

STATUS OF THE BAIT INDUSTRY IN THE NORTH CENTRAL REGION

Chairperson: Daniel W. Coble, Wisconsin Cooperative Fishery Research Unit, University of Wisconsin-Stevens Point

Extension Liaison: Daniel A. Selock, Southern Illinois University-Carbondale

Funding Request: \$62,000

Duration: 2 Years (September 1, 1992 - August 31, 1994)

Objectives:

1. Conduct a comprehensive survey of the status of the bait fish industry in selected north central states to determine: a. species used; b. sizes of species marketed; c. sources of species; d. seasonal availability; e. shortfalls in supplies; f. relative value of various fish and nonfish species; and g. common problems of the industry that may need to be addressed by research.
2. Estimate the costs of culturing bait species commonly used in the North Central Region in selected types of production facilities, e.g., extensive and intensive pond culture, tanks, raceways.
3. Estimate the economic contribution (output, employment, income) generated by the bait industry to selected state economies.
4. Assemble a list of rules and regulations for each state affecting the bait fish culture industry.
5. As time permits, summarize biological life cycle information for several underused or unused species that have culture potential and which may match needs of the regional industry.

Proposed Budget:

Institution	Principal Investigator(s)	Objective(s)	Year 1	Year 2	Total
University of Wisconsin-Stevens Point	Frederick A. Copes Daniel W. Coble	1-5	\$25,000	\$25,000	\$50,000
Ohio State University	Leroy J. Hushak	2 & 3	\$6,000	\$6,000	\$12,000
TOTALS			\$31,000	\$31,000	\$62,000

Non-funded Collaborators:

Institution or Business	Collaborator
South Dakota Cooperative Fishery & Wildlife Research Unit	Charles Berry, Jr.
Missouri Cooperative Fishery & Wildlife Research Unit	Charles Rabeni
Minnesota Department of Natural Resources	Dirk Peterson
Gollon Brothers Fish Farms, Wisconsin	Carl Gollon

TABLE OF CONTENTS

SUMMARY OVERVIEW (PARTICIPANTS, OBJECTIVES, AND PROPOSED BUDGETS) 1

JUSTIFICATION 3

RELATED CURRENT OR PREVIOUS WORK 4

ANTICIPATED BENEFITS 5

OBJECTIVES 5

PROCEDURES 6

FACILITIES 7

REFERENCES 7

PROJECT LEADERS 10

BUDGETS (PARTICIPATING INSTITUTIONS AND PRINCIPAL INVESTIGATORS) 11

 BUDGET AND BUDGET JUSTIFICATION FOR EACH PARTICIPATING INSTITUTION

 University of Wisconsin-Stevens Point (Copes and Coble - Objectives 1-5) 12

 Ohio State University (Hushak - Objectives 2 and 3) 14

 BUDGET SUMMARY FOR EACH YEAR FOR ALL PARTICIPATING INSTITUTIONS 16

RESOURCE COMMITMENT FROM INSTITUTIONS 17

SCHEDULE FOR COMPLETION OF OBJECTIVES 18

LIST OF PRINCIPAL INVESTIGATORS 19

CURRICULUM VITAE FOR PRINCIPAL INVESTIGATORS 20

COLLABORATORS 23

JUSTIFICATION

Sport fishing involves a huge amount of economic activity in the United States. Estimated revenues from sale of licenses and associated permits, tags, and stamps -- a small part of sport fishing expenditures -- totaled \$784 million in 1990. Many anglers, of course, fish with minnows and other baits. Bait fish production is one of the largest aquaculture industries in the United States (Brown and Gratzek 1980) with the value of commercial production exceeding \$100 million annually (Huner and Dupree 1984). In 1980, 36.4 million anglers of age 16 and over fished the freshwaters of the nation (U.S. Department of the Interior 1982), and used an estimated 0.23 to 0.45 kg (1/2 to 1 pound) of bait minnows per person (Guidice et al. 1981) or a total of 8.3-16.5 million kilograms (18.2-36.4 million pounds) of bait fish.

