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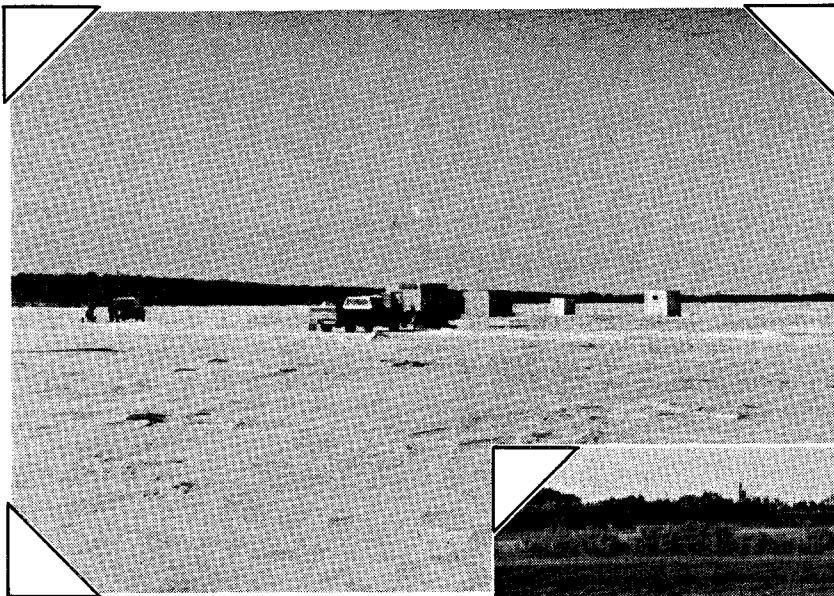
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Regional Socioeconomic Impact of the Devils Lake Fishery



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Preface

Water quality and quantity changes have led to booms and busts in the Devils Lake fishery. The current boom stimulated local business interests and fisheries management personnel to assess the impact of the fishery on local business activity. This study--a year-long effort supported by the Devils Lake Area Chamber of Commerce, the Valley City National Fish Hatchery, and the North Dakota Parks and Recreation Department--is the result of that local interest.

Frank Pfeifer, Valley City National Fish Hatchery, first brought the idea of an economic assessment to the attention of local Devils Lake interests. He was instrumental in pulling together the various factions that supported the project, both in spirit and financially.

Al Stewart, administrative manager of the Devils Lake Area Chamber of Commerce, and Dave Hochhalter, past administrative manager, deserve recognition for their initiative in getting the project started and for enlisting the support of local businesses.

Other project supporters included Karen Assel, North Dakota Parks and Recreation Department, and Arlen Harmoning, North Dakota Game and Fish Department. Their contributions of encouragement, information, and departmental funds added to the successful completion of this study.

Four survey enumerators deserve special recognition for their abilities to collect information from otherwise tight-lipped anglers. Rita Staloch, Valerie Walter, Donald Gefroh, and Mari Smaby each contributed greatly to the completion of this project through on-site interviews of anglers at Devils Lake.

Our thanks are extended to the many anglers who took time to answer our questions.

Finally, Jackie Snortum deserves credit for typing survey instruments and several versions of this manuscript.

Any errors, omissions, or gaps in logic remain the sole responsibility of we, the authors.

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Highlights

Recreational fishing at Devils Lake is an important industry and source of revenue for the Devils Lake regional economy. A personal interview survey of anglers who fished Devils Lake during the 1983-84 season was conducted to obtain data on selected socioeconomic variables and fishing expenditures which were used to estimate the direct and secondary impacts on the Devils Lake local economy.

Anglers were divided into three types: local anglers (Devils Lake local anglers), nonlocal anglers (North Dakota resident anglers excluding Devils Lake local anglers), and nonresident anglers, because home origin influences spending patterns. Local anglers spent \$415 per summer season, \$115 in the winter; nonlocal anglers spent \$682 per summer season, \$174 in the winter; and nonresident anglers averaged \$343 per summer season, \$94 in the winter.

Total estimated expenditures by anglers during the 1983-84 fishing season was \$12 million which resulted in \$28 million of gross business volume for the Devils Lake regional economy. Nonlocal and nonresident fishing expenditures were responsible for generating approximately 80 percent of the total impact. Over 700 people were employed either directly or indirectly from the gross business volume that was generated. In addition \$517,100 of tax revenue was realized from these fishing expenditures.

