



Aquaculture: NCRAC and MarketMaker™ Collaboration

Funding level: \$23,565
 Project start date: 1 September 2010
 Project duration: 1 year
 Participant: Iowa State University

With respect to production coordination, marketing outreach and production demographics, North Central Region (NCR) aquaculture producers are an underserved producer group. This project increases producer visibility, enabling producers to create easily executed market evaluations and customer-contact strategies. These goals will be achieved by utilizing the rapidly growing Web-based marketing tool MarketMaker™, a national partnership of Land Grant institutions and State Departments of Agriculture dedicated to the development of a comprehensive interactive data base of food industry marketing and business data. It is currently one of the most extensive collections of searchable food industry related data in the country. All the information can be mapped and queried by the user. Through the development of aquaculture-specific training materials, instructors will be able to demonstrate the capabilities of MarketMaker™ as a research and marketing tool to NCRAC producers. It will also serve as a tool for professionals from Iowa State University’s Extension Value-Added Agriculture Program (VAAP) and the North Central Regional Aquaculture Center to develop appropriate strategies to assist the overall industry, as well as more targeted plans for specific producers, regions, or production-system segments.

Evaluation of the Newly-Developed Least-Cost Experimental Diet for Bluegill at Commercial Densities in Ponds at Two or More Facilities in the North Central Region

Funding level: \$124,400
 Project start date: 1 September 2010
 Project duration: 2 years
 Participants: Iowa State University (Lead Institution), Lincoln University, Purdue University

A substantial need exists to reduce feed costs and develop more nutritionally adequate diets for established as well as emerging aquaculture species in the North Central Region. In light of past studies there is now a need to measure the effectiveness of the newly-developed bluegill diet (see

“Rapid Determination and Amino Acid Requirements of *Lepomis* Sunfish,” Project start date: 1 September 2007, below) against a base commercial diet often used by current sunfish producers in the North Central Region. To be relevant to actual culture practices, these new studies will include direct comparisons under actual field conditions.

Determination of Production Parameters of Selected Yellow Perch Lines at Commercial Densities in Ponds at Two or More Facilities in the North Central Region

Funding level: \$150,000
Project start date: 1 September 2010
Project duration: 3 years
Participants: Ohio State University (Lead Institution), University of Wisconsin-Stevens Point

Yellow perch (*Perca flavescens*) is a particularly important aquacultural and ecological species in the Great Lakes Region (GLR) and the North Central Region (NCR). The demand for yellow perch has remained very high in the GLR because they are the traditional fish species used in local restaurants, social organizations, and the Friday night fish fry dinners that are a staple in many Great Lakes states. Despite this opportunity, rapid expansion of the yellow perch aquaculture industry has not occurred in the NCR and the GLR. One reason in particular hindering expansion has been relatively slow growth of currently cultured populations of this species. Using current yellow perch strains, only 60% of the fish cultured in aquaculture operations reach market size in a normal growth cycle (16 months), with the rest being below market size. This is an inefficient use of resources, feed, and operational costs, and leads to marginal profits at best. Therefore, improving and promoting yellow perch growth and aquaculture using selected lines of yellow perch that have been developed by Ohio State University should improve the profitability of fish farmers.

Comparison, Identification, and Role of Microbial Communities in Recirculating Systems in the North Central Region

Funding level: \$65,000
Project start date: 1 September 2009
Project duration: 1 year
Participants: University of Michigan (Lead Institution), University of Wisconsin-Milwaukee

Indoor shrimp aquaculture is an infant industry in the United States. There is potential for the industry to expand in the U.S., but limitations imposed by climate and land cost dictate that indoor operations away from the coasts be considered. This will require (i) a greenhouse or indoor system with heating and temperature control, (ii) the availability of local brackish water sources or the artificial preparation of salt water, and (iii) water treatment to allow recycling of the water. Using currently available technologies, the energy and material costs of such a system

exceed those of outdoor production facilities in warmer areas with ready access to salt water. It is clear that developing a viable indoor shrimp aquaculture industry in the U.S. will require operations to be highly efficient, predictable, and stable in order to compete with inexpensive imports. One way to achieve this goal will be through microbial resource management. To this end, four researchers from two institutions are (1) characterizing the microbial communities in established production scale marine and freshwater recirculating aquaculture system (RAS) units; (2) once these microbial communities have been identified, the role(s) of these microbial communities within the nitrogen cycle will be quantified with the goal of increasing the efficiency of the RAS (increased survival, growth and density, etc. of aquatic organisms), and (3) results of this project will be coordinated for dissemination.

