contaminated sediments.

Project description:

The traditional approach for predicting bioavailability is to relate organic carbon normalized sediment concentrations to residues or effects. Due to the multiple variables influencing the properties of sediments, this method has limitations. A method of predicting bioavailability needs to be developed that is independent of sediment type in order to be universally applicable. Recent studies have demonstrated that chemical methods including Tenax beads and SPME fibers can adequately predict total body residues for some compounds. However, several areas warrant further investigation to evaluate in what scenarios these methods can accurately predict bioavailability. The proposed project will address five issues essential to implementation of Tenax and SPME fibers in predicting residues and toxicity: 1) What is the optimal way to measure the potential bioavailable concentration and residues?; 2) How to accurately determine body residues when biotransformation is an issue?; 3) Is there a relationship between the potential bioavailable concentration and toxicity?; and, 4) Can these methods be used to predict bioavailability and subsequent risk of sediment associated insecticides at contaminated sites? The study will evaluate and compare the applicability of both Tenax and SPME fibers to predict the bioavailability of toxic, biotransformed, insecticides to aquatic species.



IDENTIFYING THE SOURCES OF SEDIMENT-ASSOCIATED CONTAMINATION IN THE ILLINOIS RIVER COMPLEX USING A WHOLE-SEDIMENT TOXICITY IDENTIFICATION EVALUATION (TIE)

Staff/Graduate Assistant: W. Tyler Mehler

Funding: Illinois Department of Natural Resource and the Waste Management Resource Center, Champaign, Illinois

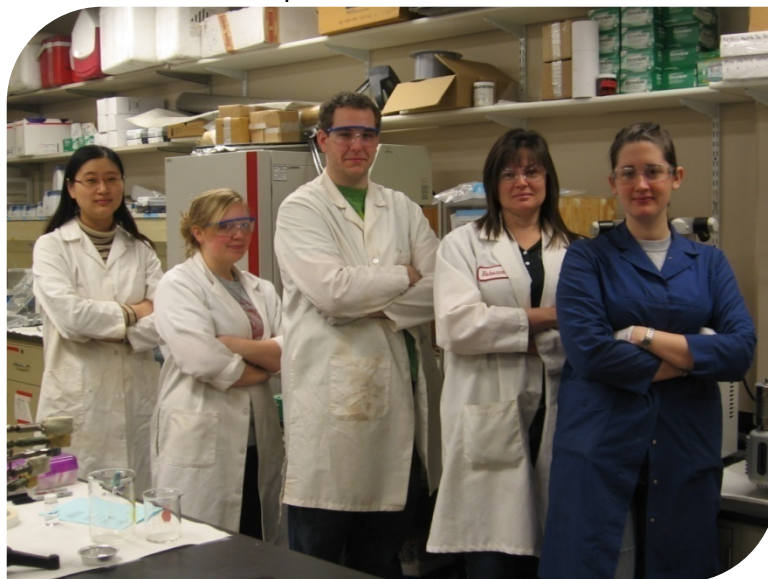
Graduate Advisor(s): Michael Lydy

Duration of Study: May 2007–July 2009

Objective(s): 1) Identify spatial trends of toxicity previously observed by Sparks and Ross (1992), as well as other areas of concern in the Illinois River. 2) Identify the contaminant classes that contribute to the toxicity of those sites. 3) Identify temporal patterns in sediment toxicity at selected sites. 4) Evaluate the differences in TIE methodologies employed in the present and past studies (whole-sediment and pore water, respectively).

Project Summary: The difficulty of assessing risk of sediment-associated contaminant mixtures to benthic ecosystems is often attributed to understanding the bioavailable fraction of each contaminant. These issues have led to the development of the toxicity identification evaluation (TIE). Past pore water TIE testing on Illinois River sediments has indicated that ammonia was the primary contaminant. The current study, however, suggests that ammonia is no longer the primary contaminant of concern, but rather non-polar organics, including polycyclic aromatic hydrocarbons, are the primary cause for toxicity in the Illinois River Complex (IRC). Summer of 2007 testing showed that six out of the seven sites that proceeded to Phase I testing exhibited a significant increase in survival with the addition of the non-polar organic amendment powdered

coconut charcoal (PCC), while zeolite (ammonia amendment) and Resin Tech SIR 300 (cationic metals amendment) did not significantly increase survival suggesting that non-polar organics are the source of toxicity. In addition, Phase II testing suggested that concentrations of PAHs were high enough to cause the observed toxicity, which confirmed the results of Phase I testing. Additional seasonal-based sampling (i.e., fall, winter, spring, and summer 2008) supported the summer findings, with little variation between toxicity and concentrations, with 46% of the sites being improved with the addition of PCC in Phase I testing. The results of Phase I and Phase II contradicted past pore water TIE studies as non-polar organics were suggested as the source of toxicity rather than ammonia. Thus, both pore water and whole sediment TIE methodologies were used on two selected sites. The results of this study suggested that discordance between the past pore water TIEs and the current whole sediment TIE were attributed to the methodologies and on a lesser note the test organisms used. The present study provides data that could be used in combination with previous work to more accurately characterize the sources and spatial trends of toxicity in Illinois River sediments for future risk assessment and mitigation. Furthermore, the present study showed that while TIE methodologies are a valuable tool in assessing risk associated with contaminants in aquatic systems, further research in understanding the role that each TIE method may serve in risk assessment is also important.