The bait fish industry originally depended on wild capture, but has turned increasingly toward bait culture. Important reasons for the change are increased demand for bait fish, decreased access to wild stocks, unreliability of wild sources, and improved culture methods, particularly in the South. In many southern states, e.g. Arkansas, Alabama, and Georgia, production of cultured bait fish has greatly surpassed wild harvest. In the north central region of the country bait fish culture currently is concentrated in the southern portion of the region and dependence on wild harvest generally increases as one moves north.

The bait industry in the north central region is substantial both in terms of numbers and weights of animals used for bait and in employment and monetary value. Millions of liters of fish (about 0.84-0.96 kg/L or 7-8 lb/gal) are sold as bait annually in the region with a value of many millions of dollars, e.g. conservative estimates of sales of bait exceeding \$25 million in 1978 in Minnesota alone and more than \$12 million for bait fish in 1980 in Ontario (Peterson and Hennagir 1980; Bedi and Clifford 1982 cited by Portt 1985). Peterson and Hennagir (1980) pointed out that the bait industry, the largest commercial fish industry in Minnesota, is a vital support to the state's billion dollar tourism economy.

Knowledge of the species, sizes, availability, and sources of bait is essential to understanding the characteristics of the bait industry. This information along with knowledge of the preferences, needs, and problems of the bait industry are required to determine avenues of aquaculture research and development likely to be most beneficial. Unfortunately, we lack basic information on the size and structure of the bait industry in the north central region (Gordon 1968). Data on culture methods, wild harvest, and sale of bait fish is sparse and incomplete (Peterson and Hennagir 1980; Van Eeckhout 1976; Illinois Department of Agriculture 1986; Welsh 1986). There has been no comprehensive study of the bait industry in the north central states. In addition, some estimates of volume and values of bait sold in the region are unreliable (Van Eeckhout 1976; Warnick 1973). We know which species have been sold, and that some are important, e.g. the fathead minnow (*Pimephales promelas*), emerald shiner (*Notropis atherinoides*), golden shiner (*Notemigonus crysoleucas*), and white sucker (*Catostomus commersoni*), but we do not know the relative importance of the various species -- fish and nonfish -- and how species and sizes vary within the region and with season. We know that a large proportion is imported from southern states, but have little detailed information on other sources, including the relative importance of cultured vs. wild bait.

Shortage of supply is a common problem in the industry. In the north central region we lack comprehensive information on shortages with respect to species, sizes, and seasons -- information needed for any attempts to alleviate the shortfalls.

Economic information is needed on bait culture methods in the north central region. Individual producers, wholesalers, and retailers know their own costs, and some -- generally inadequate -- economic information has been obtained for some states outside or on the fringes of the region (Ruhr 1954; Espinosa et al. No Date; Nielsen 1982), but to our knowledge, there is no comprehensive economic information on the industry in the north central region. Information is needed on the comparative costs of different culture methods used in the region and the economic value of the bait industry in the region.

Beside the economic information, it would be useful to have comprehensive information for the north central region on state laws and regulations concerning bait retailers, wholesalers, and producers. The industry is profoundly affected by the various state laws and regulations. Useful information would include kinds of licenses and fees required, legal and illegal species, permissible waters and methods of capture, laws concerning crossing of state borders and transport within states, inspection/certification programs, and reporting requirements.

Unused and underused species of bait fishes may have culture potential in the north central region. Important bait fishes presently cultured include the fathead minnow, golden shiner, and white sucker. Besides shortages of certain baits at some times of the year, the industry often experiences shortages of specific sizes, and variation among species in disease resistance; ability to withstand handling, transportation and holding; and sensitivity to change in water quality and temperature. Species not presently cultured that could overcome some of these problems could have a market niche.

