AQUACULTURE ECONOMICS AND MARKETING IN THE NORTH CENTRAL REGION

Chairperson: Patrick D. O'Rourke, Illinois State University

Extension Liaisons: Donald L. Garling, Michigan State University; Terrence B. Kayes, University of Nebraska-Lincoln; Daniel A. Selock, Southern Illinois University-Carbondale; LaDon Swann, Purdue University

Funding Request: $40,000

Duration: 2 Years (September 1, 1993 - August 31, 1995)

Objective:

To develop cost of production budgets and expected revenues for the raising of food-sized walleye, yellow perch, and hybrid striped bass on farms in the North Central Region.

Proposed Budgets:

Institution	Principal Investigator(s)	Year 1	Year 2	Total
Illinois State University	Patrick D. O'Rourke	$11,635	$10,135	$21,770
Southern Illinois University-Carbondale	Susan T. Kohler	$5,000	$5,000	$10,000
Purdue University	Marshall A. Martin Jean R. Riepe	$5,469	$2,761	$8,230
	TOTALS	**$22,104**	**$17,896**	**$40,000**

TABLE OF CONTENTS

JUSTIFICATION

Within the U.S., aquaculture (the production of fish and other seafood in controlled environments) is an expanding industry. The outlook for continued expansion of the industry is good for a number of reasons (Robinson et al. 1991). U.S. domestic consumers continue to be health and calorie conscious. Fish products offer a low calorie, healthy alternative to red meat as a source of protein. Further, legal restrictions affect the sale and consumption of many popular food fish. Moreover, biological limitations continue to affect wild-caught fish and seafood products. Many seafood species have been harvested in excess of biological sustainability to satisfy consumer demand. Any substantive increase in consumer demand will be sustainable only if the species is grown in a controlled environment. This results in an increase in demand for fish and seafood products in general and specifically, for aquaculture products.

Domestic Market

The domestic marketing opportunities for fish and seafood products continue to grow. Per capita consumption of fish and seafood products during the 1980s increased approximately 25 percent from 5.7 kg (12.5 lbs) to 7.0 kg (15.5 lbs), and is expected to increase to 9.1 kg (20 lbs) by 2,000. Every 0.45 kg (1 lb) increase in per capita consumption translates into approximately 340 million kilograms (750 million pounds) live weight of fish consumed.

The consumption of fish rose during the 1980s in spite of rapid increases in consumer prices of fish and seafood products. Throughout the 1980s, fish and seafood prices were rising faster than the prices of red meat and poultry. For example, during 1982-91, fish prices rose by 51 percent compared to 10, 12 and 13 percent, respectively, for poultry, beef and pork. This made seafood relatively more expensive than red meat and poultry, but did not prevent a rise in the consumption of fish and seafood products. Seafood is expected to continue as a premium food commanding a premium price in seafood markets.

Farm Production of Fish

World production of farm-raised salmon increased by a factor of six between 1985 and 1990 to 279 million kilograms (614 million pounds). In the U.S. over this same period, the production of farm-raised salmon increased by a factor of three to nine million pounds; this production represented rapid growth but still a loss of world market share. Farm-raised catfish production in the U.S. increased from 2.6 million kilograms (5.7 million pounds) in 1970, to 21.1 million kilograms (46.4 million pounds) in 1980, and to 163.5 million kilograms (360.4 million pounds) in 1990, while trout production increased by 32 percent between 1981 and 1990 to 25.8 million kilograms (56.8 million pounds) (USDA). These growth rates are high in part because of the small base from which the increases are computed. However, they suggest rapid response by producers to the seafood market.

While the quantity of landings of wild-caught species has been growing, the growth in value has been slower. The average price of many landed species is less than a dollar per pound, due largely to increased harvest of low-valued species such as Alaskan pollock. The aquaculture opportunities, on the other hand, are in the production of high valued species including salmon, trout, walleye, yellow perch, catfish, or hybrid striped bass. Positioning of product by emphasizing consistent high quality and accessibility is one way producers can gain entry to seafood markets.

Imports and Exports

Throughout most of the 1980s, U.S. imports of fish and seafood products rose. U.S. imports of fish and seafood products rose much more rapidly than exports of seafood products. The result was a net deficit in seafood trade which peaked at about $7 billion in 1987 (USDA). This increase in seafood imports was the result of increased domestic consumption and a strong U.S. currency which favored imports. Since 1988, this trend has reversed. During 1990, exports rose both in quantity terms (58 percent) and in value terms (25 percent) reducing the trade deficit to about $3 billion. A majority of the increase in exports is the result of an increase in the export of pollock to Japan and other Asian countries. In addition, U.S. exports of shellfish are increasing significantly to both Canada and Mexico. Further progress on the North American free trade agreement could result in increased exports of farm-raised products to Mexico.

U.S. exports of fish and seafood products will face increasingly competitive markets during the 1990s. For many countries, revenue from the sale of aquaculture products provides much needed foreign currencies. Aquaculture development in several Asian and South American countries has outpaced development of aquaculture in the U.S. These countries have encouraged the development of aquaculture through input subsidies and maintain their share of international markets by subsidizing export prices. They are expected to actively protect aquaculture through a variety of barriers to trade. This will largely translate into subsidized production and protected domestic markets.

While U.S. exports are growing, imports of fish and seafood products continue to fall. A weaker U.S. dollar has made imported seafood products relatively more expensive than domestic products. However, much of the decrease in imports is attributable to a substitution of domestic for imported seafood products. This further corresponds to a four year increase in the quantity of landings of U.S. fish and seafood products.

Production in the North Central Region

More than $1.3 million has been spent or allocated for species specific research through the North Central Regional Aquaculture Center (NCRAC) since 1989. There has been relatively little research conducted concerning the economic viability of the selected species. This is in part due to the lack of commercial producers of these species for food fish markets. This project will attempt to answer some of the basic questions related to economic feasibility of producing three species commercially in the region: walleye, yellow perch, and hybrid striped bass.

Several agencies have attempted to compile the production, marketing and economic data for the United States aquaculture industry. However, no one agency has full responsibility for tracking this data and therefore coverage of aquaculture production has been limited in nature and partial in scope (Hushak et al. In press; Thomas et al. 1992). Catfish production budgets for different sized operations are in existence. Trout and catfish production costs are being studied by the current NCRAC Economics and Marketing Work Group. The budgets will serve as examples for feasibility studies for yellow perch, walleye and hybrid striped bass in the North Central Region. Limited work has been done for the North Central Region in creation of enterprise budgets for yellow perch, walleye, and hybrid striped bass.

One major limitation to the collection of data has been the hesitation on the part of the producers to share data. Due to the competitive nature of the industries, many producers are hesitant to provide accurate production data. Data that is available is often from information that is required to be filed with regulatory agencies. Producers are reluctant to provide information that may result in additional regulatory involvement. An important component of the project will be to help North Central producers understand the importance of agglomeration economies, i.e. market power gained from several producers able to serve a large market rather than a single producer serving one small market. In addition, collection of data in person-to-person interviews where possible will increase the consistency and reliability of the information.