Official Transfer of 17 α -methyltestosterone (MT) Analytical Method for Feed

Funding level: \$27,880
Project start date: 1 September 2009
Project duration: 1 year
Participants: CANTEST Ltd., USGS Upper Midwest Environmental Sciences Center

The approval of 17 α -methyltestosterone (MT) medicated feed for use in tilapia to produce male fish would be of significant benefit to the U.S. industry. Tilapia is now the fifth most consumed seafood in the United States. Male fish grow faster than do their female counterparts, and by using all male fish, reproduction can be minimized or eliminated in grow-out systems, further benefiting growers. Approval of MT will allow all tilapia producers to have legal access to MT without an investigational new animal drug (INAD) permit and will provide them with a legal means to yield increased biomass, thus resulting in more revenue for those producers. The production of male populations of tilapia is important to the U.S. tilapia industry if they are to remain competitive with foreign producers of tilapia. Additionally, approval by FDA's Center for Veterinary Medicine (CVM) should help to alleviate fears from the public and erroneous claims by some environmental groups as to the safety of this technique. Approval of MT will provide advantages for those producers who currently do not have the space, time, or money to produce "super male brood stock" of tilapia through use of techniques such as producing genetically male populations of tilapia. MT is a major tool that could be used to manipulate the gender of a variety of cultured fish other than tilapia (e.g., hybrid striped bass, trout, percids, sunfish, and esocids). The successful completion of this project and acceptance of the methodology by CVM will be necessary if MT is first to be approved for use for tilapia and subsequently other species important to the North Central Region and other portions of the United States.

Rapid Determination and Amino Acid Requirements of Yellow Perch and Tilapia

Funding level: \$89,000
Project start date: 1 September 2009
Project duration: 2 years
Participants: University of Missouri-Columbia

Yellow perch (*Perca flavescens*) and Nile tilapia (*Oreochromis niloticus*) are considered emerging aquaculture species in the North Central Region (NCR). Despite being a culture species of high interest in the NCR for some time, very limited information is available on the nutritional requirements of yellow perch. High-cost trout diets are recommended for yellow perch because the nutritional needs of yellow perch and trout appear to be similar. In contrast, many studies have evaluated nutrient requirements of juvenile Nile tilapia and the potential to formulate low-cost feeds for this species. However, only limited information is available on the nutrient requirements of maturing/adult tilapia. Studies aimed at increasing knowledge of nutrient requirements of these two species at different grow-out phases that also evaluate their ability to use regionally available feedstuffs are warranted. Information derived from such studies would hold good potential to increase fish growth rates and to reduce waste production, feed cost, and excess fat deposition.

Effectiveness Research Leading to Approvals for Controlling Mortality in Coolwater and Warmwater Finfish Due to Aeromonad Infections with Terramycin 200 for Fish® (Oxytetracycline Dihydrate) and Aquaflor®

Funding level: \$150,000
Project start date: 1 September 2008
Project duration: 2 years
Participants: USGS Upper Midwest Environmental Sciences Center

Some investigators have contended that disease constitutes the largest single cause of economic loss to the aquaculture sector. There are few treatments available for current and emerging aquaculture diseases. The control of mesophilic or motile *Aeromonas* infections (MAI) is extremely relevant to the aquaculture industry in the North Central Region (NCR) as it has experienced a loss of income in commercially important food fish species and baitfish. These economic losses result directly from fish mortality due to MAI and from opportunistic secondary infections, and indirectly because of unappealing visual appearance of food fish with gross external lesions. Both Terramycin 200 For Fish® (oxytetracycline dihydrate) and Aquaflor® (florfenicol) have been shown to be effective against a wide variety of Gram-negative bacterial pathogens of fish including certain *Aeromonas* spp. (e.g., *A. salmonicida*). It is likely that one or both of these antibacterials will effectively reduce mortality associated with motile *Aeromonas* septicemia (MAS) in coolwater and warmwater fish. This research will provide valuable information to commercial and public fish culturists and enable them to effectively reduce production loss in cool- and warmwater fish caused by *Aeromonas* species.