PREDICTING BIOAVAILABILITY AND TOXICITY OF HYDROPHOBIC PESTICIDES IN SEDIMENTS USING BIOASSAYS AND THE MATRIX-SPME APPROACH

Staff/Graduate Assistant: Yuping Ding

Funding: California State Water Resources Control Board

Graduate Advisor(s): Michael Lydy

Duration of Study: 2006-2011

Objective(s): The objectives of this research are to expand the application of a chemical approach (matrix solid phase microextraction, matrix-SPME) as a biomimetic method of estimating contaminant bioavailability by measuring pore water concentrations and internal body residues to directly evaluate toxicity of legacy and emerging pesticides in sediments, and to identify the causative contaminants in mixture toxicity using a bioavailable toxic unit (BTU) model based on a relationship between matrix-SPME measurements and toxicity responses, and to assess toxicity of sediments collected from agricultural areas of Illinois and California to benthic invertebrates with both the traditional TU method and the newly developed BTU model.

Project Summary: In this study, toxicity thresholds for 10 sediment-associated pesticides including abamectin, diazinon, dicofol, fenprothrin, indoxacarb,

methylparathion, oxyfluorfen, phorate, propargite, and pyraclostrobin, were established for third instar *Chironomus dilutus* larvae and amphipod *Hyalella azteca* using U.S EPA standard 10-d sediment toxicity tests.

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- Lewis, H. A., J. Trushenski, R. Lane, and C. Kohler. September 2009. Sunshine bass embryonic and larval survival differ in response to replacement of marine oil in material broodstock diets. 139th Annual Meeting of the American Fisheries Society, Nashville, TN.
- Lewis, H.A., J. Trushenski, R. Lane, and C. Kohler. February 2009. Sunshine bass embryonic and larval survival differ in response to removal of marine oil from maternal broodstock diets. Aquaculture America, Seattle, WA.
- Lydy, M. J., A. J. Trimble and J. D. Maul. November 2009. Ecological bioavailability of permethrin and p,p'-DDT: Implications for aquatic ecosystems with multiple organic matter matrices. Society of Environmental Toxicology and Chemistry North America 30th National Meeting, New Orleans, LA.
- Lydy, M. J. and T. Mehler. July and September 2009. Identification of the sources of sediment-associated toxicity in the Illinois River using a whole-sediment Toxicity identification Evaluation (TIE) approach. Illinois Sustainable Technology Center, Champaign, IL.
- Myers, D. J., M. R. Whiles, and G. W. Whitley. 2009. Use of δD and $\delta^{18}O$ to trace the origins and movements of macroinvertebrates in large river floodplain water bodies. 41st Annual Meeting of the Mississippi River Research Consortium, La Crosse, WI.
- Myers, D. J., M. R. Whiles, and G. W. Whitley. May 2009. Use of $\delta^{2}H$ and $\delta^{18}O$ to trace the origins and movements of macroinvertebrates in large river floodplain water bodies. Annual meetings of the North American Benthological Society, Grand Rapids, MI.
- Noatch, M. R. and G. W. Whitley. December 2009. Comparison of biological, chemical, and integrated biological-chemical approaches for controlling aquaculture pond snails. 70th Midwest Fish and Wildlife Conference, Springfield, IL.
- Peterson, S. D., M. R. Whiles, M. I. Gladyshev, K. J. Regester, N. N. Sushchik, and O. N. Makhutova. May 2009. Use of fatty acid analyses to assess trophic relations of omnivorous larval amphibians. Annual meetings of the North American Benthological Society, Grand Rapids, MI.
- Phelps, Q. E., H. A. Lewis, D. J. Myers, J. M. Zeigler, J. S. Eichelberger, M. R. Noatch, M. J. Saltzgiver and G. W. Whitley. September 2009. Otolith microchemistry of prey fish consumed by a fish predator: does digestion hinder Russian doll techniques? 139th Annual Meeting of the American Fisheries Society, Nashville, TN.