Marketing

In a market economy, prices guide production and consumption decisions (Tomek and Robinson 1990), and determine how scarce resources are rationed among competing, alternative uses (Watson and Holman 1977). Thus, prices play a central role in both the functioning and efficiency of a market. Watson and Holman (1977) stated that "prices determine what goods and services are produced, how they are produced, and who gets them." Accordingly, the determination of market prices, as opposed to discovering the prices of only a few individual transactions, should be a central goal of any industry. Agricultural prices are especially difficult to determine because of several factors including: (1) price volatility, (2) the biological aspects of agricultural as contrasted to manufacturing production, (3) seasonality of production, (4) time intervals between production decisions and harvest, and (5) the geographic dispersion of production units (Tomek and Robinson 1990). These same difficulties also apply to determining market prices for aquaculture products.

Since the seafood industry has not historically been considered part of agriculture and USDA has not overseen or regulated its activities, relatively little price information is available on fisheries products. However, within the last few years, USDA was designated the lead U.S. government agency for aquaculture development. Accordingly, the Economic Research Service (ERS) of USDA now publishes an Aquaculture Situation and Outlook. Few prices are published in the Aquaculture Situation and Outlook, and only those on catfish and trout are regularly reported. Since the catfish and trout industries are both well established, especially the catfish industry in the South, these prices are not difficult to obtain. For an emerging industry such as aquaculture in the North Central Region, however, no organized marketing channels for farm-raised fish exist, nor is it possible to identify all the producers in the region. Aquaculture industries in most other regions of the country are in a similarly immature state. Consequently, market prices for species other than catfish and trout are seldom, if ever, reported in the Aquaculture Situation and Outlook.

RELATED CURRENT AND PREVIOUS WORK

Aquaculture is a fledgling industry in the North Central Region. Because of this, very little information is published about fish production or producers for these states, or about the marketability of freshwater

species. In this section we report on work of the current Economics and Marketing Work Group, work related to the proposed Work Group objective, and on work of the proposed Work Group investigators.

Work of Current Economics and Marketing Work Group

Grower Characteristics

A total of 893 fish growers were identified and surveyed in north central states in 1991 under the current NCRAC Economics and Marketing project (Brown and Hushak 1991). A total of 451 growers (51 percent) responded. Of these, 123 either declined to answer or said they were not actually raising fish. Another 33 respondents were strictly baitfish capturers, wholesalers, live haulers or fee-fishing operators. That left 295 respondents, or 65 percent of the 451 respondents, who grew fish in the twelve states. The states with the most growers were Wisconsin, Minnesota, Ohio, Missouri, Michigan, and Illinois.

Aquaculture in the North Central Region is characterized by producers raising a variety of species for a variety of purposes. Fifty-nine percent of the respondents listed two or more types of aquaculture businesses. Over one-half of the fish producers (56 percent) raise fish for food at the food-size, fingerling or the egg stage. Close behind are those who raise game fish for stocking ponds and recreation (45 percent). Twenty-nine percent raise fish in fee-fishing operations, while 25 percent raise baitfish. Twenty-five percent wholesale or live-haul and 11 percent are involved in the capture of wild baitfish.

The most common species produced in the region were salmonids followed by catfish, bass, baitfish, sunfish, walleye, perch, carp, crustaceans including shrimp, temperate bass, pike, and tilapia. Table 1 shows the number of producers raising these species by state. The two most frequently grown species for food were trout and catfish. Of the 295 grower respondents, 104 or 35 percent raised trout, while 105 or 36 percent raised catfish.

One fifth of the respondents stated that their aquaculture business represented 75 to 100% of their family income, while 64 percent raised fish as a supplement to their income or a `money-making' hobby. Fifty-seven percent reported their gross sales were less than $10,000, compared to 16 percent who declared gross sales exceeding $100,000.

Table 1. Number of Producers Raising Species by State.

STATE:	IL	IN	IA	KS	MI	MN	MO	NE	OH	SD	WI	TOTAL
SPECIES:												
Baitfish[1]	6	3	4	6	5	26	10	7	16	1	9	93
Bass[2]	7	6	5	5	6	9	7	10	24		22	101
Carp[3]		5	2	5			11	2	8		1	34
Catfish	15	7	10	17	4	1	20	13	14	1	5	107
Crustacean[4]	4	1		2			2	1	6			16
Perch					8	5		6	12	1	9	41
Pike		1		1	5			1	1	3	13	
Temp. bass[5]	2	3	2	1			3		3			14
Tilapia	1		2	1			1		1		1	7
Salmonids[6]		1	4	2	19	13	5	16	9	2	39	110
Sunfish[7]	6	7	6	4	7	6	9	6	23		14	88
Walleye	3		6		3	19		2	1		13	47
#Respondents[8]	22	12	18	19	26	50	27	22	33	3	54	286

[1]Includes minnows (Bluntnose, Chub, Flathead, Red and Rosey Red), shiners (Golden and Redfin), Gambusia, Horny Head Chub, Buffalo fish, leeches, suckers and tadpoles.
[2]Includes bass (Black, Largemouth, Smallmouth and Rock) and crappie (Black and White).
[3]Includes carp (Bighead and Grass), Coppernose bream, Goldfish, Koi and White amur.
[4]Includes shrimp.
[5]Includes bass (Hybrid, Striped and White) and Striped perch.
[6]Includes trout (Brook, Brown, Donaldson, Golden, Rainbow Steelhead and Tiger), salmon (Atlantic and Coho) and Sunapee.
[7]Includes Bluegill, Hybrid Bluegill, sunfish (Green and Hybrid), Redear, and Warmouth.
[8]Producers raised multiple species. Totals are for number of respondents.

The most significant species by gross sales were salmonids (44 percent or $6,718,000), catfish (19 percent or $2,585,000), baitfish (14 percent or $1,888,000), walleye (8 percent or $1,108,000), and bass (5 percent or $653,000). Total gross sales by species and by state are listed in Table 2. Missouri reported the highest gross sales followed by Minnesota, Wisconsin, Ohio, Kansas, and Nebraska with a regional total of $18,669,000.

Several types of facilities were reported for raising many of the species. Ponds were the most frequently reported facility used to raise fish (89 percent of respondents), while 23 percent reported raceways, 24 percent tanks, 14 percent cages, and 3 percent reported `other' facilities. Fourteen percent of the respondents recirculated water through a filtration and an ammonia removal system.