REGIONAL SOCIOECONOMIC IMPACT OF THE DEVILS LAKE FISHERY

Cynthia J. Schwinden and Jay A. Leitch*

Introduction

One-fourth of North Dakota's population fished an average of 15 days each during the 1980 fishing season (1980 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation). These figures suggest that sport fishing is an important industry that must be managed to ensure its viability. In the 1974-75 fishing season 48.3 percent of the total statewide northern pike (Esox lucius) harvest came from Devils Lake, the largest natural lake in North Dakota (Devils Lake Basin Advisory Committee 1976). In addition, the winter perch fishery has attracted anglers from many states and produced hundreds of "whopper" perch the past few winters.

One measure of the impact and significance of the Devils Lake fishery is its impact on the regional economy. The purpose of this report is to discuss a one-year survey of anglers' expenditures and activities at Devils Lake and estimate the resulting regional economic impacts.

Many studies have explored the economic impacts of recreational activities on state and local economies; however, none have specifically examined the impact that recreational fishing has on a local economy in North Dakota (Schwinden 1984). If recreational fishing in North Dakota is to be managed in the most efficient manner, activity and expenditure data from anglers need to be collected and analyzed.

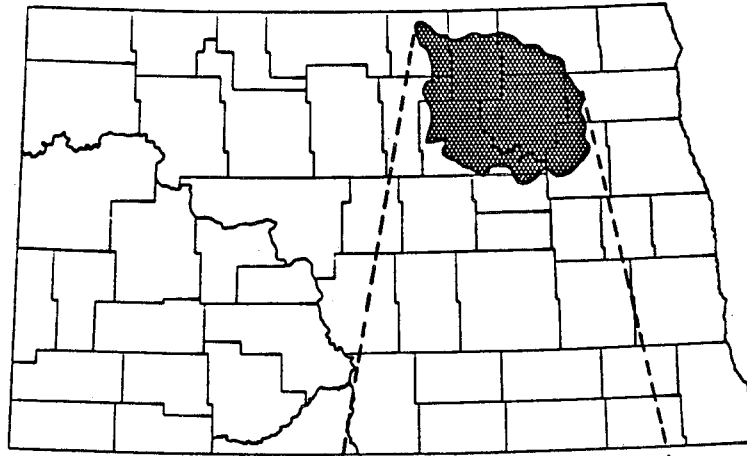
Study Area

The Devils Lake Basin (DLB), a hydrologic subdivision of the Red River Basin, lies within North Dakota's central drift prairie (Figure 1) (Devils Lake Basin Study Report 1976; Whitman and Wali 1975). The DLB drains 3,814 square miles (2,440,960 acres) or 5.5 percent of the state's land surface and is divided into nine watersheds which include drainage areas from nine counties (Benson, Cavalier, Eddy, Nelson, Pierce, Ramsey, Rolette, Towner, and Walsh) (Devils Lake Basin Study Report 1976). The DLB drainage system is a closed watershed--it has no outlet (Swenson and Colby 1955). Additional water from groundwater inflows is variable depending upon climatic conditions (Swenson and Colby 1955).

Devils Lake once covered 142 square miles with a water elevation of 1,435 feet (Figure 2). The water level has fluctuated dramatically over the years, receding to 1,406 feet in 1939. Since 1970 the water volume has steadily increased. Currently, the water level at Devils Lake is 1,425 feet.

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North Dakota



WATERSHEDS

- 1. Hurricane Lake
- 2. Comstock
- 3. Stump Lake
- 4. Edmore
- 5. Starkweather
- 6. Chain Lakes
- 7. Mauvais Coulee
- 8. Devils Lake
- 9. South Slope

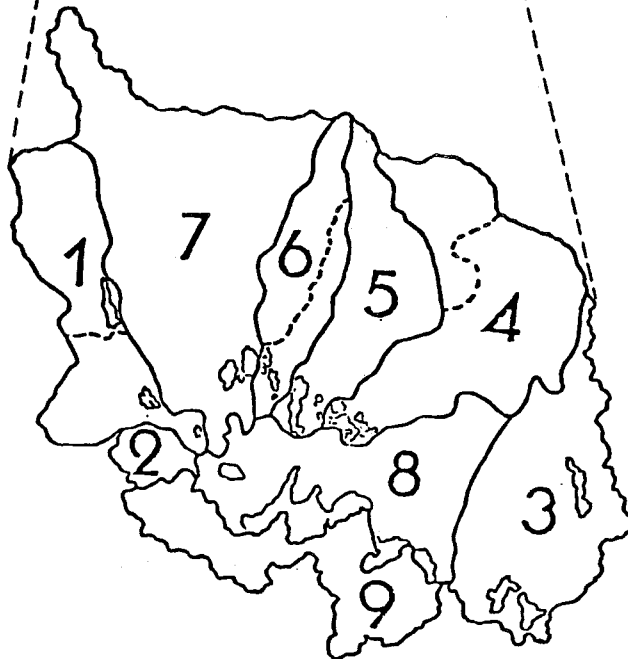


Figure 1. The Devils Lake Basin

Source: Devils Lake Basin Study Report 1976.