RELATED CURRENT OR PREVIOUS WORK

The importance of various species of bait fish apparently varies both within and outside the north central region. Van Eeckhout (1976) found that in North Dakota, fathead minnows, followed by white suckers, then several indigenous species were the most important sold. Similarly in Minnesota, fathead minnows, white suckers, shiners, chubs, and dace, in decreasing order, were the principal bait fish sold (Peterson and Hennagir 1980). Yet in Wisconsin important species, with no order specified, were chubs, emerald shiners, suckers, and creek shiners (Niemuth 1959). In Ohio the most important in decreasing order were fathead minnows, shiners, suckers, and chubs, but in West Virginia the order was fathead minnows, suckers, shiners, and suckers (Nielsen 1982). In New York, Forney (1956) reported the three most important species were emerald shiner, golden shiner, and silvery minnow (*Hybognathus regius*) and in Tennessee the most important bait fish sold were goldfish (*Carassius auratus*) followed by fathead minnows and golden shiners (Ruhr 1954). In New Mexico the top three were fathead minnows, red shiners (*Cyprinella lutrensis*) and the plains minnows (*Hybognathus placitus*) (Schmitt 1975). Several of these studies were conducted before development of the large bait fish culture industry in the southern states; relative importance of the bait fishes may differ today. We are unaware of recent or comprehensive studies of the region.

All but one of these studies ignored invertebrates. In the exception, Peterson and Hennagir (1980) reported substantial volumes of sales of leeches, night crawlers, other earthworms, and insect larvae in Minnesota. Crayfish, frogs, and salamanders are also sold (Warnick 1973; Peterson and Hennagir 1980; Carlson and Berry 1990), but there is even less information about them than the other baits.

Sources of bait vary geographically. In North Dakota a third were from cultured stocks and the rest from local wild populations (Van Eeckhout 1976), whereas in Tennessee nearly 90% were propagated with the remainder from local streams (Ruhr 1954). With the development of the large bait fish industry in southern states it is likely that substantial amounts of bait fish are imported to the north central region from the South, but recent studies in the region are lacking.

Many studies revealed seasonal variation in availability and shortfalls of supplies. Gordon (1968) and Peterson and Hennagir (1980) found shortages during peak sport fishing periods -- spring and summer. Ruhr (1954), Forney (1956), Van Eeckhout (1976), and Espinosa et al. (No Date) all found that dealers experienced times when they could have sold more bait had supplies been available. The shortages have resulted in substantial importation of bait from Canada to the north central region. Other problems reported by the industry have included parasites and diseases, handling and holding mortality, temperature shocks, and poor water quality (Van Eeckhout 1976; Peterson and Hennagir 1980).

Obtaining reliable economic information on the industry has been elusive. Both Warnick (1973) and Van Eeckhout (1976) considered their estimates of volume and values of bait sold to be dubious. The problems may not be insurmountable, however. Nielsen (1982) and Peterson and Hennagir (1980) obtained economic information that they did not consider unreliable. Nielsen (1982) used a questionnaire with follow-up procedures. He obtained much better cooperation in his survey than for one conducted in the same area (Ohio) about 10 years earlier (Pierce and Wachtman 1971). Nielsen attributed his success to improved design and administration of the survey, which followed the total design system of Dillman (1978), and to simplification of the questionnaire. The system of Dillman (1978) gives careful consideration to all aspects of a survey including size, shape, and layout of the questionnaire, structure of questions, cover letters, and follow-up procedures. Peterson and Hennagir (1980) emphasized that extensive field contacts to open channels of communication were crucial for securing meaningful data. They estimated a value of over \$26 million in-state with an additional \$1.5 million for exports for Minnesota's live bait industry.

There appears to have been few attempts to relate life history information of a variety of bait fishes to industry needs and aquaculture potential. Important bait fishes cultured in the north central region are the fathead minnow, golden shiner, and white sucker, and life histories and culture methods for these and some other species have been studied (e.g., Dobie et al. 1948; Hedges and Ball 1953; Marek and LaBar 1980; Becker 1983). The cultured species constitute only a few of the species in but two families, the minnow (Cyprinidae) and sucker (Catostomidae) families. It seems likely that other species may have aquaculture potential. Life cycle information has been published for many potential bait fishes. Coupling that information with knowledge of the needs, preferences, and problems of the industry, e.g. seasonal supply shortages, intolerance of some species to handling, temperature change, or low dissolved oxygen, may suggest other species that would be useful for the industry.