Viral Hemorrhagic Septicemia (VHS)

Funding level: \$197,960
Project start date: 1 September 2008
Project duration: 2 years
Participants: University of Wisconsin-Stevens Point (Lead Institution), Iowa State University, Michigan State University, USGS Upper Midwest Environmental Sciences Center

Viral hemorrhagic septicemia (VHS) is an extremely serious disease of fresh and saltwater fish species. The recent occurrence and spread of VHS in the Great Lakes area has raised concerns regarding the risk of introduction of the virus to fish farms or additional natural waters in the North Central Region (NCR). Although fish culturists would prefer to disinfect eggs with iodine to reduce the risk of introducing a disease organism to their facility or the wild, there are no data available to assure the safety of iodine disinfection to cool- and warmwater fish. Secondly, there is no information on the effectiveness of iodine to kill the virus in non water hardened and water hardened eggs. A component of this project will look at the efficacy and safety of iodine disinfection on walleye and northern pike eggs infected with VHS. Another component of this project is to develop and disseminate information and the tools to combat the threat of VHS and other fish pathogens to NCR fish farmers through sound and efficacious biosecurity practices. One of those tools will be a Hazard Analysis and Critical Control Point (HACCP) approach to biosecurity.

2nd Regional Aquaculture Extension Specialist (RAES)

Funding level: \$150,000
Project start date: 1 September 2009
Project duration: 2 years
Participants: Michigan State University

At the 2008 Annual Program Planning Meeting of the North Central Regional Aquaculture Center (NCRAC) the Industry Advisory Council (IAC) unanimously supported the continuation of the Regional Aquaculture Extension Specialist (RAES) position, i.e., project. Areas identified for which the RAES could provide vital support to the industry include critical needs assessment, strategy development and implementation, partnership facilitation, and information transfer. The 2nd RAES project has been developed to address those areas of need for the aquaculture industry in the North Central Region (NCR).

North Central Regional Aquaculture Center Extension Project (also known as “Base” Extension)

The 11th and 13th “Base” Extension Projects were continuations of the 10th project. A summary of those three projects is given below after the 10th project description. The 12th “Base” Extension Project had different objectives and is summarized separately.

13th “Base” Extension Project

Funding level: \$29,000
Project start date: 1 September 2009
Project duration: 2 years
Participants: Iowa State University (Lead Institution), Kansas State University, Lincoln University, Michigan State University, North Dakota State University, Purdue University, Ohio State University, South Dakota State University, University of Illinois, University of Minnesota-Duluth, University of Nebraska-Lincoln

11th “Base” Extension Project

Funding level: \$114,319
Project start date: 1 September 2007
Project duration: 2 years
Participants: Iowa State University (Lead Institution), Kansas State University, Michigan State University, North Dakota State University, Ohio State University, Purdue University, South Dakota State University, University of Minnesota-Duluth, University of Nebraska-Lincoln, University of Missouri-Columbia, University of Illinois, University of Wisconsin-Milwaukee

10th “Base” Extension Project

Funding level: \$219,280
Project start date: 1 September 2005
Project duration: 2 years
Participants: Iowa State University (Lead Institution), Kansas State University, Michigan State University, North Dakota State University, Ohio State University, Purdue University, South Dakota State University, University of Illinois, University of Minnesota-Duluth, University of Missouri-Columbia, University of Wisconsin-Milwaukee

A network of Sea Grant and Cooperative Extension Service (CES)-designated contacts has been established to help maximize efficiency of education programs in the 12-state North Central

