

# EXTENSION<sup>(1)</sup>

Progress Report for the Period  
May 1, 1989 to August 31, 2001

**NCRAC FUNDING LEVEL:** \$476,052 (May 1, 1989 to August 31, 2001)

## **PARTICIPANTS:**

Fred P. Binkowski	University of Wisconsin-Milwaukee	Wisconsin
James M. Ebeling	Ohio State University	Ohio
Robert D. Espeseth	University of Illinois	Illinois
Donald L. Garling	Michigan State University	Michigan
Jeffrey L. Gunderson	University of Minnesota-Duluth	Minnesota
F. Robert Henderson	Kansas State University	Kansas
John N. Hochheimer	Ohio State University	Ohio
Paul B. Jarvis	North Dakota State University	North Dakota
Anne R. Kapuscinski	University of Minnesota	Minnesota
Terrence B. Kayes	University of Nebraska-Lincoln	Nebraska
David L. Klinkebiel	North Dakota State University	North Dakota
Ronald E. Kinnunen	Michigan State University	Michigan
Christopher C. Kohler	Southern Illinois University-Carbondale	Illinois
David J. Landkamer	University of Minnesota	Minnesota
Charles D. Lee	Kansas State University	Kansas
Frank R. Lichtkoppler	Ohio State University	Ohio
Terry A. Messmer	North Dakota State University	North Dakota
Jeff Mittlemark	University of Minnesota	Minnesota
Joseph E. Morris	Iowa State University	Iowa
Kenneth E. Neils	Kansas State University	Kansas
Robert A. Pierce II	University of Missouri	Missouri
Shawn H. Sanders	North Dakota State University	North Dakota
Daniel A. Selock	Southern Illinois University-Carbondale	Illinois
John P. Slusher	University of Missouri	Missouri
Fred L. Snyder	Ohio State University	Ohio
Brian R. Stange	North Dakota State University	North Dakota
LaDon Swann	Purdue University	Indiana/Illinois
Laura G.Tiu	Ohio State University	Ohio

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## **PROJECT OBJECTIVES**

(1) Strengthen linkages between North Central Regional Aquaculture Center (NCRAC) Research and Extension Work Groups.

- (2) Enhance the NCRAC extension network for aquaculture information transfer.
- (3) Provide in-service training for Cooperative Extension Service, Sea Grant Advisory Service, and other landowner assistance personnel.
- (4) Develop and implement aquaculture educational programs for the North Central Region (NCR).
- (5) Develop aquaculture materials for the NCR including extension fact sheets, bulletins, manuals/guides, and instructional video tapes.

### **ANTICIPATED BENEFITS**

Members of the NCRAC Extension Work Group have promoted and advanced commercial aquaculture in a responsible fashion through an organized education/training outreach program. The primary benefits are:

- Increased public awareness through publications, short courses, and conferences regarding the potential of aquaculture as a viable agricultural enterprise in the NCR;
- Technology transfer to enhance current and future production methodologies for selected species, e.g., walleye, hybrid striped bass, yellow perch, salmonids, and sunfish, through hands-on workshops and field demonstration projects;
- Improved lines of communication between interstate aquaculture extension specialists and associated industry contacts;
- Access to information by the aquaculture industry through 24-hour access to worldwide aquaculture information (i.e., photographs, slide sets, and publications); and
- An enhanced legal and socioeconomic atmosphere for aquaculture in the NCR.

### **PROGRESS AND PRINCIPAL ACCOMPLISHMENTS**

#### *OBJECTIVE 1*

Aquaculture Extension Work Group members have:

- Served as extension liaison, if not an active researcher, for every NCRAC-funded project.
- Assisted in developing, writing, and editing of several culture manuals, e.g., Walleye Culture Manual, Sunfish Culture Guide, and Yellow Perch Culture Manual.
- Assisted with the planning, promotion, and implementation of hybrid striped bass, walleye, and yellow perch workshops held throughout the region.
- Provided the NCRAC Economics and Marketing Work Group with information relevant to that group's efforts to develop production budgets and expected revenues for the commercial production of food fish.