- Phelps, Q. E., G. W. Whitley, and J. E. Garvey. December 2009. Identifying river of origin for age-0 sturgeon in the middle Mississippi River using fin ray microchemistry. 70th Midwest Fish and Wildlife Conference, Springfield, IL
- Phelps, Q. E., H. A. Lewis, S. J. Tripp, M. J. Hill, J. T. Trushenski, and J. E. Garvey. December 2009. The influence of a chemical therapeutant on growth and survival of hybrid striped bass surgically implanted with dummy ultrasonic transmitters. 70th Midwest Fish and Wildlife Conference, Springfield, IL.
- Ratnapradipa, D., J. T. Trushenski, A. Haseeb, and A. Wodika. November 2009. Public health information about the safety of seafood: where can I find it? National Forum on Contaminants in Fish, Portland, OR.
- Rothert, A. K., P. F. Landrum, M. J. Lydy and M. R. Whiles. 2009. Bioavailability of slower desorbing fractions of sediment-associated permethrin. Society of Environmental Toxicology and Chemistry North America 30th National Meeting, New Orleans, November 19-23.
- Rugenski, A., M. R. Whiles, K. R. Lips, C. M. Pringle, S. S. Kilham, and M. J. Vanni. May 2009. Quantifying the roles of larval amphibians in nutrient cycling in neotropical headwater streams. Annual meetings of the North American Benthological Society, Grand Rapids, MI.
- Saltzgiver, M., E. Heist, P. Hedrick, and J. Geltz. July 2009. Genetic management plan for endangered pallid sturgeon captive broodstock maintained at Gavin's Point National Fish Hatchery. American Society of Ichthyologists and Herpetologists Annual Meeting, Portland, OR.
- Schrey, A., R. Boley, and E. J. Heist. May 2009. Hybridization between pallid and shovelnose sturgeon. Worlds Sturgeon Conservations Society International Sturgeon Symposium. Wuhan, China.
- Schultheis, R., M. W. Eichholz, M. R. Whiles, and T. Yerkes. May 2009. Invertebrate availability in flooded agricultural habitats of the upper Midwest. Annual meetings of the North American Benthological Society, Grand Rapids, MI.
- Schultheis, R. M. W. Eichholz, T. Yerkes, and M. R. Whiles. 2009. Patterns in invertebrate availability for waterfowl consumption during the spring migratory period. North American Duck Symposium, Toronto.
- Sechler, D., Q. Phelps, and J. E. Garvey. March 2009. Diet composition of young-of-year Scaphirhynchus sturgeon in the Middle Mississippi River: Does foraging behavior change with season, macrohabitat and total length of fish? Illinois Chapter of the American Fisheries Society Meeting, Moline, IL.
- Smith, K. T. and G. W. Whitley. December 2009. A stable isotope labeling technique for mass-marking fin rays of age-0 sturgeon. 70th Midwest Fish and Wildlife Conference, Springfield, IL.
- Smith, K. T., N. P. Rude, M. R. Noatch, D. R. Sechler, Q. E. Phelps, and G. W. Whitley. Contrasting population characteristics of yellow bass (*Morone mississippiensis*) in two southern Illinois reservoirs. 70th Midwest Fish and Wildlife Conference, Springfield, IL.
- Tripp, E. M., L. J. Schuler, P. F. Landrum, A. D. Harwood and M. J. Lydy. November 2009. Mixture toxicity of fluoranthene and pentachlorobenzene on *Hyalella azteca* and *Chironomus dilutus*. Society of Environmental Toxicology and Chemistry North America 30th National Meeting, New Orleans, LA.