Table 2. Total gross sales by species and by state ($U.S. x 1,000).[1]

STATE	IL	IN	IA	KS	MI	MN	MO	NE	OH	SD	WI	TOTAL[2]
SPECIES												
Baitfish	6	0	0	9	2	1,419	306	6	4	nr[3]	135	1,888
Bass	113	120	60	3	1	63	18	74	128	0	73	654
Carp	0	0	nr	17	0	0	127	nr	167	0	nr	371
Catfish	169	130	116	98	24	nr	1,897	81	69	nr	1	2,586
Crustacean	5	nr	0	nr	0	0	nr	nr	2	0	0	34
Perch	0	0	0	0	2	0	0	17	36	nr	7	63
Pikes	nr	0	0	0	nr	90	0	0	nr	nr	0	96
Salmonids	0	nr	5	nr	573	1,133	1,714	584	786	nr	1,355	6,179
Sunfish	82	224	4	0	61	1	50	21	98	0	14	556
Temperate bass	nr	126	nr	nr	0	0	75	0	2	0	0	353
Tilapia	0	0	nr	nr	0	0	nr	0	nr	0	nr	11
Walleye	7	0	156	0	15	894	0	nr	nr	0	32	1,108
Subtotal[2]	386	600	553	145	680	3,602	4,215	784	1,302	10	1,622	13,899
Residual[4]	38	442	77	1,106	244	886	485	289	206	300	697	4,770
TOTAL[2]	424	1,042	630	1,251	924	4,488	4,700	1,073	1,508	310	2,319	18,669

[1]Excluding sales from businesses which strictly capture baitfish, or those with fee-fishing operations using full-grown fish.
[2]Row and column sums may not equal totals due to exclusion of data because of confidentiality or because of data-rounding.
[3]nr=not reported due to confidentiality.
[4]Sales of un-specified species.

Preferences for Farm-Raised Products

Two surveys of firms which comprise the traditional marketing channels for fish and seafood products within the North Central Region were conducted in 1990 and 1991 (Gleckler 1991; Gleckler et al. 1991; Hushak et al. In press). The purpose of the studies was to gain an understanding of the current marketing channels (from producer to final consumer) in order to facilitate the marketing of farm-raised fish and seafood products within the region and to evaluate the marketability for fresh water species.

The results showed that channel catfish, trout, salmon, freshwater shrimp, and tilapia were the five freshwater species which were most frequently sold in the North Central Region. Respondents also indicated that fish and seafood species with the most marketing potential in the region were walleye, yellow perch, bluegill (sunfish), large mouth bass, and frogs.

The overall perception of farm-raised products was positive within the seafood distribution channels. On many specific qualities, farm-raised species were viewed as superior to wild-caught species. Most respondents clearly viewed farm-raised species as having less seasonality, easier availability, and greater

shipment accuracy than wild-caught species. Further, farm-raised fish and seafood products were perceived as fresher, healthier, and of higher quality than wild-caught species. Overall, 50 percent of the respondents believed farm-raised products were a somewhat better or superior product to wild-caught species.

These results indicate that it is possible to position a farm-raised product as a high-quality, high-valued product. This means that a farm-raised product may be marketed to consumers as a higher priced alternative to wild-caught species by emphasizing quality characteristics (freshness, uniformity, healthiness or safety). A farm-raised product can be marketed within the distribution channel as being a higher priced alternative to wild-caught species by emphasizing supply consistencies.

Most market channel members were very optimistic about the future of fish and seafood products. They felt that the demand for fish and seafood products had not yet reached its peak. So they were optimistic that domestic demand would continue to grow. Moreover, they felt that aquaculture products could benefit from that growth. In particular they indicated that current supplies of wild-caught species were not going to be sufficient to meet future demands for fish and seafood products. Therefore, they viewed a farm-raised product as a superior alternative and an avenue for further growth in the fish and seafood markets.

Work Related to Proposed Work Group Objective

A reasonable amount of research has been conducted to develop cost of production budgets for aquaculture. Unfortunately for producers in the North Central Region, the majority of this body of literature is devoted to pond production of catfish in southern states. The balance is focused mostly on less well known species produced in the South. Since production costs can differ dramatically by species, production system, and geographic location, most of the cost estimates in currently available literature are not applicable to aquaculture in the North Central Region.

Many of these reports or books are useful, however, for researchers desiring to develop production cost budgets for other species or regions because they provide examples of budget formats and what items should be included in a budget. The following is a sample of the catfish literature:

Branch, W., and D.S. Tilley. 1990. Oklahoma net-pen catfish production systems: estimated production levels and costs. Agricultural Experiment Station, Research Report P-912, Oklahoma State University, Stillwater.

Huner, J.V., and H.K. Dupree. 1984. Methods and economics of channel catfish production, and techniques for the culture of flathead catfish and other catfishes. From the Third Report to the Fish Farmers. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.

Keenum, M.E., and J.E. Waldrop. 1988. Economic analysis of farm-raised catfish production in Mississippi. Mississippi Agricultural and Forestry Experiment Station, Technical Bulletin 155, Mississippi State University.

Pomeroy, R.S., D.B. Luke, and T. Schwedler. 1989. Commercial catfish budgets and cashflow statements. Department of Agricultural Economics and Rural Sociology, Extension Economics Report 108, Cooperative Extension Service, Clemson University, South Carolina.

Other literature provides sample budgets for southern production of species other than catfish:

Baldridge, T., L. Dellenbarger, and D. Huffman. 1991. Economics of commercial redfish production in Louisiana. Department of Agricultural Economics and Agribusiness, DAE Research Report No. 688, Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge.

Dellenbarger, L.E., L.R. Vandeveer, and T.M. Clarke. 1987. Estimated investment requirements, production costs, and breakeven prices for crawfish in Louisiana, 1987. Department of Agricultural Economics and Agribusiness, DAE Research Report No. 670, Agricultural Experiment Station, Louisiana State University Agricultural Center, Baton Rouge.

Pomeroy, R.S., and J.R. Morrison. 1990. Enterprise budgets for blue tilapia production in ponds and cages in South Carolina. Department of Agricultural Economics and Rural Sociology, Extension Economics Report 121, Cooperative Extension Service, Clemson University, South Carolina.

Pomeroy, R.S., D.B. Luke, and J. Whetstone. 1989. Budgets and cashflow statements for South Carolina Crawfish Production. Department of Agricultural Economics and Rural Sociology,

Extension Economics Report 106, Cooperative Extension Service, Clemson University, South Carolina.

Some publications do exist which report cost estimates for fish production outside of the South and/or for species or production systems of particular interest to North Central producers:

Brown, J.W., J.E. Easley, Jr., and R.G. Hodson. 1988. Investment and production costs for the hybrid striped bass **x** white bass in North Carolina. Working Paper 88-2. University of North Carolina Sea Grant College Program, North Carolina State University, Raleigh.

Cost, C.F., and T.M. Stockdale. 1985. The potential for profit from aquaculture in Ohio. Unpublished manuscript, School of Natural Resources, Ohio State University, Columbus.

Easley, J.E., Jr. 1987. Economic research: the striped bass-white bass hybrid. Pages 83-91 *in* Hybrid striped bass culture: status and perspective. University of North Carolina Sea Grant College Publication 87-03, North Carolina State University, Raleigh.

Gempesaw, C.M., II, J.R. Bacon, and F.F. Wirth. 1992. Economies of pond size for hybrid striped bass growout. Journal World Aquaculture Society 23:38-48.

Gempesaw, C.M., II, F.F. Wirth, and J.R. Bacon. 1992. A financial analysis of integration in aquaculture production: the case of the hybrid striped bass. Aquaculture 104:193-215.

Liao, D.S. 1985. The economic and market potential for hybrid bass aquaculture in estuarine waters: a preliminary evaluation. Journal of the World Mariculture Society, 16:151-157.