- Participated as Steering Committee members for a regional public forum regarding revision of the National Aquaculture Development Plan and three National Aquaculture Extension Workshops/Conferences.
- Participated as Steering Committee members for the past four North Central Regional Aquaculture Conferences.
- Served as writers and reviewers of several white papers for the Center.
- Served as Steering Committee members of state-specific aquaculture conferences as well as state aquaculture coordinating councils.

## *OBJECTIVE 2*

The demand for aquaculture extension education programs cannot be met by the few specialists in the NCR (currently less than 3.0 full time equivalents). A NCRAC white paper on extension presents several strategies to address this concern.

Networking of specialists and Cooperative Extension Service (CES)-designated contacts has maximized efficiency of education programs and minimized duplication. Individual state extension contacts often respond to 10–15 calls per month from outside their respective state as well as interacting with colleagues with mutual concerns related to developing aquaculture activities. Many of these requests have been met by providing fact sheets, technical bulletins, bibliographies, maintenance of list servers, and detailed responses to both generalized and specialized questions. This extension network is critical to being able to match specific aquaculture questions with the best source of information, e.g., crawfish and leech information with Gunderson.

The Aquaculture Network Information Center (AquaNIC [<http://aquanic.org/>]) was established at Purdue University in 1994 through funds from USDA's Cooperative State Research, Education, and Extension Service and the Illinois-Indiana Sea Grant Program. AquaNIC hardware is housed in the Department of Animal Sciences at Purdue University and is coordinated by the Mississippi-Alabama Sea Grant Consortium, the Alabama Cooperative Extension System, and the Illinois-Indiana Sea Grant College Program.

AquaNIC was the first U.S. aquaculture Web site and is globally one of the most widely accessed and cited aquaculture Web sites. More than 1,000 individual, educational, commercial, and governmental Web sites link to AquaNIC as a source of online aquaculture information. An online aquaculture course has also been developed (<http://ag.ansc.purdue.edu/courses/aq448/index.htm>).

Aquaculture handbooks have been developed and distributed to each NCRAC-designated aquaculture extension contact and selected CES and Sea Grant field staff members.

As with any organization, there have been changes in NCRAC extension personnel since the inception of the project. For instance, Landkamer was the primary aquaculture extension contact for Minnesota. In the intervening years, he has been replaced by Kapuscinski and then by Gunderson. Two other individuals were replaced in 1994. In Kansas, Neils replaced Henderson and in Illinois, Kohler replaced Selock. Lee replaced

Neils in Kansas in 1996. Hochheimer, who replaced Ebeling in Ohio, left Ohio State University; Tiu was appointed as the aquaculture extension specialist for Ohio in 1998. Sanders replaced Klinkebiel as the extension contact for North Dakota in 1998, resigned the following year; Brian Stange followed who was replaced by Paul Jarvis in 1999. Jerry Mills is now the appointed NCRAC Extension contact for South Dakota. As of 1999, Kayes is no longer with Nebraska Extension; to date no replacement has been designated. In 2000, Swann resigned from Indiana/Illinois Sea Grant; that position is currently open.

### *OBJECTIVE 3*

In-service training for CES and Sea Grant personnel and other landowner assistance personnel have been held in most of the states in the region. Training has been in the areas of basic aquaculture, species-specific technologies, e.g., yellow perch, and safe seafood handling including Hazard Analysis Critical Control Point (HACCP). Many of these individuals have, in turn, trained industry representatives in respective subject matter.

To help prevent the spread of aquatic nuisance species (ANS) via cultured fish and baitfish, and to provide the industry with a tool to demonstrate to natural resource agencies that private fish culturists can provide an ANS-free product, the ANS-HACCP approach was developed by Gunderson and Kinnunen. Developed materials include a manual and video for use in the training sessions as well as a related poster use in for retail outlets.

### *OBJECTIVE 4*

A number of workshops, conferences, videos, field-site visits, hands-on training sessions, and other educational programs have been developed and implemented.