ANTICIPATED BENEFITS

This survey will provide the groundwork for future decisions on investments and study of the bait industry in the north central United States by describing the industry's structure and how it functions, estimating its economic value, and identifying important problems. The information obtained will be communicated through technical/scientific publications, presentations at industry and professional meetings as appropriate, and extension education communications as determined by the Extension Liaison.

OBJECTIVES

1. Conduct a comprehensive survey of the status of the bait fish industry in selected north central states to determine:
 - a. species used;
 - b. sizes of species marketed;
 - c. sources of species;
 - d. seasonal availability;
 - e. shortfalls in supplies;
 - f. relative value of various fish and nonfish species; and
 - g. common problems of the industry that may need to be addressed by research.
2. Estimate the costs of culturing bait species commonly used in the North Central Region in selected types of production facilities, e.g. extensive and intensive pond culture, tanks, raceways.
3. Estimate the economic contribution (output, employment, income) generated by the bait industry to selected state economies.
4. Assemble a list of rules and regulations for each state affecting the bait fish culture industry.
5. As time permits, summarize biological life cycle information for several underused or unused species that have culture potential and which may match needs of the regional industry.

PROCEDURES

Because both the time and budget are insufficient to allow investigation in all of the north central states, we plan to obtain information on the industry in six states. Probable candidates are South Dakota, Minnesota, Wisconsin, the upper peninsula of Michigan, Ohio, and Missouri. Crucial problems to overcome will be first to identify people involved in the industry, particularly producers and wholesalers, and then to get their cooperation to obtain reliable information.

We will use a variety of sources to contact the industry and obtain information, including Dan Selock, extension liaison, cooperators in the various states, state fisheries management and agriculture agencies, fish producer associations, state aquaculture boards, and information from the recent survey of fish producers in the north central states conducted by the Economics, Marketing, and Policy (EMP) Work Group of the North Central Regional Aquaculture Center.

Survey (Objective 1)

We will obtain lists of retailers, wholesalers, and producers in each state from cooperators, fisheries management, and agriculture agencies and the EMP survey. From the same sources and others including Fred Copes' contacts with the fish producer industry in Wisconsin, we will identify fish producer associations and aquaculture boards in the states. We will try to contact the associations and boards personally -- perhaps even speaking at one of their meetings -- to explain the survey and seek their cooperation. Dan Selock will aid in contacting the industry to inform them of the purposes and importance of the study.

Then we will send questionnaires to the wholesalers and producers and a randomly selected sample of the retailers in each of the states. The questionnaire will be carefully constructed to foster their return. They will briefly explain the purpose of the survey, be short and simple, carry the endorsement of the state industry associations if possible, and may include incentives for filling out and returning the questionnaires such as a small monetary reward or a promise of later receipt of information from Objective 4.

Leroy Hushak (EMP Work Group) and Dan Selock (extension liaison) have experience with mail surveys and will help formulate the questionnaire. In addition the questionnaire will be pretested by at least 30 people, both from the bait industry and other investigators as recommended by Dillman (1978), in the various states.

We will make follow-up telephone calls to encourage return of questionnaires, obtain additional information, and assess accuracy of information received. We will also visit a random sample of producers, wholesalers, and retailers in each state to obtain the information requested in Objective 1, to determine unit value and volume of baits *produced and sold*, and to assess reliability of information from the questionnaires.

Many states require the industry to report information on their business including species used, sources, and volumes acquired and sold. We would compare information from these reports with information from questionnaires and interviews to assess reliability of information received. Where bait species are indicated in the surveys, we would purchase samples of specimens to determine species composition and sizes.

Cost of Culturing Bait Species (Objective 2)

The EMP work group is developing questionnaires to examine costs of production for trout and catfish in ponds, tanks, and raceways. The work group plans to mail these budget questionnaires to potential respondents and then complete them by telephone interview. From the experience gained with the survey procedures, live bait budget questionnaires will be revised for bait producers and administered to them by the "best" procedures available based on experience with trout and catfish producers.