- Tripp, S. J., R. C. Brooks, J. E. Garvey, M. Hill, H. A. Calkins, T. Spier, N. Bloomfield, T. Moore, D. Herzog, B. Hrabik. October 2009. 2009 Telemetry Update. Annual NESP Fish Passage Monitoring Meeting, Warsaw, IL.
- Tripp, S. J., Q. E. Phelps, D. P. Herzog, D. Ostendorf, J. Ridings, J. E. Garvey, and R. Hrabik. December 2009. Early-life ecology of paddlefish in the unimpounded Mississippi River. 70th Midwest Fish and Wildlife Meeting, Springfield, Illinois.
- Trushenski, J. T. June 2009. AFS Fish Culture Section—U.S. Fish and Wildlife Service Partnership: novel collaborations to reach end-users. Aquaculture Drug Approval Coordination Workshop, Little Rock, AR.
- Trushenski, J. T., J. Boesenberg, H. Lewis, and C. Kohler. September 2009. Saturated dietary lipid sources in grow-out feeds for hybrid striped bass. 139th Annual Meeting of the American Fisheries Society, Nashville, TN.
- Trushenski, J., D. Theisen, and C. Woods. February 2009. Maternal lipid nutrition affects zebrafish oocyte fatty acid composition and fertilization success but not larval growth or survival. Aquaculture America, Seattle, WA.
- Trushenski, J. T. February 2009. Women in aquaculture—perspectives from the new kid on the block, Invited. Aquaculture America, Seattle, WA.
- Trushenski, J. T., J. Boesenberg, and C. C. Kohler. February 2009. Fatty acid turnover in Nile tilapia and restoration of beneficial fatty acid profile. Aquaculture America, Seattle, WA.
- Trushenski, J. T., J. Boesenberg, and C. C. Kohler. February 2009. Saturated dietary lipid sources in grow-out feeds for hybrid striped bass: production performance and fillet fatty acid composition. Aquaculture America, Seattle, WA.
- Trushenski, J. T. February 2009. Recent hybrid striped bass nutrition studies at SIUC, Invited presentation to Striped Bass Growers' Association. Aquaculture America, Seattle, WA.
- Trushenski, J. T. September 2009. Use of soy in aquafeeds: recent results and upcoming projects at SIUC, Invited presentation, Soy in Aquaculture Stakeholders' Meeting, Montgomery, AL.
- Trushenski, J. T. January 2009. Recent aquaculture research at SIUC: basic and applied studies of cool water fishes. Cool Water Fish Culture Workshop, Whittington, IL.
- Trushenski, J. T. 2009. Recent aquaculture research at SIUC: basic and applied studies in finfish nutrition, Invited presentation, Agriculture and the Environment Meeting, Carbondale, IL.
- Walther, D. A., and M. R. Whiles. May 2009. Relationships between benthic organic matter standing stocks and secondary production in temperate North American streams. Annual meeting of the North American Benthological Society, Grand Rapids, MI.
- Whiles, M. R. December 2009. Quantifying the ecological consequences of declining biodiversity: responses of stream invertebrates to changes in vertebrate diversity. Annual Meeting of the Entomological Society of America, Indianapolis, IN.
- Whiles, M. R., H. Rantala, D. Walther, and K. Heinrich. December 2009. Biological responses to constructed rock riffles in the upper Cache River, Illinois. 70th Midwest Fish and Wildlife Conference, Springfield IL.

Whitledge, G., Q. Phelps, and J. E. Garvey. September 2009. Identifying river of origin for age-0 sturgeon in the middle Mississippi River using fin ray microchemistry. 139th Annual Meeting of the American Fisheries Society, Nashville, TN.

Whitledge, G. W., J. Trushenski, and P. Hitchens. January 2009. Surveillance of wild and feral fish species in Illinois susceptible to viral hemorrhagic septicemia. Coolwater Fish Culture Workshop, Whittington, IL.

Whitledge, G. W., J. Trushenski, and P. Hitchens. March 2009. VHS surveillance in Illinois' lakes and rivers. 47th Annual Meeting, Illinois Chapter of the American Fisheries Society, Moline, IL.

Whiting, D. P. and M. R. Whiles. May 2009. Macroinvertebrate production and food web structure along a tallgrass prairie stream continuum. Annual meetings of the North American Benthological Society, Grand Rapids, MI.

Zandona, E., S. S. Kilham, C. M. Pringle, M. Marshall, R. El-Sabaawi, S. Thomas, A. Flecker, M. R. Whiles, K. Lips, and D. Reznick. July 2009. Stable isotope analyses as a tool in conservation biology. Annual Meetings of the Society for Conservation Biology, Beijing, China.

DISSERTATIONS AND THESES COMPLETED IN 2009

W. Tyler Mehler – MS

Identifying the sources of sediment-associated contamination in the Illinois River complex using a whole-sediment toxicity identification evaluation (TIE).

Melody Saltzgiver - MS

Genetic management plan for endangered pallid sturgeon (*Scaphirhynchus albus*) captive broodstock maintained at Gavin's Point Fish Hatchery.

Andrew Trimble - PhD

Determining the occurrence, fate, and effects of pesticide mixtures using the aquatic amphipod *Hyallela azteca*

DISSERTATIONS AND THESES CURRENTLY IN PROGRESS



Ryan M. Boley - MS

Abundance and microhabitat preferences of larval *Scaphirhynchus* sturgeon in the lower Missouri and middle Mississippi Rivers.

Heather A. Calkins - MS

Linking habitat use of silver carp and phytoplankton consumption in the Mississippi River

Fred Chu-Koo - PhD

Plant digestibilities in the frugivorous Amazonian fishes *Colossoma macropomum* and *Piaractus brachypomus* and the role of these fishes in dissemination of plant seeds.

Andrew R. Coursey - MS

Maximizing marine feedstuff replacement in largemouth bass culture while maintaining production performance

Yuping R. Ding – PhD

Predicting bioavailability and toxicity of hydrophobic pesticides in sediments using bioassays and the matrix-some approach.