There have been workshops on general aquaculture, fish diseases, commercial recirculation systems, leach and baitfish culture, aquaculture business planning, crayfish culture, pond management, yellow perch and hybrid striped bass culture, rainbow trout production, in-service training for high school vocational-agricultural teachers, and polyploid induction in sunfish held in the region. Depending on the workshop, the number in attendance often exceeded 100.

Four North Central Regional Aquaculture Conferences have been held. The first in Kalamazoo, Michigan was held in March 1991; the second was held in February 1995 in Minneapolis, Minnesota; the third conference was held in Indianapolis, Indiana; and the fourth was held February 1999 in Columbia, Missouri. These regional meetings were attended by hundreds of individuals including persons from Canada.

On April 10, 1993, over 700 viewers from 35 states and Canada watched the first national interactive teleconference on aquaculture, "Investing in Freshwater Aquaculture," that was broadcast from Purdue University. It was a televised satellite broadcast for potential fish farmers. The program consisted of 10 five- to seven-minute video tape segments that

addressed production aspects of channel catfish, crayfish, rainbow trout, hybrid striped bass, tilapia, yellow perch, baitfish, and sportfish.

A Yellow Perch Producers' Forum was conducted in Hudson, Wisconsin on January 21-22, 2000. NCRAC extension contacts helped design the forum, the goals of which were to: (1) increase profitability and sustainability of existing perch producers, (2) increase cooperation between and among producers, researchers, and extension personnel, and (3) identify yellow perch research and extension needs. A summary of research and extension needs identified by the producers was compiled.

Kinnunen was instrumental in developing and compiling support for the "Environmental Strategies for Aquaculture Symposium." This two-day meeting took place during the 62<sup>nd</sup> Midwest Fish and Wildlife Conference in Minneapolis, Minnesota, December 3-6, 2000. The symposium provided a forum where industry, resource management agencies, and environmental/conservation organizations could discuss the scientific information available and/or needed to make reasoned decisions regarding aquaculture development. Several NCRAC state aquaculture extension contacts, i.e., Gunderson, Kinnunen, Morris, and Tiu, participated in the planning of or made presentations at this symposium.

In 2000, a workshop, entitled "Organic Aquaculture Standards Workshop" was developed and supported by Minnesota extension contacts. With support from the USDA's Agricultural Marketing Service, Packard Foundation, and the University of Minnesota's Extension Service, 43 national and international participants came together to address issues of concern regarding the National Organic Standards Board's organic aquaculture standards.

NCRAC extension contacts have served as editors for regional aquaculture newsletters as well as in-state aquaculture associations; served on state aquaculture advisory councils and state aquaculture task forces; and assisted in the planning and implementation of state aquaculture association meetings.

In support of extension activities being funded through research projects, i.e., hybrid striped bass and sunfish research projects, extension specialists have completed fact sheets, book chapters, and videos. These extension materials, arising from the combined efforts of both extension specialists and researchers, will help to address many questions concerning aquaculture in the NCR.

In addition to the previously mentioned areas, NCRAC extension contacts have been instrumental in fostering the continued growth of the aquaculture industry in the region. For example, Pierce created the Cooperative Extension Aquaculture and Marketing Educational Program to facilitate the development and implementation of aquaculture educational programs in Missouri. Tiu has also worked to revitalize the Ohio Aquaculture Association (OAA). She has continued to coordinate monthly OAA board meetings and edit the OAA newsletter. Gunderson has worked to distribute information about the Environmental Assessment Tool for Land-based Aquaculture developed by Kapuscinski under contract by the Great Lakes Fisheries Commission. This instrument has the ability

to impact aquaculture development in much of the NCR. Lee has worked with the Kansas Aquaculture Association to develop and fund a current directory of Kansas fish producers.

Many of the NCRAC extension contacts have worked with industry and governmental representatives to produce state aquaculture plans and improved governmental regulations. Binkowski has worked with the Wisconsin Department of Agriculture, Trade and Consumer Protection in the production of A Wisconsin Aquaculture Industry Profile Processor Survey 1998 and 1998 Wisconsin Aquaculture Directory.