Type of production systems used to culture bait in north central states will be identified from the survey administered for Objective 1 and the EMP Work Group survey. Bait producers will be identified from respondents to these surveys and from direct personal contacts with knowledgeable people in each of the targeted states. Standard budgeting procedures will be used to develop cost of production parameters for use in software such as FINPAC.

Economic Contribution to State Economies (Objective 3)

Total volume and value of bait sold in each targeted state will be estimated from the bait survey of Objective 1. Estimates of income and employment generated by bait sales will also be made from the survey responses. Total sales, income, and employment for each selected state in the production of bait will be obtained from estimates of total volume and value of bait produced by state and the costs of producing bait.

Rules and Regulations (Objective 4)

We would contact each state agency -- all 12 states in the North Central Region -- by telephone and in writing requesting information on kinds of licenses and fees required, legal and illegal species, permissible waters and methods of capture, laws concerning crossing state borders and transport within states, inspection/certification programs, and reporting requirements.

Biological Information for Underused or Unused Species (Objective 5)

Problems of the industry -- shortfalls of supply, species and sizes, intolerance to holding or handling -- should be identified in Objective 1. As time permits, we will use that information coupled with life cycle information and any existing culture information from the literature to identify underused or unused species with culture potential to match unmet needs of the industry. Computer data bases may be useful for searching the more recent literature, but we suspect that much of the life cycle information will be in the older literature that will require time consuming searches.

FACILITIES

The University of Wisconsin-Stevens Point has all the institutional resources needed for this project, including offices, administrative support, secretarial help, contacts with agencies, library, computers, vehicles, faculty, and students. The cooperators will serve mainly as consultants. Supplies or facilities required for any other tasks of the cooperators that would not be available to them would be supplied by the University of Wisconsin in Stevens Point.

The Department of Agricultural and Rural Sociology at Ohio State University has numerous personal computers and access to the University's main computer facility. The Department's faculty and staff are experienced in survey research and employ full-time programmers to assist faculty in research.

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PROJECT LEADERS

<u>State</u>	<u>Name/Institution</u>	<u>Area of Specialization</u>
Wisconsin	Frederick A. Copes University of Wisconsin-Stevens Point	Ecology of Fishes/Fish Population Dynamics
	Daniel W. Coble Wisconsin Cooperative Fishery Research, University of Wisconsin- Stevens Point	Freshwater Fisheries
Ohio	Leroy J. Hushak Ohio State University	Production Economics

PARTICIPATING INSTITUTIONS AND PRINCIPAL INVESTIGATORS

University of Wisconsin-Stevens Point

Frederick A. Copes
Daniel W. Coble

Ohio State University

Leroy J. Hushak

**PROPOSED BAITFISH BUDGET FOR
UNIVERSITY OF WISCONSIN-STEVENS POINT (UW-ST)
(Copes and Coble)**

Objectives 1-5

					Year 1	Year 2
					Year 1	Year 2
					No.	FTEs
					No.	FTEs
A.	Salaries and Wages					
1.	No. of Senior Personnel & FTEs ¹					
a.	(Co)-PI(s)	2	0.20	2	0.20	\$5,000 \$5,000
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	\$9,500 \$9,500
d.	Prebaccalaureate Students . .					
e.	Secretarial-Clerical					
f.	Technical, Shop, and Other . .					
	Total Salaries and Wages					\$14,500 \$14,500
B.	Fringe Benefits (33.34% of 1a +18.66% of 2c)					\$3,440 \$3,440
C.	Total Salaries, Wages and Fringe Benefits					\$17,940 \$17,940
D.	Nonexpendable Equipment					\$0 \$0
E.	Materials and Supplies					\$2,200 \$2,200
F.	Travel - Domestic (<i>Including Canada</i>)					\$4,860 \$4,860
G.	Other Direct Costs					\$0 \$0
	TOTAL PROJECT COSTS PER YEAR (C through G)					\$25,000 \$25,000
						TOTAL PROJECT COSTS \$50,000

¹FTEs = Full Time Equivalents based on 12 months.