Losordo, T.M., and P.W. Westerman. 1991. An analysis of biological, economic and engineering factors effecting the cost of fish production in recirculating aquaculture systems. Proceedings of workshop on design of high density recirculating aquaculture systems. Louisiana State University, Baton Rouge.

Losordo, T.M., J.E. Easley, and P.W. Westerman. 1989. The preliminary results of a feasibility study of fish production in recirculating aquaculture systems. Paper No. 897557 presented at the American Society of Agricultural Engineers 1989 International Winter Meeting, New Orleans.

O'Rourke, P.D. 1990. Intensive aquaculture economics: can it be profitable? Pages 35-43 *in* D.L. Swann, editor. Proceedings from the regional workshop on commercial fish culture using water reuse systems. Illinois State University, Normal.

O'Rourke, P.D. 1991. Preproduction analysis of economic profitability for recirculating aquaculture systems. Workshop on design of high density recirculating aquaculture systems. Louisiana State University, Baton Rouge.

O'Rourke, P.D. 1991. Current status on profits in recirculating systems. Proceedings of the second annual workshop: commercial aquaculture using water recirculating systems. Illinois State University, Normal.

Posadas, B., and J. Homziak. 1991. Survey of hybrid striped bass fry and fingerling producers. Aquaculture Magazine 17(1):39-45.

Rosati, R., P.D. O'Rourke, and R.D. Henry. 1990. Preliminary results of high density fish culture in a water recirculating system. National symposium for freshwater crayfish aquaculture. Fremantle College, Fremantle, Australia.

Rosati, R., P.D. O'Rourke, and R.D. Henry. 1989. Commercial tilapia production in a water reuse system. 1989 International Winter Meeting of the American Society of Agricultural Engineers, New Orleans.

Strand, I., and D. Lipton. 1989. Aquaculture: an alternative for Maryland farmers. Pages 37-45 *in* Proceedings from the governor's conference on the future of Maryland agriculture, Baltimore.

VanOlst, J.C., and J.M. Carlberg. 1990. Commercial culture of hybrid striped bass: status and potential. Aquaculture Magazine. 16(1):49-59.

Wirth, F.F., C.M. Gempesaw II, J.R. Bacon, and G. Vaughn. 1990. A financial simulation analysis of hybrid striped bass production stages from hatchery to market. Selected paper presented at the American Agriculture Economics Association Annual Meeting, Vancouver.

Other economics literature provides valuable insights on procedures and methods for analysis of commercial aquaculture:

Cacho, O.J., U. Hatch, and H. Kinnucan. 1990. Bioeconomic analysis of fish growth: effects of dietary protein and ration size. Aquaculture 88(1990):223-238.

Cacho, O.J., H. Kinnucan, and U. Hatch. 1991. Optimal control of fish growth. American Journal of Agricultural Economics, February: 174-183.

Hatch, U., and H. Kinnucan. 1992. Aquaculture: models and economics. Westview Press, Boulder, Colorado.

Hatch, U., S. Sindelar, D. Rouse, and H. Perez. 1987. Demonstrating the use of risk programming for aquaculture farm management: The case of *Penaeid* shrimp in Panama. Journal of the World Aquaculture Society 18(4):260-262.

Hawkins, R.O., D.W. Nordquist, R.H. Craven, J.A. yates, and K.S. Klair. 1985. An overview of FINPAK: a computerized farm financial planning and analysis package. University of Minnesota, Cooperative Extension Service, St. Paul.

Work of the Proposed Work Group Investigators

Illinois State University (ISU)
Pat O'Rourke has been engaged in agribusiness management teaching and research for over 15 years, the last 10 at ISU. He has specifically been engaged in economic analysis of commercial aquaculture in the Midwest since 1988. The focus of his research has been on ascertaining the economic viability of commercial food fish production in Illinois and the Midwestern portion of the United States. That work has included the synthesis of cost of production budgets for commercial scale food fish production.

One of the more serious limitations to these cost of production studies has been the lack of publicly available data from actual commercial producers for several potential commercial species for this region (especially walleye, yellow perch, and hybrid striped bass). While there is some basic cost of production data available for hybrid striped bass, verifiable cost of production data for the other two species is almost non-existent.

The major challenge then for this project will be to surface as much actual producer data as possible and supplement it with acceptable data developed from other sources in developing models for commercial production of the identified species. This is not an approach that is new or unusual for economists who often must use simulation modeling to develop the first publicly available cost of production budgets for new agricultural enterprises.

O'Rourke and other scientists at ISU have conducted field trials of aquaculture production systems at the ISU Laboratory Farm and ADM Inc., headquarters in Decatur, Illinois. They have developed several simulation models for fish production in indoor intensive recirculating aquaculture systems. These systems, if economically viable, would be important to the future of commercial fish production in the Midwest for several reasons: (1) environmental control is enhanced with respect to water quality, temperature and potential contaminants; (2) predator control is improved; and 3) year round production and marketing is made possible. These simulation models can be adapted to pond or raceway production system simulations.

Southern Illinois University-Carbondale (SIUC)
Sue Kohler is a Research Project Specialist with the Office of Economic and Regional Development and an Adjunct Assistant Professor in the Department of Agricultural Education at SIUC. Research areas include aquaculture development as it relates to regional economies. Previous research includes an aquaculture market research study funded by the Southern Illinois Coalition. Kohler also received funding from Illinois/Indiana Sea Grant Program and NCRAC to evaluate a university-based aquaculture training program for Cooperative Extension Service personnel. She has also published two reports on organizational structures for aquaculture businesses. Currently Kohler is a member of the Hybrid Striped Bass Growers Association. Current work is focused on expanding aquaculture enterprises in southern Illinois and developing prototypes for aquaculture business plans.

Purdue University

Jean Riepe and Marshall Martin, along with others in Purdue University's Department of Agricultural Economics, have conducted research and extension activities in aquaculture economics and marketing since acquiring grant funding from the Indiana Department of Commerce in December 1989, about the same time Purdue hired its first aquaculture extension specialist (LaDon Swann). Since Swann's training is in aquaculture production, he has relied on staff in the Department of Agricultural Economics, and Jean Riepe in particular, to provide him with guidance and contributions on aquaculture economics and marketing. Riepe has worked closely with Swann and Paul Brown (faculty member specializing in fish nutrition) to develop enterprise budgets based on their production research with hybrid striped bass. Together they have: (1) developed for an animal science professional meeting a presentation which examined fingerling production in cages; (2) published an extension publication analyzing the profitability of hybrid striped bass cage culture; and (3) submitted an article to the *Journal of the World Aquaculture Society* assessing different levels of protein in the hybrid striped bass diet. With input from Swann, Riepe prepared production budgets and marketing suggestions for a cage culture regional workshop. John Kadlec, an agricultural economics professor, has supervised a Master's thesis exploring the economic feasibility of catfish production in Indiana. Riepe and Swann are currently working with Kadlec to finalize an extension article from this thesis.