Brian R. Gause – MS

Replacement of fish meal in sunshine bass diets with ethanol yeast

Jennifer S. Eichelberger – PhD

Development of single nucleotide polymorphism (SNP) markers for rapid, inexpensive, and standardized identification of pallid (*Scaphirhynchus albus*) and shovelnose (*S. platorhynchus*) sturgeon

Amanda D. Harwood – PhD

What is the best chemical approach to estimate the bioavailability of sediment associated insecticides to benthic invertebrates

William D. Hintz – PhD

Factors limiting the recruitment of *Scaphirhynchus* sturgeons in the Mississippi River basin

Jennifer L. Johnson - MS

Evaluating habitat use of Age-0 *Scaphirhynchus* sturgeon with telemetry

Matthew S. Krampe - MS

Development of single nucleotide polymorphism (SNP) markers for rapid, inexpensive, and standardized identification of pallid (*Scaphirhynchus albus*) and shovelnose (*S. platorhynchus*) sturgeon larvae.

Heidi A. Lewis – PhD

Influence of dietary fatty acids on white bass reproductive performance and quality of progeny.

Shawn M. Meyer – MS

Comparison of production and fatty acid profiles among striped bass, white bass, and their hybrid (female *Morone chrysops* X male *M. saxatilis*) when fed a plant-based or fish-based dietary lipid source.

Sara A. Muetting – PhD

Fate, transport and mixture toxicity of transgenic *Bacillus thuringiensis* corn (*Zea mays*) and associated insecticides

Bonnie L. Mulligan – MS

Implementation of standard and modified soy oils as substitutes for fish oil in feeds for Nile tilapia *Oreochromis niloticus*

Matthew R. Noatch - MS

An evaluation of chemical, biological, and combined chemical-biological approaches for controlling snails in aquaculture ponds

Quinton E. Phelps – PhD

Early-life ecology of *Scaphirhynchus* sturgeon in the Mississippi River.

Amanda K. Rothert – MS

Bioavailability of slowly desorbing fractions of sediment-associated hydrophobic contaminants.

Neil P. Rude – MS

Tracing energy flow pathways to fish using stable hydrogen isotopes and fatty acids

Dawn R. Sechler - MS

Effects of abiotic and biotic factors on diet composition of age-0 sturgeon (*Scaphirhynchus spp.*) in the middle Mississippi River

Kurt T. Smith – MS

Evaluation of fin ray and fin spine chemistry as an indicator of environmental history of three fish species

John M. Zeigler - MS

Utility of otolith microchemistry and stable isotopic composition for determining fish environmental history in the Mississippi and Illinois Rivers.



PROFESSIONAL MEETINGS ATTENDED

Aquaculture America, Orlando, Florida. 9-12 February 2009 – Bergerhouse, Kohler, Lewis, Trushenski

Aquaculture Drug Approval Coordination Workshop, Little Rock, AR. 8-12 June 2009 - Trushenski

American Fisheries Society 139th Annual Meeting, Nashville, TN. August 30 – September 3rd – Blaufuss, Boley, Calkins, Coursey, Garvey, Gause, Heidinger, Heist, Hintz, Johnson, Kohler, Krampe, Lewis, Mulligan, Noatch, Rude, Smith, S. Tripp, Trushenski, Whitledge

American Society of Ichthyologists and Herpetologists Annual Meeting, Portland, OR. 22 -27 July 2009 – Eichelberger, Heist

Coolwater Fish Culture Workshop, Whittington, Illinois. 11-13 January 2009 – Bergerhouse, Gause, Hitchens, Lewis, Mulligan, Rude, Trushenski

Ecological Society of America 94th Annual Meeting, Albuquerque, NM. 2-7 Aug 2009 - Hintz

Illinois Chapter of the American Fisheries Society 47th Annual Meeting, Moline, IL. 24-26 February 2009 – Bergerhouse, Calkins, Sechler, Smith, S. Tripp, Whitledge

Illinois Soybean Association Soy-in-Aquaculture Stakeholders' Meeting, Montgomery, AL. - Trushenski

Indiana Soybean Alliance: Aquaculture Cooperative Workshop, Lebanon, IN. 27-28 March 2009 - Hitchens

Lower Basin Pallid Sturgeon Meeting, Vicksburg, MS. - Heist

Mid-Continent Warm Water Fish Culture Workshop. 2-4 February 2009 – Bergerhouse

Middle Basin Meeting of the Pallid Sturgeon Work Group, Blue Springs, MO. 26-27 January 2009 – Boley, Heist, Krampe

Midwest Fish and Wildlife 70th Conference, Springfield, IL. 6-9 December 2009 – Garvey, Gause, Heidinger, Hintz, Johnson, Noatch, Rude, Smith, S. Tripp, Whitledge