BUDGET JUSTIFICATION FOR UNIVERSITY OF WISCONSIN-STEVENSON POINT

- A. Salaries and Wages.** Budget includes about one month salary for one of the PIs (Copes) who is on a 9-month appointment. This will only be for a portion of his effort and considerably more time will be spent on the project. A Graduate Student (0.50 FTE) will be employed to assist in the project.
- E. Materials and Supplies.** Project supplies such as production of questionnaires, postage, long distance telephone calls for interviews, purchase of bait.
- F. Travel.** Project travel to producers, wholesalers, retailers and for meeting with the other investigators.

**PROPOSED BAITFISH BUDGET FOR
OHIO STATE UNIVERSITY (OSU)**

(Hushak)

Objectives 2 and 3

					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)								
b. Senior Associates								
2. No. of Other Personnel (Non-Faculty) & FTEs								
a. Research Assoc./Postdoc ...								
b. Other Professionals								
c. Graduate Students	1	0.17	1	0.17	\$4,000	\$4,000		
d. Prebaccalaureate Students ..								
e. Secretarial-Clerical								
f. Technical, Shop, and Other ..								
Total Salaries and Wages					\$4,000	\$4,000		
B. Fringe Benefits					\$0	\$0		
C. Total Salaries, Wages and Fringe Benefits					\$4,000	\$4,000		
D. Nonexpendable Equipment					\$0	\$0		
E. Materials and Supplies					\$1,000	\$1,000		
F. Travel - Domestic (<i>Including Canada</i>)					\$1,000	\$1,000		
G. Other Direct Costs					\$0	\$0		
TOTAL PROJECT COSTS PER YEAR (C through G)					\$6,000	\$6,000		
TOTAL PROJECT COSTS					\$12,000			

¹FTEs = Full Time Equivalents based on 12 months.

BUDGET JUSTIFICATION FOR OHIO STATE UNIVERSITY

- A. **Salaries and Wages.** A Graduate Student (0.17 FTE) will be employed part time to assist in questionnaire design, data collection and data analysis.
- E. **Materials and Supplies.** Materials and supplies include postage and long distance telephone charges to conduct interviews with baitfish producers for the purpose of collecting data to develop cost of production budgets, as well as the costs of reproducing questionnaires, reports and other written materials.
- F. **Travel.** The travel budget contains funds to meet with the other investigators on the project once each year and the costs of travel to pretest the cost of production questionnaires.

STATUS OF THE BAIT INDUSTRY IN THE NORTH CENTRAL REGION

Budget Summary for Each Participating Institution \$31.0K for the First Year

	UW-ST	OSU	TOTAL
Total Salaries and Wages	\$14,500	\$4,000	\$18,500
Fringe Benefits	\$3,440	\$0	\$3,440
Total Salaries, Wages and Benefits	\$17,940	\$4,000	\$21,940
Nonexpendable Equipment	\$0	\$0	\$0
Materials and Supplies	\$2,200	\$1,000	\$3,200
Travel	\$4,860	\$1,000	\$5,860
Other Direct Costs	\$0	\$0	\$0
TOTAL PROJECT COSTS	\$25,000	\$6,000	\$31,000

Budget Summary for Each Participating Institution \$31.0K for the Second Year

	UW-ST	OSU	TOTAL
Total Salaries and Wages	\$14,500	\$4,000	\$18,500
Fringe Benefits	\$3,440	\$0	\$3,440
Total Salaries, Wages and Benefits	\$17,940	\$4,000	\$21,940
Nonexpendable Equipment	\$0	\$0	\$0
Materials and Supplies	\$2,200	\$1,000	\$3,200
Travel	\$4,860	\$1,000	\$5,860
Other Direct Costs	\$0	\$0	\$0
TOTAL PROJECT COSTS	\$25,000	\$6,000	\$31,000