Region (NCR). However, many of these contacts are part-time on aquaculture and need additional resources to meet the growing demands of the aquaculture industry. Project participants have promoted and advanced commercial aquaculture in a responsible fashion through an organized education/training outreach program. The primary benefits are and have been:

- 1) Increased public awareness through publications (fact sheets, technical bulletins, culture guides/manuals, many of which are available as PDF files on the North Central Regional Aquaculture Center (NCRAC) Web site (<http://www.ncrac.org/Publications/>); short courses; and conferences regarding the potential of aquaculture as a viable agricultural enterprise in the NCR;
- 2) Technology transfer to enhance current and future production methodologies for selected species, e.g., yellow perch, walleye, and hybrid striped bass, through hands-on workshops and field demonstration projects;
- 3) Improved lines of communication between interstate aquaculture extension specialists and associated industry contacts;
- 4) Access to aquaculture information by the industry at any time via the Internet, including such things as photographs, publications, and traditional as well as educational streaming videos and financial support for AquaNIC, the Aquaculture Network Information Center (<http://aquanic.org/>);
- 5) An enhanced legal and socioeconomic atmosphere for aquaculture in the NCR; and
- 6) Continued development of state producer organizations that are engaged in identifying and providing solutions to industry issues.

12th “Base” Extension Project

Funding level: \$60,505
Project start date: 1 September 2008
Project duration: 2 years
Participants: Iowa State University (Lead Institution), Michigan State University, University of Wisconsin-Madison, University of Wisconsin-Stevens Point

Aquatic animal health and fish disease management are extremely relevant to the aquaculture industry in the North Central Region (NCR) because the industry has experienced both long-term and recent disease issues that have resulted in significant changes to the regulation of the industry and economic losses associated with fish mortalities and greater requirements for disease detection and assessment on the farm. The objectives of this project are to develop an online Fish Health Certificate Program for producers, providing them with relevant risk assessment and management principles and practices to reduce losses due to fish diseases and set up mechanisms to collect data on the impact of the training on the individual fish operations and the industry in general and development and presentation of workshops focused on Aquatic Invasive Species-Hazard Analysis and Critical Control Point (AIS-HACCP) training.

Management (Biological, Chemical, Physical) of Snails for Grub Control

Funding level: \$225,000
Project start date: 1 September 2007
Project duration: 2 years (extended to 31 August 2010)
Participants: Iowa State University, Southern Illinois University (Lead Institution),
University of Wisconsin-Stevens Point

Aquaculture producers have experienced significant monetary losses due to the infestation of digenetic trematodes, often referred to as grubs, in many commercially important food fish species. Five researchers from three institutions are investigating methods of potentially useful approaches to snail population management and/or grub control and assemble an updatable snail management guide which includes a literature review of known control options, a method of determining snail infestation levels in any water system, and a set of standard operating procedures to reduce snail populations and trematode infestations.

Rapid Determination and Amino Acid Requirements of *Lepomis* Sunfish

Funding level: \$80,000
Project start date: 1 September 2007
Project duration: 2 years
Participants: University of Missouri-Columbia

Substantial evidence demonstrates that both nutritional inadequacies and high cost of fish diets are currently impeding aquaculture's growth and production in the North Central Region (NCR). For example, lower-protein catfish diets have been fed to largemouth bass and also to sunfish (*Lepomis* spp.) by some NCR producers to reduce feed costs, despite general awareness that these fish grow better on diets with protein levels above 40%. Fatty livers, sometimes leading to substantial mortality, have also been observed in sunfish fed salmonid or other higher-protein diets in indoor recirculating aquaculture system tanks. To reduce costs of salmonid diets, research efforts within the NCR have explored the potential to replace high-cost fish meal with vegetable or animal by-product protein. Results indicate good potential for this but further research is clearly warranted to enhance the quality of such diets.