Mississippi River Research Consortium 41st Annual Meeting, La Crosse, WI. 30 April 2009 – S. Tripp, Whitledge

Navigation and Ecosystem Sustainability Program (NESP) Fish Passage Monitoring Meeting, Warsaw, IL. 21 October 2009 – S. Tripp

North American Benthological Society 57th Annual Meeting, Grand Rapids, MI. 16-23 May 2009 – Whiles, Whitledge

Shawnee Freshwater Prawn Growers Association . 6 August 2009 - Hitchens

Society of Environmental Toxicology and Chemistry North America 30th Annual Meeting, New Orleans, Louisiana. 19-23 November 2009 – Ding, Harwood, Lydy, Mueting

World Sturgeon Conservation Society International Sturgeon Symposium, Wuhan, China. - Heist



2009 GRANTS AND CONTRACTS

Acquisition of an isotope ratio mass spectrometer for geochemical, biological, and petrologic research, education, and training at Southern Illinois University. National Science Foundation Major Research Instrumentation Program, \$407,335 (Lefticariu, G. Kinsel, Whittledge)

Assessing reproductive dynamics of pallid sturgeon in the Mississippi River (Part 6). U.S. Army Corps of Engineers. \$369,649 (Garvey, Heist, and Tripp)

Chemical desorption analyses in Ballona Estuary. Southern California Coastal Water Research. \$21,396 (Lydy)

Current-use insecticides as a limiting factor for Coho salmon conservation and recovery in urban streams. National Oceanic and Atmospheric Administration. \$10,000 (Lydy)

Development and implementation of tailored biosecurity plans for Illinois aquafarms. U.S. Department of Agriculture Animal and Plant Health Inspection Service. \$47,762 (Trushenski and Whittledge)

Development of microsatellite markers in paddlefish. U.S. Fish and Wildlife Service. \$8,000 (Heist)

Development of single nucleotide polymorphism (SNP) markers for rapid, inexpensive, and standardized Identification of pallid (*Scaphirhynchus albus*) and shovelnose (*S.*

platorhynchus) sturgeon larvae. U. S. Geological Survey. \$105,104 (Heist)

Development of stable isotope marking techniques for early life stages of lake sturgeon. Great Lakes Fishery Commission. \$9,975 (Whittledge)

Effect of habitat fragmentation on migration rates in southern pine beetles using genetic markers. U.S. Geological Survey/U.S. Forest Service. \$75,590 (Ibrahim, Heist, Reeve)

Effects of storm damage on densities of the SPB predator *Thanasimus dubius*: Effect of habitat fragmentation on migration rates of SPB using genetic markers. U. S. Department of Agriculture Forest Service. \$23,000 (Reeve, Ibrahim, and Heist)

Fatty acid profiling in a model of Alzheimer's Disease. SIUC ORDA Interdisciplinary Seed Grant Program. \$20,000 (Rose, Trushenski, Patrylo)

Feed training carnivorous fish. U.S. Department of Agriculture North Central Regional Aquaculture Center. \$20,000 (Whittledge, Malison, Hayward, Binkowski)

Field- and watershed-scale research for sustainable crop production. Howard Buffett Foundation. \$1,751,182 (Young, Willard, Schoonover, Lydy)

Genetic purity of 2009 pallid sturgeon broodstock for the middle and lower Missouri River. U.S. Army Corps of Engineers. \$9,400 (Heist)

Identification of the sources and temporal patterns of sediment-associated toxicity in the Illinois River. Illinois Department of Natural Resources/WMRC. \$133,331 (Lydy, You, and Maul)

Implementation of microbially-derived product in aquafeeds to enhance production performance in aquaculture. Archer-Daniels Midland. \$60,000 (Trushenski)

Implementation of rendered fats in aquaculture feeds. Fats and Proteins Research Foundation Inc. \$64,000 (Trushenski)

Implementation of traditional and designer soy oils in aquaculture. Illinois Soybean Association. \$315,000 (Trushenski, Kohler, and Russin)

Increased utilization of soy-derived protein sources in aquaculture. Illinois Soybean Association. \$138,000 (Trushenski, Kohler, and Russin)

Increasing the availability of veterinarians for Indiana and Illinois aquaculturists. Illinois-Indiana Sea Grant. \$10,000 (Trushenski)

Management (biological, chemical, physical) of snails for grub control. U.S. Department of Agriculture North Central Regional Aquaculture Center. \$121,340 (Whitledge, Hartleb, Huspeni, Morris, Clayton)

Management practices of mitigating off-site transport of soil-adsorbed pesticides: Evaluation of alternatives and methods. California State Water Resources Control Board. \$800,000 (Weston, Lydy, Prichard, and Zhang)