RESOURCE COMMITMENT FROM INSTITUTIONS¹

Institution/Item	Year 1	Year 2
University of Wisconsin-Stevens Point		
Salaries and Benefits: TY @ 0.10 FTE	\$3,150	\$3,150
Supplies, Expenses, and Equipment	\$3,000	\$3,750
Indirect Costs (16% of Salaries and Benefits)	\$2,650	\$2,650
Total	\$8,800	\$9,550
Wisconsin Cooperative Fishery Unit		
Salaries and Benefits: SY @ 0.10 FTE	\$6,566	\$6,566
Supplies, Expenses and Equipment	\$1,500	\$1,500
Total	\$8,066	\$8,066
Ohio State University		
Salaries and Benefits: SY @ 0.10 FTE	\$4,000	\$4,000
Supplies, Expenses, and Equipment	\$1,000	\$1,000
Total	\$5,000	\$5,000
Total per Year	\$21,866	\$22,616
GRAND TOTAL	\$44,482	

¹Since cost sharing is not a legal requirement institutions do not need to maintain documentation.

SCHEDULE FOR COMPLETION OF OBJECTIVES

Objective 1: Initiated in Year 1 and completed in Year 2.

Objective 2: Initiated in Year 1 and completed in Year 2.

Objective 3: Initiated in Year 1 and completed in Year 2.

Objective 4: Initiated in Year 1 and completed in Year 2.

Objective 5: Initiated in Year 1 and completed in Year 2.

LIST OF PRINCIPAL INVESTIGATORS

Frederick A. Copes, University of Wisconsin-Stevens Point

Daniel W. Coble, Wisconsin Cooperative Fishery Research Unit, University of Wisconsin-Stevens Point

Leroy J. Hushak, Ohio State University

VITA

Frederick A. Copes
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EDUCATION

B.S. University of Wisconsin-Stevens Point, 1960
M.S. University of North Dakota-Grand Forks, 1965
Ph.D. University of Wyoming-Laramie, 1970

POSITIONS

Professor of Fishery Biology, College of Letters and Sciences, University of Wisconsin-Stevens Point (1978-present)
Ecological Specialist, Museum of Natural History, University of Wisconsin-Stevens Point (1977-present)
Associate Professor of Biology, University of Wisconsin-Stevens Point (1970-1977)
Ichthyology Specialist, Museum of Natural History, University of Wisconsin-Stevens Point (1964-present)
Assistant Professor of Biology, Wisconsin State University, Stevens Point (1964-1966)
Biology and Science Instructor, Waupaca High School, Waupaca, Wisconsin (1960-1963)

SCIENTIFIC AND PROFESSIONAL ORGANIZATIONS

American Institute of Fishery Research Biology
American Fisheries Society
Sigma Xi
Phi Kappa Phi
North American Native Fishes Association

SELECTED PUBLICATIONS

- Copes, F.A. 1986. Management, population dynamics and yield estimates for lake whitefish from Green Bay and northern Lake Michigan, U.S.A. *People to People-Fisheries Research Journal* 1986:119-136.
- Copes, F.A., and N. Payne. 1986. *Wildlife and fisheries habitat improvement handbook*. USDA Forest Service. Wildlife and Fisheries, Washington, DC.
- Ebener, M., and F.A. Copes. 1985. Population statistics, yield estimates, and management consideration for two lake whitefish stocks in Lake Michigan. *North American Journal of Fish Management* 5:435-448.
- Copes, F.A. 1983. The ecology of the longnose dace, *Rhinichthys cataractae valenciennes*. Museum of Natural History, University of Wisconsin-Stevens Point, *Reports on the Fauna and Flora of Wisconsin* 19:1-11.
- Copes, F.A., and M. Ebener. 1982. Loss of Floy anchor tags from lake whitefish. *North American Journal of Fisheries Management* 2:90-93.

VITA

Daniel W. Coble
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Wisconsin Cooperative Fishery Research Unit
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EDUCATION

B.S. Purdue University, 1958
M.S. Oregon State University, 1960
Ph.D. University of Toronto, 1965

POSITIONS

Leader, Wisconsin Cooperative Fishery Research Unit and Professor, University of Wisconsin-Stevens Point (1971-present)
Assistant Unit Leader, Missouri Cooperative Fishery Research Unit and Assistant Professor, University of Missouri (1967-1971)
Research Scientist, Ontario Department of Lands and Forests (1963-1967)
Demonstrator (Zoology), University of Toronto (1960-1963)