Various staff in the Department of Agricultural Economics have worked in areas of aquaculture other than economics. Riepe and others have helped Swann train Indiana county agricultural agents in various economics, marketing, and business aspects of aquaculture. Along with Martin and Schrader, Riepe developed a survey to elicit information and attitudes from Indiana restaurants concerning current and potential purchases of fish, particularly farm-raised fish. A short extension paper has been published which highlights the major results, while a station bulletin reports results in detail.

The past and current record of Riepe, Martin, and others in the Department of Agricultural Economics at Purdue University reveals their interest in aquaculture economics and marketing and their strong ties with others at Purdue who are more oriented towards production research and extension.

ANTICIPATED BENEFITS

The overall goal of this collaborative project is to enhance potential commercial production of walleye, yellow perch and hybrid striped bass by developing enterprise budgets for production in the North Central Region. This supports the mission of NCRAC, especially by conducting research "for the enhancement of viable and profitable commercial aquacultural production in the United States for the benefit of producers, consumers, and the American economy" (North Central Regional Aquaculture Center 1989).

The cost of production or budgeting components of this project offer the potential to help in identifying production systems for walleye, yellow perch and hybrid striped bass most likely to be commercially viable. Information on production costs is quite limited since it must be location, facility and species specific. Enterprise budgets will enable producers to access the needed budget costs for comparisons to their own operation, for projections on the feasibility of a new enterprise, or for increased production in their present facility in comparison to reasonable expectations about market prices. Economic feasibility analysis will help producers evaluate technical advances in fish production.

This contribution is critical as a guide to future research funding in the various species and production systems suitable for commercial production. More specifically, the work under this proposed project will attempt to quantify commercial production budgets for walleye, yellow perch and hybrid striped bass in appropriate production systems for the region.

The distribution of research results from this project through the Extension liaison committee using computer budget software will provide a structured and informed dissemination system which is credible with producers, financial institutions and others.

OBJECTIVE

The overall goal of this project is to investigate the potential economic viability of farm production of three specific fish species in the North Central Region (walleye, yellow perch, and hybrid striped bass), and to provide current information to fish producers of the region. The specific objective of the project is:

To develop cost of production budgets and expected revenues for the raising of food-sized walleye, yellow perch and hybrid striped bass on farms in the North Central Region.

PROCEDURES

There will be a three-phased approach in developing cost of production budgets for commercial fish production in the North Central Region (NCR). These activities will be led by Pat O'Rourke at ISU. In the first phase, the PIs will review research and trade literature for information and data relevant to ascertaining the potential economic viability of commercial production in the NCR for walleye (O'Rourke), yellow perch (Riepe) and hybrid striped bass (Kohler). The PIs will also utilize extension personnel associated with NCRAC and the producer lists and production budgets developed by Sherrick and Hushak as a starting point in the analysis of the three identified species. Close interaction will be developed with the species specific projects (Work Groups) that NCRAC is funding on walleye, yellow perch, and hybrid striped bass.

The potential production systems that will be considered will include open ponds, flow-through raceways, intensive tank culture, cage culture in ponds, and combinations of intensive-extensive culture systems. Extension personnel and the species specific Work Groups will be consulted for ascertaining which of these systems should be given priority for investigation and analysis in the initial phases of this project.

The PIs will interact with the appropriate Work Group for obtaining the necessary biological characteristics and in developing appropriate formats for enterprise budgets. The Walleye and Yellow Perch Work Groups will be conducting field trials to demonstrate the efficacy of raising these species using selected production systems. Arrangements will be made with the producers to provide reasonably detailed investment and cost of production data. In regard to hybrid striped bass, the NCRAC Work Group does not have plans for similar field trials. However, the Work Group members and affiliated extension personnel have significant experience of working with producers of this fish and arrangements will be made to work with those individuals willing to provide detailed investment and cost of production data. Table 3 details factors of production (including investment and operation data) for which information will be collected from producers of these three fish species. Some types of production systems will not require all of the data listed in Table 3. For example, supplemental oxygen is not normally a production expense in open-pond systems. This data, together with the biological and husbandry information provided by the Work Groups and research literature will provide a basis for estimating cost of production budgets for the three species in selected alternative production systems. Where possible, investment and operating data will be reviewed with other selected producers in the NCR as well as research and extension personnel familiar with production of these species.

Table 3. Data to be collected on walleye, yellow perch, and hybrid striped bass production systems.

ITEM	DETAIL
Investment: Land Facilities Equipment	**Will include:** Purchase price or market value Economic life Depreciable life Repair and maintenance Property insurance Property tax Interest expense
Operations: Fingerlings Feed Labor charges Management charges Energy Oxygen Water Chemicals Licenses and fees Production insurance Marketing/hauling Other expenses	**Will include:** Quantity per period Physical description Source Price paid or market value

The procedures described above for collecting and verifying cost of production data for the three species is believed to be the best approach given: (1) the number of verified commercial producers in the NCR of these species is very small (relative to other agricultural enterprises), (2) the number of producers

willing to share production data and having good production records is small (based on previous experience for collecting this type of data by the NCRAC Economics and Marketing Work Group), and (3) the budget for this project will not support both a general cost of production survey of all identified producers and the procedures described above.

In the second phase, hypothetical investment and production budgets will be developed for the three species and appropriate commercial production systems. These will be shared with producers/cooperators and the other Work Groups to assist in identifying additional data needs. The source and reliability of all data will be thoroughly documented. Producers of walleye, yellow perch, and hybrid striped bass will be contacted, visited and encouraged to assist in this stage of further developing the data for the cost of production budgets. The number of producers/cooperators contacted in this second phase will be limited by the project's budget. Other data sources and economic-engineering model estimates will be utilized to support further development of realistic investment and production budgets.

In the third phase, the cost of production parameters will be incorporated into computerized budgeting software models which are determined to be most useful to producers, potential producers/investors and the aquaculture research and extension community. Ordinary spreadsheet software (such as Lotus, Excel, and Quattro Pro) as well as farm budgeting software (such as FINPAC) will be evaluated for this purpose. Results will be disseminated through appropriate professional journals, extension publications and the trade press.

FACILITIES

Each of the participating universities has full access to university computer facilities and numerous PCs. Each university employs full-time programmers to assist faculty and staff in research. No special or unique facilities or laboratories are required for this project.

REFERENCES

Brown, G.J., and L.J. Hushak. 1991. The NCRAC producers survey and what we have learned: an interim report. Pages 69-71 *in* Proceedings of the North Central Aquaculture Conference, Kalamazoo, Michigan, March 18-21, 1991. Michigan Department of Natural Resources, Wolf Lake Fish Hatchery, Mattawan, Michigan.

Gleckler, D.P. 1991. Southern North Central Region wholesale and retail fish and seafood sellers survey. M.S. thesis, Ohio State University, Columbus.

Gleckler, D.P., L.J. Hushak, and M.E. Gerlow. 1991. Distribution channels for wild-caught and farm raised fish and seafood. Pages 77-81 *in* Proceedings of the North Central Aquaculture Conference, Kalamazoo, Michigan, March 18-21, 1991. Michigan Department of Natural Resources, Wolf Lake Fish Hatchery, Mattawan, Michigan.