Monitoring population status and movement of native and non-native fishes in the Upper Mississippi River. U. S. Army Corps of Engineers. \$400,000 (Garvey and Brooks)

Monitoring VHS in Chicago area waterways to improve early detection. U.S. Department of Agriculture Animal and Plant Health Inspection Service. \$64,089 (Whitledge and Trushenski)

Quad Cities Fisheries Investigations. Exelon Corporation. \$238,545 (Bergerhouse and Heidinger)

Outreach to increase awareness of VHS in Illinois waters and to enhance preventative measures among individuals. U.S. Department of Agriculture Animal and Plant Health Inspection Service. \$58,201 (Trushenski, Davenport, and Whitledge)

Reducing unexplained toxicity to protect sediment quality associated with irrigated agriculture. California State Water Resources Control Board. \$532,000 (Weston, Lydy, Halpin, Prichard, Zhang)

Replacement of fish meal in hybrid striped bass diets with proteinaceous fermentation biomass. Illinois-Indiana Sea Grant. \$6000 (Trushenski and Gause)

Soy oils in essential fatty acid and lipid nutrition of cobia *Rachycentron canadum*. Illinois Soybean Association. \$77,000 (Trushenski and Schwarz)

Sturgeon Caviar Research at SIUC. Illinois Soybean Association. \$84,675 (Winters, Jones, Garvey, Small)

Surveillance of wild and feral fish species in Illinois susceptible to viral hemorrhagic septicemia. U.S. Department of Agriculture Animal and Plant Health Inspection Service. \$175,298 (Whitledge and Trushenski)

Testing consumer acceptability and nutritional value of hybrid striped bass raised on soy-based feed. Illinois Soybean Association. \$33,000 (Smith and Trushenski)

Transport of pyrethroids pesticides to the Delta: Sources, seasonality, and toxicity. California State Water Resources Control Board. \$293,500 (Weston and Lydy)

Use of alternative lipid sources and finishing feeds to improve the nutritional value and safety of aquaculture products. National Oceanic and Atmospheric Administration. \$183,548 (Trushenski, Lydy, and Kohler)

VHS surveillance of fishes in Chicago area waterways. U.S. Department of Agriculture Animal and Plant Health Inspection Service. \$35,000 (Whitledge and Trushenski)

VHS surveillance in Illinois watersheds of high risk or unknown VHS status. U.S. Department of Agriculture Animal and Plant Health Inspection Service. \$170,055. (Whitledge and Trushenski)

UNIVERSITY AND EXTRA UNIVERSITY SERVICES, ACTIVITIES, AND HONORS

Garvey, James E.

Invited participant, Upper Mississippi River Research Consortium Symposium
Program Chair, Midwest Fish and Wildlife Conference
Member, Faculty Senate
Member, Technical Committee, North Central Regional Aquaculture Center
Member, Todd Fink Memorial Award Committee
Member, Touch of Nature Advisory Committee
Member, University Graduate Fellowship Award Committee
Member, Wetland Field Station Advisory Committee
Member, Yellowstone River Pallid Sturgeon Advisory Committee
Panelist, NSF Graduate Research Fellowship Program, Ecology
Reviewer, Great Lake Fishery Commission proposal
Reviewer, Hudson River Foundation proposal
Reviewer, Hydrobiologia
Reviewer, Journal of Zoology
Reviewer, Journal of Fish Biology
Reviewer, American Midland Naturalist
Reviewer, Freshwater Ecology
Reviewer, Canadian Journal of Fisheries and Aquatic Sciences
Reviewer, Transactions of the American Fisheries Society
Reviewer, Oikos
Reviewer, USGS Columbia Environmental Research Center, draft research report
Webmaster, Illinois Chapter of the American Fisheries Society

Heist, Edward J.

Faculty Advisor, Saluki Bassers
Guest Editor, Northeastern Naturalist
Member, Zoology Advisory Committee
Member, College of Science Personnel Committee
Member, Board of Directors, American Elasmobranch Society

Past President, American Fisheries Society Genetics Section
Reviewer, Biology Letters
Reviewer, BMC Genetics
Reviewer, Conservation Genetics
Reviewer, Environmental Biotechnology
Reviewer, Great Lakes Fisheries Trust
Reviewer, Journal of Heredity
Reviewer, Marine Ecology Progress Series
Reviewer, Molecular Ecology
Reviewer, National Science Foundation proposals

Kohler, Christopher C.