All fish processors, including those who handle aquaculture products, are now required by law to process their fish following HACCP guidelines. Kinnunen has conducted numerous HACCP training workshops throughout the NCR. These workshops served to train fish processors on the principles of HACCP and to give them knowledge on how to develop and implement a HACCP plan for their specific facility.

NCRAC extension contacts have been responsive to arising issues for the NCR aquaculture industry. For instance, the aquaculture industry is accused of being an important vector for the spread of exotic species like zebra mussels, Eurasian watermilfoil, round goby, and others because water and organisms are moved from one water body to another. Minnesota and Michigan extension contacts worked with other aquaculture and exotic species specialists from around the region to address this issue important to many fish farmers in the NCR, especially people raising fish for stocking or baitfish. To better identify the risks of spreading exotic species and to reduce those risks, a HACCP approach was used. Extension specialists in Illinois/Indiana, Michigan, Minnesota, and Ohio are participating in this project. The project is designed to identify critical control points and to develop guidelines for controlling the spread of exotic species while not overburdening the industry with unnecessary regulations.

In-service training of secondary teachers has taken place in a number of states. For instance, teachers in Iowa, Ohio, and Wisconsin have received instruction in aquaculture which they can use in their vocational agriculture courses.

Several states have on-site facilities that are used for extension programming. For instance, the Northern Aquaculture Center operated by North Dakota State University is used to inform the public about aquaculture as well as foster grass root support for this agriculture enterprise. The Piketon facilities operated by Ohio State University have also been used in a similar fashion.

The National Catfish Information Database has proceeded with Swann serving on the planning committee as well as serving as a lead editor. The Aquaculture Business Plan Guide has been delayed due to Swann's departure from Purdue University.

#### *OBJECTIVE 5*

Numerous fact sheets, technical bulletins, and videos have been written or produced by various participants of the Extension Work Group. These are listed in the [Appendix](#).

## **WORK PLANNED**

Efforts will continue in regard to strengthening linkages between research and extension work groups as well as enhancing the network for aquaculture information transfer. Participants will also continue to provide in-service training for CES, Sea Grant, and other land owner assistance personnel.

Educational programs and materials will be developed and implemented. This includes final publication of the Sunfish Culture Guide and development of the Yellow Perch Culture Manual and videos, and a Hybrid Striped Bass Culture Guide.

Future HACCP workshops will be planned as needed in the NCR. Any additional workshops developed and hosted by state extension contacts will be advertised in surrounding states to take advantage of the NCRAC extension network and the individual expertise of Extension Work Group participants.

The Aquaculture Business Plan Guide will be completed by Southern Illinois University-Carbondale contacts in 2002.

## **IMPACTS**

- In-service training for CES and Sea Grant personnel has enabled those professionals to respond to initial, routine aquaculture questions from the general public.
- Development of aquaculture education programs for the NCR has provided "hands-on" opportunities for prospective and experienced producers. More than 5,000 individuals have attended workshops or conferences organized and delivered by the NCRAC Extension Work Group.
- Fact sheets, technical bulletins, and videos have served to inform a variety of clients about numerous aquaculture practices for the NCR. For instance, "Making Plans for Commercial Aquaculture in the North Central Region" is often used to provide clients with initial information about aquaculture, while species-specific publications on walleye, trout, and catfish have been used in numerous regional meetings and have been requested by clients from throughout the United States. Publications on organizational structure for aquaculture businesses, transportation of fish in bags, and others are beneficial to both new and established aquaculturists. In a 1994 survey, NCRAC extension contacts estimated that NCRAC publications were used to address approximately 15,000 client questions annually.
- NCRAC extension outreach activities have helped to foster a better understanding and awareness for the future development of aquaculture in the region.
- AquaNIC has become an entry point for many people searching for aquaculture information on the Web. AquaNIC's home page now averages more than 3,000 visits per month by people from more than 50 countries.