Hushak, L.J., C.F. Cole, and D.P. Gleckler. In press. Survey of wholesale and retail buyers in the six southern states of the North Central Region. Technical Bulletin Series #104, North Central Regional Aquaculture Center, East Lansing, Michigan.

Hushak, L.J., D.W. Floyd, and R.L. Vertrees. 1992. The aquaculture industry: is growing fish a competitive enterprise in North Central states? Ohio's Challenge 5(1):3-5.

North Central Regional Aquaculture Center. 1989. Operations manual. North Central Regional Aquaculture Center, East Lansing, Michigan.

Robinson, M, D.F. Zepponi, and B.J.Sherrick. 1991. Assessing market potential for new and existing species in the North Central Region. Pages 72-76 *in* Proceedings of the North Central Aquaculture Conference, Kalamazoo, Michigan, March 18-21, 1991. Michigan Department of Natural Resources, Wolf Lake Fish Hatchery, Mattawan, Michigan.

Thomas, S.K., R.M. Sullivan, D.W. Floyd, and R.L. Vertrees. 1992. Aquaculture law in the North Central states: a digest of state statutes pertaining to the production and marketing of aquaculture products. Technical Bulletin Series #101, North Central Regional Aquaculture Center.

Tomek, W.G., and K.L. Robinson. 1990. Agricultural product prices. Third Edition. Cornell University Press, Ithaca.

USDA. Various Issues. Aquaculture Situation and Outlook. Economic Research Service.

Watson, D.S., and M.A. Holman. 1977. Price theory and its uses. Houghton Mifflin Company, Boston.

PROJECT LEADERS

State	Name/Institution	Area of Specialization
Indiana	Patrick D. O'Rourke Illinois State University	Aquaculture Production Economics
	Susan T. Kohler Southern Illinois University-Carbondale	Aquaculture Production Economics
Illinois	Marshall A. Martin Purdue University	Aquaculture Production Economics
	Jean R. Riepe Purdue University	Aquaculture Production Economics

PARTICIPATING INSTITUTIONS AND PRINCIPAL INVESTIGATORS

Illinois State University (ISU)
Patrick D. O'Rourke

Southern Illinois University-Carbondale (SIUC)
Susan T. Kohler

Purdue University
Marshall A. Martin
Jean R. Riepe

PROPOSED ECONOMICS/MARKETING BUDGET FOR
ILLINOIS STATE UNIVERSITY

(O'Rourke)

	Year 1 No.	Year 1 FTEs	Year 2 No.	Year 2 FTEs	Year 1	Year 2
A. Salaries and Wages						
1. No. of Senior Personnel & FTEs[1]						
a. (Co)-PI(s)	1	0.15	1	0.15	$4,500	$4,500
b. Senior Associates						
2. No. of Other Personnel (Non-Faculty) & FTEs						
a. Research Assoc./Postdoc						
b. Other Professionals						
c. Graduate Students	1	0.50	1	0.50	$0	$0
d. Prebaccalaureate Students	1	0.50	1	0.50	$2,200	$2,200
e. Secretarial-Clerical						
f. Technical, Shop, and Other						
Total Salaries and Wages					$6,700	$6,700
B. Fringe Benefits (23% of 1a)					$1,035	$1,035
C. **Total Salaries, Wages and Fringe Benefits**					$7,735	$7,735
D. Nonexpendable Equipment					$0	$0
E. Materials and Supplies					$500	$200
F. Travel - Domestic (*Including Canada*)					$3,000	$2,000
G. Other Direct Costs					$400	$200
TOTAL PROJECT COSTS PER YEAR (*C through G*)					$11,635	$10,135
TOTAL PROJECT COSTS					$21,770	

[1]FTEs = Full Time Equivalents based on 12 months.

BUDGET JUSTIFICATION FOR ILLINOIS STATE UNIVERSITY

(O'Rourke)

A. Salaries and Wages. The PI is a tenured Associate Professor on annual nine month contract. The contract period typically includes teaching six courses and conducting departmentally assigned research projects. Most externally funded research contracts are allocated to the summer employment period for salaries with the exception of graduate student salaries. The one month summer appointment in this budget is necessary to cover the PI's commitment to the project.

B. Fringe Benefits. ISU uses the rate of 23% times faculty salaries for fringe benefits.

E. Materials and Supplies. Expenses for general office/computer supplies and software.

F. Travel. Covers estimated travel for visits to producers, university professionals and others in the aquaculture industry for consultation and data collection. Includes travel funding for Work Group meetings and for professional meetings related to conduct and results of the project.

G. Other Direct Costs. Telecommunications (telephone, FAX, e-mail), photocopying, and postage.

PROPOSED ECONOMICS/MARKETING BUDGET FOR
SOUTHERN ILLINOIS UNIVERSITY-CARBONDALE

(Kohler)

	Year 1		Year 2		Year 1	Year 2
A. Salaries and Wages	No.	FTEs	No.	FTEs		
1. No. of Senior Personnel & FTEs[1]						
a. (Co)-PI(s)	1	0.10	1	0.10	$0	$0
b. Senior Associates						
2. No. of Other Personnel (Non-Faculty) & FTEs						
a. Research Assoc./Postdoc						
b. Other Professionals						
c. Graduate Students						
d. Prebaccalaureate Students	1	0.10	1	0.10	$1,000	$1,000
e. Secretarial-Clerical						
f. Technical, Shop, and Other						
Total Salaries and Wages					$1,000	$1,000
B. Fringe Benefits					$0	$0
C. **Total Salaries, Wages and Fringe Benefits**					$1,000	$1,000
D. Nonexpendable Equipment					$0	$0
E. Materials and Supplies					$1,000	$1,000
F. Travel - Domestic (*Including Canada*)					$2,000	$2,000
G. Other Direct Costs					$1,000	$1,000
TOTAL PROJECT COSTS PER YEAR (*C through G*)					$5,000	$5,000
			TOTAL PROJECT COSTS		$10,000	

[1]FTEs = Full Time Equivalents based on 12 months.

BUDGET JUSTIFICATION FOR SOUTHERN ILLINOIS UNIVERSITY-CARBONDALE

(Kohler)

A. Salaries and Wages. A Prebaccalaureate Student to assist PI in data collection.

E. Material and Supplies. Reference materials, printer supplies, etc.

F. Travel. Travel to obtain information from growers and/or suppliers; travel to work group meeting(s); travel to grower's association meeting(s).