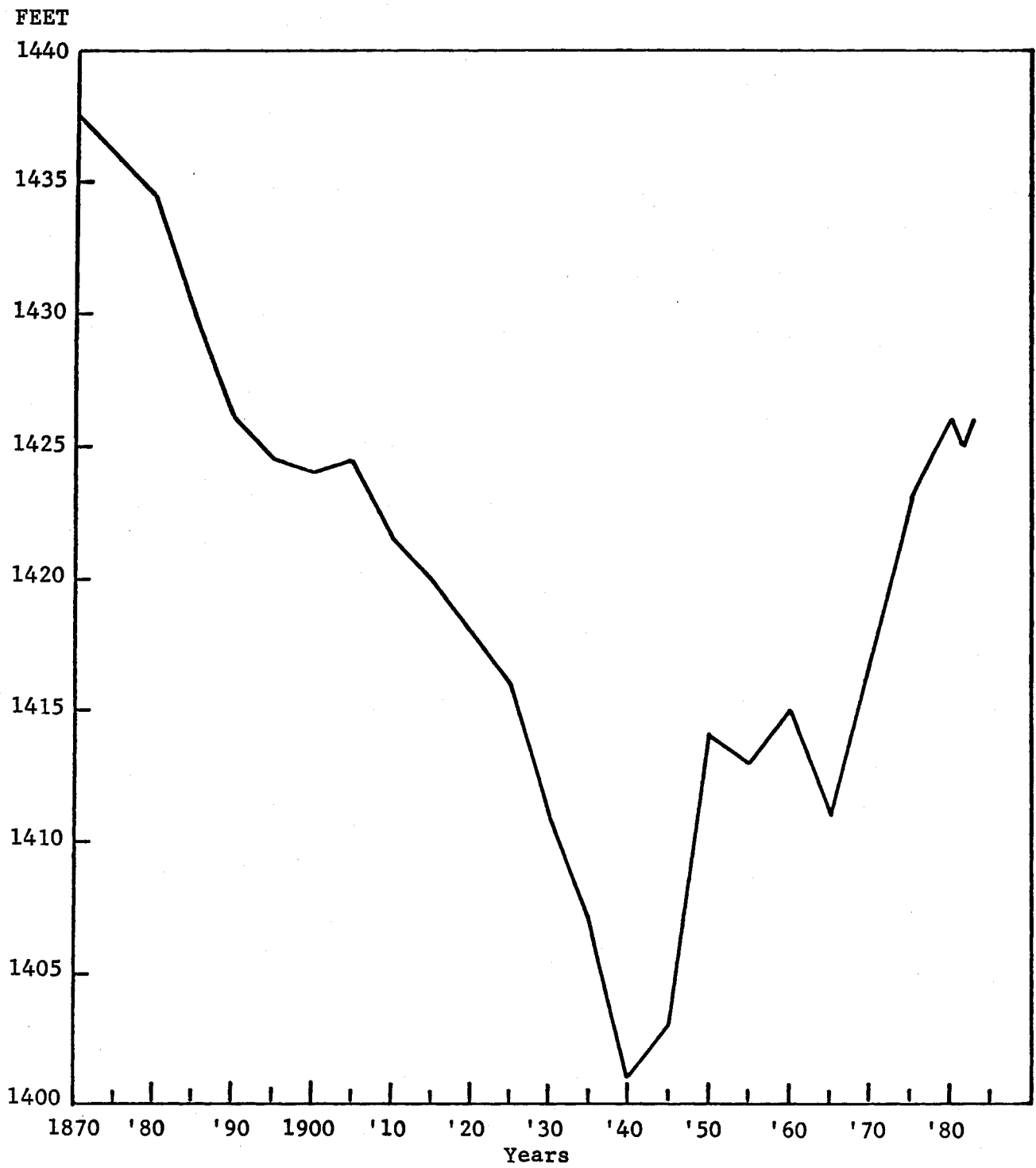


Figure 2. Water Level Fluctuations in Devils Lake 1870-1970

The city of Devils Lake (population 7,442) is a regional trade center (Pietsch 1968, Vangsness 1974). While agriculture is the main industry, recreation and tourism provide a significant share of business activity in the trade area.