Chair, Hybrid Striped Bass Work Group, North Central Regional Aquaculture Center
Chair, Technical Research Committee, North Central Regional Aquaculture Center, USDA
Co-editor, North American Journal of Aquaculture
Member, American Fisheries Society, Equal Opportunities and Fisheries Management Sections
Member, American Fisheries Society Investment Advisory Committee
Member, Association of Marine Laboratories of the Caribbean
Member, Joint Subcommittee on Aquaculture Task Force on Effluents
Member, Network of Tropical Fisheries Scientists
Member, Overview Committee, North American Journal of Aquaculture, American Fisheries Society
Member, Strategic Planning Committee, North Central Regional Aquaculture Center, USDA
Member, Technical Committee, North Central Regional Aquaculture Center
Member, USA Chapter, World Aquaculture Society
Proposal Reviewer, North Central Regional Aquaculture Center
University Network Representative, American Fisheries Society
Vice Chair, Membership Committee, American Fisheries Society

Lydy, Michael J.

Advisor on regional ecosystem management, pest control, and chemical analyses
Invited speaker, Illinois Sustainable Technology Center
Lab Session Conductor, Illinois Junior Science and Humanities Symposium
Member, American Chemical Society
Member, American Fisheries Society
Member, Editorial Board, Archives of Environmental Toxicology and Chemistry
Member, Education Committee, Society of Environmental Toxicology and Chemistry
Member, Faculty Senate
Member, Fellowship Committee, Society of Environmental Toxicology and Chemistry
Member, Graduate Curriculum Committee, Zoology
Member, ORDA Faculty Seed Grant Review Committee for the College of Science
Member, Outstanding Dissertation Award Committee
Member, Society of Environmental Toxicology and Chemistry (National and Mid-South Regional Chapters)
Member, University Faculty Status and Welfare Committee
Member, The Wildlife Society

Trushenski, Jesse T.

Faculty Advisor, SIUC Subunit of the United States Aquaculture Society
President, Fish Culture Section, American Fisheries Society
Reviewer, Aquaculture
Reviewer, Aquaculture Nutrition
Reviewer, Canadian Journal of Fisheries Science
Reviewer, Current Zoology
Reviewer, Environmental Management
Reviewer, Fish and Shellfish Immunology
Reviewer, Fish Physiology and Biochemistry
Reviewer, Journal of Agricultural and Food Chemistry

Reviewer, Journal of Animal Physiology and Animal Nutrition
Reviewer, Journal of the World Aquaculture Society
Reviewer, Lipids
Reviewer, North American Journal of Aquaculture
Reviewer, Transactions of the American Fisheries Society
Symposium Chair, "Advances in Bass Culture", American Fisheries Society 2009 Annual Meeting
Symposium Chair, "Lipids in Aquaculture Nutrition and Physiology" World and U.S. Aquaculture Societies 2009 Annual Meeting

Whitledge, Gregory W.

Chair, Feed Training Carnivorous Fish Workgroup, North Central Regional Aquaculture Center
Chair, Snail Control Workgroup, North Central Regional Aquaculture Center
Member, Animal Care and Use Committee
Member, Undergraduate Curriculum Committee, Zoology
Member, Undergraduate Student Assistantship Committee
Representative for SIUC, Mississippi River Basin Panel on Aquatic Nuisance Species
Reviewer, Canadian Journal of Fisheries and Aquatic Sciences
Reviewer, Journal of the North American Benthological Society
Reviewer, Limnology and Oceanography

AWARDS

- 🐟 Patrick Blaufuss, SIUC Master of Science Fellowship
- 🐟 Ryan Boley, Todd E. Fink Memorial Scholarship
- 🐟 Darcy Ernat, Research-Enriched Academic Challenge (REACH) Undergraduate Award, \$1500 (Whitledge mentored)
- 🐟 Amanda Harwood, SIUC Doctoral Fellowship
- 🐟 Chris Kohler, Excellence in Soybean Research, Illinois Soybean Association
- 🐟 Heidi Lewis, J. Frances Allen Scholarship Award Honorable Mention, American Fisheries Society
- 🐟 Heidi Lewis, Roy C. Heidinger Service Award, SIUC Fisheries and Illinois Aquaculture Center
- 🐟 Sara Mueiting, SIUC Doctoral Fellowship
- 🐟 Quinton Phelps, Student Mentee Award, American Fisheries Society Annual Meeting, Nashville, TN
- 🐟 Quinton Phelps, Richard E. Blackwelder Award for dedication to research and teaching, Department of Zoology, SIUC
- 🐟 Quinton Phelps, Student Research Grant, Illinois Chapter of the American Fisheries Society, \$480
- 🐟 Quinton Phelps, travel grant, Illinois Chapter of the American Fisheries Society, \$100
- 🐟 Mandy Rothert, travel award, Society of Environmental Toxicology and Chemistry, \$200
- 🐟 Dawn Sechler, travel grant, Illinois Chapter of the American Fisheries Society, \$100
- 🐟 Brian Small, USDA Certificate of Merit for Outstanding Performance as a Research Physiologist