G. Other Direct Costs. Telecommunications (telephone, FAX, e-mail), photocopying, and postage.

PROPOSED ECONOMICS/MARKETING BUDGET FOR PURDUE UNIVERSITY

(Martin and Riepe)

	Year 1		Year 2		Year 1	Year 2
A. Salaries and Wages	Year 1 No.	Year 1 FTEs	Year 2 No.	Year 2 FTEs		
1. No. of Senior Personnel & FTEs[1]						
a. (Co)-PI(s)	2	0.15	2	0.08	$3,772	$1,906
b. Senior Associates						
2. No. of Other Personnel (Non-Faculty) & FTEs						
a. Research Assoc./Postdoc						
b. Other Professionals						
c. Graduate Students						
d. Prebaccalaureate Students						
e. Secretarial-Clerical						
f. Technical, Shop, and Other						
Total Salaries and Wages					$3,772	$1,906
B. Fringe Benefits (27.1% of 1a)					$1,022	$517
C. **Total Salaries, Wages and Fringe Benefits**					$4,794	$2,423
D. Nonexpendable Equipment					$0	$0
E. Materials and Supplies					$75	$38
F. Travel - Domestic (*Including Canada*)					$600	$300
G. Other Direct Costs					$0	$0
TOTAL PROJECT COSTS PER YEAR (*C through G*)					$5,469	$2,761
TOTAL PROJECT COSTS					$8,230	

[1]FTEs = Full Time Equivalents based on 12 months.

BUDGET JUSTIFICATION FOR PURDUE UNIVERSITY

(Martin and Riepe)

A. Salaries and Wages. Jean Riepe, a co-principal investigator, is a nonfaculty research associate whose salary and benefits are totally supported through grant funding. Allocation of project funds for Ms. Riepe's salary and benefits is therefore a prerequisite for her undertaking work on this project. Riepe's demonstrated interest and experience in aquaculture economics and marketing research in the North Central Region make her an essential contributor to this project. Because of her work in this area, it is appropriate that she be included in the project as a Co-PI. However, the Principal Investigator from Purdue University must be Marshall Martin since he is a faculty member and Riepe is not.

B. Fringe Benefits. Purdue University uses the rate of 27.1% times research associate salaries for computing fringe benefit costs.

E. Materials and Supplies. General office and computer supplies.

F. Travel. Travel funds are to visit aquaculture producers, producer groups, university professionals, etc. for data collection and consultation.

AQUACULTURE ECONOMICS AND MARKETING IN THE NORTH CENTRAL REGION

Budget Summary for Each Participating Institution at $22.1K for the First Year

	ISU	SIUC	Purdue	TOTALS
Total Salaries and Wages	$6,700	$1,000	$3,772	$11,472
Fringe Benefits	$1,035	$0	$1,022	$2,057
Total Salaries, Wages and Benefits	$7,735	$1,000	$4,794	$13,529
Nonexpendable Equipment	$0	$0	$0	$0
Materials and Supplies	$500	$1,000	$75	$1,575
Travel	$3,000	$2,000	$600	$5,600
Other Direct Costs	$400	$1,000	$0	$1,400
TOTAL PROJECT COSTS	**$11,635**	**$5,000**	**$5,469**	**$22,104**

Budget Summary for Each Participating Institution at $17.9K for the Second Year

	ISU	SIUC	Purdue	TOTALS
Total Salaries and Wages	$6,700	$1,000	$1,906	$9,606
Fringe Benefits	$1,035	$0	$517	$1,552
Total Salaries, Wages and Benefits	$7,735	$1,000	$2,423	$11,158
Nonexpendable Equipment	$0	$0	$0	$0
Materials and Supplies	$200	$1,000	$38	$1,238
Travel	$2,000	$2,000	$300	$4,300
Other Direct Costs	$200	$1,000	$0	$1,200
TOTAL PROJECT COSTS	**$10,135**	**$5,000**	**$2,761**	**$17,896**

RESOURCE COMMITMENT FROM INSTITUTIONS[1]

State/Institution		Year 1	Year 2
Illinois State University			
Salaries and Benefits: SY @ 0.083 FTE		$4,500	$4,500
Waiver of Overhead		$3,551	$3,551
	Total	$8,051	$8,051
Southern Illinois University-Carbondale			
Salaries and Benefits: SY @ 0.10 FTE		$3,703	$3,703
Waiver of Overhead		$2,100	$2,100
	Total	$5,803	$5,803
Purdue University			
Salaries and Benefits SY @ 0.025 FTE		$2,025	$2,025
Waiver of Overhead		$3,418	$1,709
	Total	$5,443	$3,734
	Total per Year	$19,297	$17,588
	GRAND TOTAL	$36,885	

[1]Since cost sharing is not a legal requirement some universities chose not to provide resource commitment from institutions

SCHEDULE FOR COMPLETION OF OBJECTIVES

All PIs will be responsible for assisting in the conduct of this project for all three identified species. Specific responsibilities for surfacing species specific data and information, as assigned under First Phase: Year 1, will continue throughout the project period.

FIRST PHASE:

Year 1: Literature review, developing lists of potential cooperating producers, and gathering of data from expert sources and producers. Assigned species: ISU -- walleye; SIUC -- hybrid striped bass; Purdue University -- yellow perch.

Year 2: Continued coordination and dialogue with producers, extension personnel and species Work Groups.

SECOND PHASE:

Year 1: Begin development of investment and production budget models for appropriate production systems by species. All PIs will contribute to the development for each species. Input from producers through telephone and interview techniques will be assembled.

Year 2: Continued development of species/production systems budgets with input solicited from producers, extension personnel and species work groups.

THIRD PHASE:

Year 1: Evaluate alternative software for evaluation and presentation of species specific enterprise budgets.

Year 2: Begin dissemination of species/production system specific enterprise budget reports and analysis. Computerized budgeting software models will be developed.

LIST OF PRINCIPAL INVESTIGATORS

Susan T. Kohler, Southern Illinois University-Carbondale

Marshall A. Martin, Purdue University

Patrick D. O'Rourke, Illinois State University

Jean R. Riepe, Purdue University

VITA

Susan T. Kohler
Research Specialist
Office of Economic and Regional Development
Southern Illinois University-Carbondale
Carbondale, IL 62901

Phone: (618) 536-4451
FAX: (618) 453-5040

EDUCATION

B.S. St. Mary's College of Maryland, 1974
M.S. Southern Illinois University-Carbondale, 1984
Ph.D. Southern Illinois University-Carbondale, 1992

POSITIONS

Research Specialist, Office of Economic and Regional Development, Southern Illinois University-Carbondale (1990-present) and Adjunct Assistant Professor, Department of Agricultural Education, Southern Illinois University-Carbondale (1993-present)
Researcher II, Department of Botany, Southern Illinois University-Carbondale (1985-1990)

SCIENTIFIC AND PROFESSIONAL ORGANIZATIONS

Striped Bass Growers Association

SELECTED PUBLICATIONS

Kohler, S.T., and D. Selock. 1991. Organizational structures available to aquaculture businesses. SIUC Fisheries Bulletin No. 12. Illinois Aquaculture Research and Demonstration Center, Carbondale.

Curry, M.P., S.T. Kohler, M. Wagner, and D. Selock. 1991. Market research to support the development of the southern Illinois aquaculture industry. Report to the Southern Illinois Coalition.

Kohler, S.T., and D. Selock. 1992. Evaluation of a university-based aquaculture training program for Cooperative Extension Service personnel. World Aquaculture Society Conference, Orlando.

Kohler, S.T., and D.A. Selock. 1992. Choosing an Organizational Structure for Your Aquaculture Business. North Central Regional Aquaculture Center Publication No. 103.