SCIENTIFIC AND PROFESSIONAL ORGANIZATIONS

American Fisheries Society (several offices including president of Wisconsin Chapter and of the North Central Division, chairships, executive committee over the years)
Societas Internationalis Limnologiae
International Association Great Lakes Research
Fisheries Society of the British Isles

SELECTED PUBLICATIONS

- Coble, D.W. 1982. Fish populations in relation to dissolved oxygen in the Wisconsin River. *Transactions of the American Fisheries Society* 111:612-623.
- Toneys, M.L., and D.W. Coble. 1980. Mortality, hematocrit, osmolality, electrolyte regulation, and fat depletion of young-of-the-year freshwater fishes under simulated winter conditions. *Canadian Journal of Fisheries and Aquatic Sciences* 37:225-232.
- Vaughan, G.E., and D.W. Coble. 1975. Sublethal effects of three ectoparasites on fish. *Journal of Fish Biology* 7:283-294.
- Coble, D.W. 1970. Vulnerability of fathead minnows infected with yellow grub to largemouth bass predation. *Journal of Parasitology* 56:395-396.
- Coble, D.W. 1965. Effects of a diet of raw smelt on lake trout. *Canadian Fish Culturist* 36:27-34.

VITA

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EDUCATION

B.S. Iowa State University, 1961
A.M. University of Chicago, 1965
Ph.D. University of Chicago, 1968

POSITIONS

Professor, Department of Agricultural Economics and Rural Sociology, Ohio State University (1978-present) and Associate Director Ohio Sea Grant (1990-present)
Associate Chair, Department of Agricultural Economics and Rural Sociology, Ohio State University (1986-1990)
Associate Professor, Department of Agricultural Economics and Rural Sociology, Ohio State University (1972-1978)
Assistant Professor, Department of Agricultural Economics and Rural Sociology, Ohio State University (1968-1972)

SCIENTIFIC AND PROFESSIONAL ORGANIZATIONS

American Economic Association
American Agricultural Economics Association
American Fisheries Society
Association of Environmental and Resource Economics
Regional Science Association International

SELECTED PUBLICATIONS

- Lichtoppler, F.R., and L.J. Hushak. 1989. Characteristics of Ohio's Lake Erie recreational marinas. *Journal of Great Lakes Research* 15(3):418-426.
- Hushak, L.J. 1989. The Land Grant system: there can be a future. *Choices: The Magazine of Food, Farm, and Resource Issues*, Second Quarter, pp. 32-33.
- Hushak, L.J., J.M. Winslow, and N. Dutta. 1988. Economic value of Great Lakes sport fishing: The case of private-boat fishing in Ohio's Lake Erie. *Transactions of the American Fisheries Society* 117(4):363-373.
- Miller, G., J. Rosenblatt, and L.J. Hushak. 1988. The effects of supply shifts on producer's surplus. *American Journal of Agricultural Economics* 70(4):886-891.
- Hushak, L.J. 1987. The use of input-output analysis in fisheries assessment. *Transactions of the American Fisheries Society* 116(4):441-449.

COLLABORATORS

Fred Copes (University of Wisconsin-Stevens Point), Dan Coble (Wisconsin Cooperative Fishery Research Unit, University of Wisconsin-Stevens Point), and Leroy Hushak (Ohio State University) will be primarily responsible for conducting the research, but have commitments from other collaborators as well. This includes Dan Selock (Southern Illinois University-Carbondale, Aquaculture Technology Transfer Specialist) who will serve as the extension liaison to this project and has been working with the bait fish industry in many states of the North Central Region. Others who have also agreed to collaborate are Charles R. Berry, Jr., South Dakota Cooperative Fishery and Wildlife Research Unit, Charles Rabeni, Missouri Cooperative Fishery and Wildlife Research Unit and Dirk Peterson of the Minnesota Department of Natural Resources. All three of these individuals are freshwater fisheries biologists with extensive contacts with the bait industry and Dirk Peterson has already conducted a successful survey of the Minnesota bait industry. In addition, Carl Gallon of Gallon Brothers in Wisconsin who has his own bait farm will also serve as a cooperator.