Determinative Method for the AQUIS® Marker Residue in Fillet Tissue

Funding level: \$129,936
Project start date: 1 January 2006
Project duration: 1 year
Participants: USGS Upper Midwest Environmental Sciences Center

A critical need for use of an anesthetic with zero withdrawal time in U.S. public aquaculture and fishery management has been expressed. A zero withdrawal anesthetic would allow anesthetized

fish to be handled and released immediately after conducting nearly all fish culture and management procedures including transport, spawning, marking, harvesting, and grading. To support the approval of a new animal drug for fish, a series of toxicology studies and residue chemistry studies are performed to demonstrate the safety of food products derived from the treated fish. An unfunded data gap is the validation of a determinative method for the AQUI-S® marker residue in fillet tissue from all species of coolwater and warmwater fin fish. The successful completion of this study will help complete one of the data packages necessary for a New Animal Drug Application (NADA) for AQUI-S® as a zero withdrawal anesthetic.

Feed Training Carnivorous Fish

Funding level: \$300,000
Project start date: 1 September 2006
Project duration: 2 years (extended to 31 August 2010)
Participants: Southern Illinois University-Carbondale (Lead Institution), University of Missouri-Columbia, University of Wisconsin-Madison, University of Wisconsin-Milwaukee

Largemouth bass and yellow perch have many biological characteristics that make them viable candidates for commercial culture. Research over the past decade has laid important groundwork and established key production parameters for the commercial culture of these species. In addition to all of the positive attributes that yellow perch and largemouth bass have as aquaculture species, they also have one common drawback. Yellow perch and largemouth bass are carnivores, and consequently do not readily accept commercial diets, although they can be trained to do so. Yellow perch and largemouth bass production of fry and subsequent feed-training techniques are similar. Once fish have absorbed their yolk sacs they are stocked into predator free nursery ponds that have been fertilized with organic and inorganic fertilizers which allows the production of sufficient zooplankton on which the small fish feed. Once the fish reach a certain size they are harvested from the pond, graded to equivalent sizes, and placed into raceways or tanks. During this tank phase of production, different producers use different types of feeds and feeding strategies to train the fish to accept formulated foods. Fish are kept in the training facility for 10–14 days before they are again graded and stocked into ponds. It is during this restocking phase that a bottleneck occurs in both yellow perch and largemouth bass production. Once largemouth bass are stocked into the grow-out ponds, only 40–50% of the fingerlings will normally continue to feed on the prepared diet unless they are confined to one area of the pond for several weeks. In an effort to keep a higher percentage of fish on feed, some producers will stock fingerlings at high densities. The percentage of yellow perch that remain on feed is currently unknown, but estimated to be similar to largemouth bass. In this project, five researchers from four institutions are evaluating strategies to enhance survival, growth, and retention of feed training for yellow perch and largemouth bass.

North Central Regional Aquaculture Center Baitfish Project

Funding level: \$200,000
Project start date: 1 September 2006
Project duration: 2 years (extended to 30 April 2011)
Participants: Iowa State University (Lead Institution), University of Minnesota-Duluth, University of Wisconsin-Stevens Point, University of Wisconsin-Madison, University of Wisconsin-Milwaukee

This project, conducted by five researchers and extension specialists at five institutions in the North Central Region (NCR), explores potentially economically viable solutions for advancing baitfish culture in the NCR by determining specific techniques and strategies for culturing golden and spotfin shiners. Results of this project will be provided to the baitfish industry through Web-based technologies, newsletters, fact sheets, workshops, and/or technical bulletins.

Drug Approval Research on 17 α -methyltestosterone

Funding level: \$50,000
Project start date: 1 November 2005
Project duration: 2 years
Participants: Southern Illinois University-Carbondale

There is a significant demand by the U.S. aquaculture sector for the approval of 17 α -methyltestosterone (MT) for sex inversion in tilapia. The production of all male populations of tilapia through ingestion of MT-medicated feeds will greatly enhance their aquaculture potential because males grow significantly faster and larger than females. This project was a target animal safety study on tilapia, the results of which were not found to be acceptable by FDA's Center for Veterinary Medicine (CVM), so therefore, another target animal safety study will have to be undertaken and completed before a New Animal Drug Application (NADA) for use of MT for sex inversion in tilapia will be approved by CVM.