- The 4-H Guide for Aquaculture will offer a tremendous opportunity to teach math, biology, and chemistry using experiential learning. Incorporating aquaculture into 4-H Youth programs is not limited to rural farming communities; the curriculum could also be used in urban and inner city schools.
- Fish processors who have attended NCRAC-sponsored HACCP Training Workshops have learned the principles of HACCP with regards to its importance in insuring the production of a safe fishery product. HACCP Plans have now been implemented by workshop attendees who are now keeping records of their daily processing and Sanitation Standard Operating Procedures. About 200 fish processors and/or aquaculturists have attended HACCP Training Workshops.
- In Ohio, an organized OAA has given producers the forum necessary to encourage appropriate legislation necessary for the success of the aquaculture industry in that state.

## **PUBLICATIONS, MANUSCRIPTS, WORKSHOPS, AND CONFERENCES**

See the [Appendix](#) for a cumulative output for all NCRAC-funded Extension activities.

## **SUPPORT**

YEARS	NCRAC- USDA FUNDING	OTHER SUPPORT					TOTAL SUPPORT
		UNIVER- SITY	INDUSTRY	OTHER FEDERAL	OTHER	TOTAL	
1989-91	\$107,610	\$237,107				\$237,107	\$344,717
1991-93	\$94,109	\$152,952				\$152,952	\$247,061
1993-95	\$110,129	\$198,099		\$250,000	\$55,000	\$503,099	\$613,228
1995-97	\$31,204	\$149,325	\$5,000	\$84,000		\$238,325	\$269,529
1997-99	\$39,000	\$110,559				\$110,559	\$149,559
1999-01	\$94,000	\$108,124				\$120,816	\$215,816
<b>TOTAL</b>	<b>\$476,052</b>	<b>\$956,166</b>	<b>\$5,000</b>	<b>\$334,000</b>	<b>\$55,000</b>	<b>\$1,362,858</b>	<b>\$1,839,910</b>

## **APPENDIX**

### **EXTENSION**

#### *NCRAC Extension Fact Sheet Series*

Garling, D.L. 1992. Making plans for commercial aquaculture in the North Central Region. NCRAC Fact Sheet Series #101, NCRAC Publications Office, Iowa State University, Ames.

Harding, L.M., C.P. Clouse, R.C. Summerfelt, and J.E. Morris. 1992. Pond culture of walleye fingerlings. NCRAC Fact Sheet Series #102, NCRAC Publications Office, Iowa State University, Ames.

- Kohler, S.T., and D.A. Selock. 1992. Choosing an organizational structure for your aquaculture business. NCRAC Fact Sheet Series #103, NCRAC Publications Office, Iowa State University, Ames.
- Swann, L. 1992. Transportation of fish in bags. NCRAC Fact Sheet Series #104, NCRAC Publications Office, Iowa State University, Ames.
- Swann, L. 1992. Use and application of salt in aquaculture. NCRAC Fact Sheet Series #105, NCRAC Publications Office, Iowa State University, Ames.
- Morris, J.E. 1993. Pond culture of channel catfish in the North Central Region. NCRAC Fact Sheet Series #106, NCRAC Publications Office, Iowa State University, Ames.
- Morris, J.E., C.C. Kohler, and C.C. Mischke. 1999. Pond culture of hybrid striped bass in the North Central Region. NCRAC Fact Sheet Series #107, NCRAC Publications Office, Iowa State University, Ames.
- Cain, K., and D.Garling. 1993. Trout culture in the North Central Region. NCRAC Fact Sheet Series #108, NCRAC Publications Office, Iowa State University, Ames.
- Riepe, J.R. 1999. Marketing seafood to restaurants in the North Central Region. NCRAC Fact Sheet Series #110, NCRAC Publications Office, Iowa State University, Ames.
- Riepe, J.R. 1997. Costs for pond production of yellow perch in the North Central Region, 1994-95. NCRAC Fact Sheet Series #111, NCRAC Publications Office, Iowa State University, Ames.
- Riepe, J.R. 1999. Supermarkets and seafood in the North Central Region. NCRAC Fact Sheet Series #112, NCRAC Publications Office, Iowa State University, Ames.
- Garling, D. In review. Whirling disease. NCRAC Fact Sheet Series #113, NCRAC Publications Office, Iowa State University, Ames,.
- Garling, D., and M. Riche. In review. Feeding tilapia in intensive recirculating systems. NCRAC Fact Sheet Series #114, NCRAC Publications Office, Iowa State University, Ames.