Kohler, S.T., and D.A. Selock. 1993. Evaluation of a Cooperative Extension Service Inservice Aquaculture Training Program. Illinois-Indiana Sea Grant Program Research Report No. IL-IN-SG-R-93-3, University of Illinois, Urbana.

VITA

Marshall A. Martin
Department of Agricultural Economics
Purdue University
1145 Krannert Building
West Lafayette, IN 47907-1145

Phone: (317) 494-4268
FAX: (317) 496-1224

EDUCATION

B.S. Iowa State University, 1966
M.S. Purdue University, 1972
Ph.D. Purdue University, 1976

POSITIONS

Professor, Department of Agricultural Economics, Purdue University (1990-present)
Director, Center for Agricultural Policy and Technology Assessment, Purdue University (1988-present)
Associate Professor, Department of Agricultural Economics, Purdue University (1981-1990)
Assistant Professor, Department of Agricultural Economics, Purdue University (1976-1981)
Graduate Instructor in Research, Department of Applied Social Sciences, University of Sao Paulo, Piracicaba, Sao Paulo, Brazil (1974-1975)

PROFESSIONAL ORGANIZATIONS

American Agricultural Economics Association
American Association for the Advancement of Science
American Economics Association

SELECTED PUBLICATIONS

Riepe, J.R., and M.A. Martin. 1992. Indiana restaurants: a promising market for Indiana aquaculture. Purdue Agricultural Economics Report, Purdue University, West Lafayette, Indiana.

Foltz, J.C., and M.A. Martin. 1991. Inclusion of alfalfa (*Medicago Sativa L.*) in crop rotations in the eastern corn belt: some environmental and economic implications. Journal of Sustainable Agriculture 2(2):117-133.

Baumgardt, B.R., and M.A. Martin, editors. 1991. Agricultural biotechnology: issues and choices. Agricultural Experiment Station, Purdue University, West Layafette, Indiana.

Martin, M.A., M.M. Schreiber, J.R. Riepe, and J.R. Bahr. 1991. The economics of alternative tillage systems, crop rotations, and herbicide use on three representative east-central corn belt farms. Weed Science 39:299-307.

Guither, H.D., B.F. Jones, M.A. Martin, and R.G.F. Spitze. 1989. U.S. farmers' preferences for agricultural and food policy in the 1990s. North Central Regional Extension Publication 361. North Central Regional Research Publication 321 and Illinois Agricultural Experiment Station Bulletin 787.

VITA

Patrick D. O'Rourke
Associate Professor
5020 Department of Agriculture
Illinois State University
Normal, IL 61761

Phone: (309) 438-3492
FAX: (309) 438-5037

EDUCATION

B.S. University of Illinois, 1969
M.S. Purdue University, 1971
Ph.D. Purdue University, 1979

POSITIONS

Associate Professor, Department of Agriculture, Illinois State University (1987-present)
Assistant Professor, Department of Agriculture, Illinois State University (1983-1987)
Assistant Professor, Department of Agricultural Economics, Purdue University (1979-1983)

SCIENTIFIC AND PROFESSIONAL ORGANIZATIONS

American Agricultural Economics Association
Illinois Aquaculture Task Force: Chair of Research Committee
International Agribusiness Management Association
Southern Agricultural Economics Association

SELECTED PUBLICATIONS

Kneller, P.B., W.N. Lockwood Jr., P.D. O'Rourke, and S.W. Waite. In press. Aquaculture and mobile fish processing. Journal of Environmental Health.

Rosati, R.R., P.D. O'Rourke, K.T. Tudor and R.D. Henry. 1993. Performance of a raceway and vertical screen filter while growing *Tilapia nilotica* under commercial conditions. Presentation for Aquaculture Engineering: An International Conference of Engineering Techniques for Modern Aquaculture, Spokane.

O'Rourke, P.D. 1991. Preproduction analysis of economic profitability for recirculating aquaculture systems. Workshop on design of high density recirculating aquaculture systems. Louisiana State University, Baton Rouge.

O'Rourke, P.D. 1991. Current status on profits in recirculating systems. Proceedings of the second annual workshop: commercial aquaculture using water recirculating systems. Illinois State University, Normal.

Rosati, R., P.D. O'Rourke, and R.D. Henry. 1990. Preliminary results of high density fish culture in a water recirculating system. National symposium for freshwater crayfish aquaculture. Fremantle College, Fremantle, Australia.

Rosati, R., P.D. O'Rourke, and R.D. Henry. 1989. Commercial tilapia production in a water reuse system. 1989 International Winter Meeting of the American Society of Agricultural Engineers. New Orleans.

VITA

Jean Rosscup Riepe
Department of Agricultural Economics
Purdue University
1145 Krannert Bldg
West Lafayette, IN 47907-1145

Phone: (317) 494-4301
FAX: (317) 496-1224

EDUCATION

B.S. North Dakota State University, 1981
M.S. North Dakota State University, 1987

POSITIONS

Research Associate, Department of Agricultural Economics, Center for Agricultural Policy and Technology Assessment, Purdue University (1988-present)
Graduate Research Assistant, Department of Agricultural Economics, Purdue University (1987-1988)
Graduate Research Assistant, Department of Agricultural Economics, North Dakota State University (1984-1987)
Economist (Co-op), USDA, Foreign Agricultural Service (1985-1986)
Grain/Futures Accountant & Grain Buyer, Atwood-Larson Company, Minneapolis, MN (1981-1984)

PROFESSIONAL ORGANIZATIONS

Sigma Xi, Associate Member

SELECTED PUBLICATIONS

Riepe, J.R., M.A. Martin, and L.F. Schrader. 1993. Indiana restaurants as a market for farm-raised fish: results from a 1991 survey. SB-665, Agricultural Experiment Station, Purdue University, West Lafayette, Indiana.

Riepe, J.R., L. Swann, and P.B. Brown. 1992. Analyzing the profitability of hybrid striped bass cage culture. Fact Sheet AS-487, Sea Grant No. IL-IN-SG-FS-92-18. Aquaculture Extension, Illinois-Indiana Sea Grant Program, Purdue University, West Lafayette, Indiana.

Riepe, J.R., and M.A. Martin. 1992. Indiana restaurants: a promising market for Indiana aquaculture. Purdue Agricultural Economics Report., Purdue University, West Lafayette, Indiana.

Swann, L., and J.R. Riepe. 1991. Making wise choices when direct marketing your aquaculture products. Fact Sheet AS-464, Sea Grant No. IL-IN-SG-FS-91-2, Aquaculture Extension, Illinois-Indiana Sea Grant Program, Purdue University, West Lafayette, Indiana.

Schrader, L.F., and J.R. Riepe. 1990. Marketing aquaculture products. Pages 44-48 *in* D.L. Swann editor. Proceedings of the regional workshop on commercial fish culture using water reuse systems. Illinois State University, Normal.

Riepe, J.R. 1990. Cage culture economics. Pages 23-29 *in* D.L. Swann and P.B. Brown editors. Proceedings of the midwest regional cage fish culture workshop, Jasper, Indiana. Purdue Unversity, West Lafayette, Indiana.