1st Regional Aquaculture Extension Specialist (RAES)

Funding level: \$199,624
Project start date: 1 September 2005
Project duration: 3 years
Participants: Ohio State University

The objectives of this project were to provide leadership for the aquaculture industry in the North Central Region (NCR) and enhance information transfer through a Regional Aquaculture Extension Specialist (RAES). Some specific accomplishments by the RAES were the development of the North Central Region Aquaculture Contacts, Transport Regulations, and Approved Aquatic Species Web site (<http://www.ncrac.org/Info/StateImportRegs/stateregsmain.htm>) and the NCR

Aquaculture Roadmap Web site (<http://www.ncrac.org/roadmap/>). The latter was developed to increase the list serve subscription in the NCR and to help provide collaborative input from across the region in regards to indentifying industry needs and dissemination of research and extension information to the industry. Another accomplishment through the combined efforts of the RAES and the University of Wisconsin School of Veterinary Medicine (UWSVM) as well as the Wisconsin Department of Agriculture, Trade and Consumer Protection (WDATCP) was the establishment of a tuition waiver which enabled 44 certified veterinarians to take the online section of the Fish Health Medicine Program offered by UWSVM which helped minimize the impacts of viral hemorrhagic septicemia (VHS) on the region.

Largemouth Bass Nutrition

Funding level: \$170,000
Project start date: 1 September 2005
Project duration: 2 years
Participants: Southern Illinois University-Carbondale (Lead Institution), Iowa State University, Purdue University

Largemouth bass growers in the North Central Region have observed that growth slows as these fish reach 0.75 pound and culturists currently provide live forage in order to obtain bass of market size (i.e., 1.5 pound). Both nutritional and environmental hypotheses have been developed as to why commercial growers have not been able to consistently raise largemouth bass in ponds to market size solely on formulated feed. Three researchers from three institutions have collaborated on assessing diet and environmental factors affecting growth and health of largemouth bass raised to 1.5 pound in ponds with formulated feed. They also developed cost-effective finisher diets that enhanced health and growth of largemouth bass and conducted a region-wide workshop on raising largemouth bass to 1.5 pound in ponds based on the results of their research activities.

National Coordinator for Aquaculture INADs/NADAs

Funding level: \$89,000
Project start date: 15 July 2004
Project duration: 5 years
Participants: Michigan State University

The Joint Subcommittee on Aquaculture (JSA) recognized in the 1990s that investigation and approval of safe therapeutants for use by the aquaculture industry to help manage diseases was one of the highest priorities currently facing the industry. The need for additional drugs is great, but securing data necessary to satisfy the requirements of FDA's Center for Veterinary Medicine (CVM) for drug approval is time consuming, costly, and procedures are rigorous. The INAD/NADA (Investigational New Animal Drug/New Animal Drug Application) process is the one method that allows the industry to provide CVM with data on efficacy and also aid producers

in their production practices. The JSA's Working Group on Quality Assurance in Aquaculture Production previously identified the need for a National Coordinator for Aquaculture INADs. The National Coordinator served as a conduit between an INAD/NADA applicant and CVM. Since the inception of the position in 1995, the National Coordinator for Aquaculture INADs/NADAs was based at Michigan State University under the aegis of the North Central Regional Aquaculture Center. During this time 16 NADAs were approved for 15 different label claims for seven drugs exceeding by >45% the number approved in the 30 years prior to the establishment of the National Coordinator's position and the allocation of funds for drug approval studies. In total, due to the efforts of the National Coordinator, the opportunity exists to achieve additional approvals for 11 new drugs and 43 label claims if all the efforts underway result in approvals. This position also helped to create the Minor Use and Minor Species Animal Health (MUMS) legislation that will form the basis of further developments in the future to include grants for safety and effectiveness studies. Aquaculture drug sponsors have gained 71 of the 85 MUMS designations for seven years of marketing exclusivity and the only MUMS grants issued to date were for aquaculture drug studies.