***NCRAC Technical Bulletin Series***

- Thomas, S.K., R.M. Sullivan, R.L. Vertrees, and D.W. Floyd. 1992. Aquaculture law in the north central states: a digest of state statutes pertaining to the production and marketing of aquacultural products. NCRAC Technical Bulletin Series #101, NCRAC Publications Office, Iowa State University, Ames.
- Swann, L. 1992. A basic overview of aquaculture: history, water quality, types of aquaculture, production methods. NCRAC Technical Bulletin Series #102, NCRAC Publications Office, Iowa State University, Ames.
- Kinnunen, R.E. 1992. North Central Region 1990 salmonid egg and fingerling purchases, production, and sales. NCRAC Technical Bulletin Series #103, NCRAC Publications Office, Iowa State University, Ames.
- Hushak, L.J., C.F. Cole, and D.P. Gleckler. 1993. Survey of wholesale and retail buyers in the six southern states of the North Central Region. NCRAC Technical Bulletin Series #104, NCRAC Publications Office, Iowa State University, Ames.

Meronek, T., F. Copes, and D. Coble. 1998. The bait industry in Illinois, Michigan, Minnesota, Ohio, South Dakota, and Wisconsin. NCRAC Technical Bulletin Series #105, NCRAC Publications Office, Iowa State University, Ames.

Lichtkoppler, F.P. 1993. Factors to consider in establishing a successful aquaculture business in the North Central Region. NCRAC Technical Bulletin Series #106, NCRAC Publications Office, Iowa State University, Ames.

Swann, L., and J. R. Riepe. 1994. Niche marketing your aquaculture products. NCRAC Technical Bulletin Series #107, NCRAC Publications Office, Iowa State University, Ames.

Swann, L., J. Morris, and D. Selock. 1995. Cage culture of fish in the North Central Region. NCRAC Technical Bulletin Series #110, NCRAC Publications Office, Iowa State University, Ames.

Riepe, J.R. 1997. Enterprise budgets for yellow perch production in cages and ponds in the North Central Region, 1994/95. NCRAC Technical Bulletin Series #111, NCRAC Publications Office, Iowa State University, Ames.

Brown, P., and J. Gunderson, editors. 1997. Culture potential of selected crayfishes in the North Central Region. NCRAC Technical Bulletin Series #112, NCRAC Publications Office, Iowa State University, Ames.

Riepe, J.R. 1998. Walleye markets in the North Central Region: results of a 1996/97 survey. NCRAC Technical Bulletin Series #113, NCRAC Publications Office, Iowa State University, Ames.

Morris, J.E., and C.C. Mischke. 1999. Plankton management for fish culture ponds. NCRAC Technical Bulletin Series #114 NCRAC Publications Office, Iowa State University, Ames.

Lane, R.L., and J.E. Morris. 2000. Biology, prevention, and effects of common grubs (Digenetic trematodes) in freshwater fish. NCRAC Technical Bulletin Series #115, NCRAC Publications Office, Iowa State University, Ames.

Ramseyer, L.J., and D. Garling. In review. Fish nutrition and aquaculture waste management. NCRAC Technical Bulletin Series #116, NCRAC Publications Office, Iowa State University, Ames.

### ***NCRAC Video Series***

Swann, L. 1992. Something fishy: hybrid striped bass in cages. VHS format, 12 min. NCRAC Video Series #101, NCRAC Publications Office, Iowa State University, Ames.

Pierce, R., R. Henderson, and K. Neils. Aquacultural marketing: a practical guide for fish producers. 1995. VHS format, 19 min. NCRAC Video Series #102, NCRAC Publications Office, Iowa State University, Ames.

Swann, L., editor. 1993. Investing in freshwater aquaculture. VHS format, 120 min. NCRAC Video Series #103, NCRAC Publications Office, Iowa State University, Ames.

Morris, J.E., and C.C. Mischke. 1998. Sunfish (*Lepomis* spp.) culture. NCRAC Video Series #104, NCRAC Publications Office, Iowa State University, Ames.

Ingham, S. 1999. A guide to making safe smoked fish. NCRAC Video Series #105, NCRAC Publications Office, Iowa State University, Ames.

Swenson, W. 2000. Fish farming: some industry perspectives. NCRAC Video Series #106, NCRAC Publications Office, Iowa State University, Ames.

Ingham, S. 2000. Fish processing plant sanitation. NCRAC Video Series #107, NCRAC Publications Office, Iowa State University, Ames.

### ***NCRAC Culture Series***

Summerfelt, R., editor. 1996. Walleye culture manual. NCRAC Culture Series #101, NCRAC Publications Office, Iowa State University, Ames.

Mischke, C.C., and J.E. Morris, editors. In review. Sunfish culture guide. NCRAC Culture Series #102, NCRAC Publications Office, Iowa State University, Ames.

### ***Other Videos***

Kayes, T.B., and K. Mathiesen, editors. 1994. Investing in freshwater aquaculture: a reprise (part I). VHS format, 38 min. Cooperative Extension, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln.

Kayes, T.B., and K. Mathiesen, editors. 1994. Investing in freshwater aquaculture: a reprise (part II). VHS format, 41 min. Cooperative Extension, Institute of Agriculture and Natural Resources, University of Nebraska-Lincoln.

### ***CD-ROMs***

Swann, L. 1998. Getting started in freshwater aquaculture. NCRAC CD-ROM Series #101, NCRAC Publications Office, Iowa State University, Ames.

### ***Situation and Outlook Report***

Hushak, L.J. 1993. North Central Regional aquaculture industry situation and outlook report, volume 1 (revised October 1993). NCRAC Publications Office, Iowa State University, Ames.

### ***Other Publications in Print***

Myers, J.J., and R.A. Pierce. 2000. Missouri aquaculture directory. Missouri Department of Agriculture, Jefferson City, Missouri.

Pierce, R.A., and C. Hicks. 2000. Understanding aquaculture businesses and their financial needs. Pages 75-76 in R. Plain, editor. Missouri farm financial outlook 2001. University Outreach and Extension, Department of Agricultural Economics, University of Missouri-Columbia.

Swann, D.L., and M.E. Einstein. 2000. User analysis and future directions of the web-based Aquaculture Network Information Center. *Journal of Extension* 38(5).

### ***Workshops and Conferences***

Salmonid Culture, East Lansing, Michigan, March 23-24, 1990. (Donald L. Garling)

Midwest Regional Cage Fish Culture Workshop, Jasper, Indiana, August 24-25, 1990. (LaDon Swann)

Aquaculture Leader Training for Great Lakes Sea Grant Extension Agents, Manitowoc, Wisconsin, October 23, 1990. (David J. Landkamer and LaDon Swann)

Regional Workshop of Commercial Fish Culture Using Water Reuse Systems, Normal, Illinois, November 2-3, 1990. (LaDon Swann)

First North Central Regional Aquaculture Conference, Kalamazoo, Michigan, March 18-21, 1991. (Donald L. Garling, Lead; David J. Landkamer, Joseph E. Morris and Ronald Kinnunen, Steering Committee)

Crayfish Symposium, Carbondale, Illinois, March 23-24, 1991. (Daniel A. Selock and Christopher C. Kohler)

Fish Transportation Workshops, Marion, Illinois, April 6, 1991 and West Lafayette, Indiana, April 20, 1991. (LaDon Swann and Daniel A. Selock)

Regional Workshop on Commercial Fish Culture Using Water Recirculating Systems, Normal, Illinois, November 15-16, 1991. (LaDon Swann)

National Aquaculture Extension Workshop, Ferndale, Arkansas, March 3-7, 1992. (Joseph E. Morris, Steering Committee)

Regional Workshop on Commercial Fish Culture Using Water Recirculating Systems, Normal, Illinois, November 19-20, 1992. (LaDon Swann)

In-Service Training for CES and Sea Grant Personnel, Gretna, Nebraska, February 9, 1993. (Terrence B. Kayes and Joseph E. Morris)

Aquaculture Leader Training, Alexandria, Minnesota, March 6, 1993. (Jeffrey L. Gunderson and Joseph E. Morris)

Investing in Freshwater Aquaculture, Satellite Videoconference, Purdue University, April 10, 1993. (LaDon Swann)

National Extension Wildlife and Fisheries Workshop, Kansas City, Missouri, April 29-May 2, 1993. (Joseph E. Morris)

Commercial Aquaculture Recirculation Systems, Piketon, Ohio, July 10, 1993. (James E. Ebeling)

Yellow Perch and Hybrid Striped Bass Aquaculture Workshop, Piketon, Ohio, July 9, 1994. (James E. Ebeling and Christopher C. Kohler)

Workshop on Getting Started in Commercial Aquaculture Raising Crayfish and Yellow Perch, Jasper, Indiana, October 14-15, 1994. (LaDon Swann)

Aquaculture in the Age of the Information Highway. Special session, World Aquaculture Society, San Diego, California, February 7, 1995. (LaDon Swann)

Second North Central Regional Aquaculture Conference, Minneapolis, Minnesota, February 17-18, 1995. (Jeffrey L. Gunderson, Lead; Fred P. Binkowski, Donald L. Garling, Terrence B. Kayes, Ronald E. Kinnunen, Joseph E. Morris, and LaDon Swann, Steering Committee)

Walleye Culture Workshop, Minneapolis, Minnesota, February 17-18, 1995. (Jeffrey L. Gunderson)

Aquaculture in the Age of the Information Highway. Multimedia session, 18 month meeting of the Sea Grant Great Lakes Network, Niagara Falls, Ontario, May 6, 1995. (LaDon Swann)

AquaNIC. Annual Meeting of the Aquaculture Association of Canada, Nanaimo, British Columbia, June 5, 1995. (LaDon Swann)

Yellow Perch Aquaculture Workshop, Spring Lake, Michigan, June 15-16, 1995. (Donald L. Garling)

Rainbow Trout Production: Indoors/Outdoors, Piketon, Ohio, July 8, 1995. (James E. Ebeling)

North Central Regional Aquaculture Center Hybrid Striped Bass Workshop, Champaign, Illinois, November 2-4, 1995. (Christopher C. Kohler, LaDon Swann, and Joseph E. Morris)

Third North Central Regional Aquaculture Conference, Indianapolis, Indiana, February 6-7, 1997. (LaDon Swann)

Overview of Sunfish Culture. Missouri Joint Aquaculture Conference, Springfield, Missouri, March 4-6, 1998. (Joseph E. Morris)

Seafood and Food Safety Issues Related to Aquaculture, North Central Regional Aquaculture Conference, Columbia, Missouri, February 24-26, 1999. (Ronald E. Kinnunen)

Overview of Sunfish Culture. North Central Aquaculture Conference, Columbia, Missouri, February 24-26, 1999. (Joseph E. Morris and Charles C. Mischke)

Angel Fish Production, North Central Regional Aquaculture Conference, Columbia, Missouri, February 24-26, 1999. (LaDon Swann)

Potential of Recirculating Systems in the North Central Region, North Central Regional Aquaculture Conference, Columbia, Missouri, February 24-26, 1999. (LaDon Swann)

Overview of Freshwater Shrimp Culture, North Central Regional Aquaculture Conference, Columbia, Missouri, February 24-26, 1999. (Laura Tiu)

Fertilization Regimes for Fish Culture Ponds, Wisconsin Aquaculture Conference, Green Bay, Wisconsin, March 12-13, 1999. (Joseph E. Morris)

Extension Programming in the North Central Region, SERA-IEG-9, Frankfort, Kentucky, March 14-16, 1999. (Joseph E. Morris)

Description of the Aquaculture and Bait Fish Industries: Threat Evaluation and Identification of Critical Control Points, International Joint Commission Workshop on Exotic Policy, Milwaukee, Wisconsin, September 22-26, 1999. (Jeffrey L. Gunderson)

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