Procedures

Field interviews conducted over a one-year period included both summer and winter fishing at Devils Lake. Interview days were selected based on a stratified random sample using trip reports¹ which indicate fishing intensity by day and date (Table 1). Boat ramps on Devils Lake were chosen as summer sample sites for three reasons. First, the majority of the anglers had to use boat ramps for lake access. Second, surveying at the ramps was cost effective since survey enumerators did not need to interview anglers on the lake. Third, departing anglers were more willing to be interviewed after they were done fishing. Winter anglers were surveyed on the lake. No set sample sites were chosen because anglers could drive onto the lake from a number of points.

TABLE 1. DEVILS LAKE FISHING SURVEY SAMPLE DATES, 1983-84 SEASON

Summer Sample Dates							Winter Sample Dates									
Date:	June	4	5	7	17	25	26	29	Date:	December	3	4	9	10	11	19
	July	8	16	17	22	26						20	29			
	August	16	21							January	7	8	16	17		
	September	6	24							February	10	11				

A mail survey of nonresident anglers was used to supplement the summer interviews (Anderson and Leitch 1984). One hundred seventeen nonresident anglers from a sample of 632 had fished Devils Lake during the 1983 season.

Estimates of resident anglers' expenditures from a previous study (Kerestes and Leitch 1983) were used to estimate required sample sizes. To estimate variable means plus or minus 10 percent at the 95 percent confidence level required a sample size of approximately 449. Initial plans were to sample 500 each of summer and winter anglers. However, only 342 summer angler observations were collected. This was not a problem due to the supplemental mail survey and low variability observed. More concern was paid to obtaining a complete sample of winter anglers since no data were available on their expenditures in North Dakota; however, only 381 winter observations were collected.

¹Trip reports are voluntarily submitted post card survey instruments on which each fishing trip is recorded. These are mailed to the State Game and Fish Department upon completion of each separate fishing trip.

Impact Estimation

Estimates of the direct and indirect impacts of anglers on the Devils Lake economy were made using the North Dakota input-output (I-0) model for State Planning Region Three (SR3) (Figure 3) (Leistriz et al. 1982). Input-output analysis is an analytical method that estimates increases in gross business volume and personal income that results from an increase in direct economic activity (Strang 1970; Hughes 1970).

The I-0 model is used to estimate interrelationships between economic sectors in an economy. A sector is a group of businesses, industries, firms, or service establishments that are semirelated in the manner in which they operate in the economy. For example, if two sectors are economically interrelated then they would purchase goods and services from one another. The level at which these two sectors purchase goods and/or services from each other is dependent upon their own current output of goods and/or services. If the level of output of goods and/or services should increase from the original point for one of the sectors, then this same sector must increase its purchase of materials and/or labor from the other sector to increase production. Therefore, the other sector will also experience an increase in its level of output due to the increased production from the first sector.

A simplified illustration of the effect of the interrelationship of economic sectors follows. Restaurant sales (a service sector in an economy) are intertwined with a grocery store (a retail trade sector in an economy). If the restaurant should experience an increase from its normal business due to a detour from a local highway, then the manager of the restaurant must purchase additional supplies (inputs) to meet increases in customers served (outputs). Goods (inputs) are purchased for the restaurant from the grocery store. Therefore, sales (outputs) are increased for the grocery store. Now the manager of the grocery store must buy additional supplies (inputs) from his supply outlet (a wholesale trade sector firm in the economy) to restock the store's shelves. In this manner, a change in the level of output of one economic sector results in changes in the level of outputs of other sectors that sell goods and/or services to the original sector. This interdependency is the basic principle of multiplier analysis or the input-output concept.

A table of interdependence coefficients yields a set of multipliers that show the direct and indirect effect upon the industry heading the row by income received by the industry heading the column. The gross receipts multiplier is computed by summing the sector's column of interdependence coefficients. The interdependence coefficients (multipliers) used in this analysis are presented in Table 2.

Industries in the I-0 model are divided into economic sectors according to their major activities. The North Dakota I-0 model has 17 economic sectors. The impact in the energy sectors, sectors 14-17, was not considered pertinent for this study. The Devils Lake economy was defined by aggregating business firms or industries into 13 sectors: (1) agriculture, livestock; (2) agriculture, crops; (3) sand and gravel mining; (4) construction; (5) transportation; (6) communication and utilities; (7) wholesale and agricultural processing; (8) retail; (9) finance, insurance, and real estate; (10) business and personal service; (11) professional and social service; (12) personal income; and (13) government.

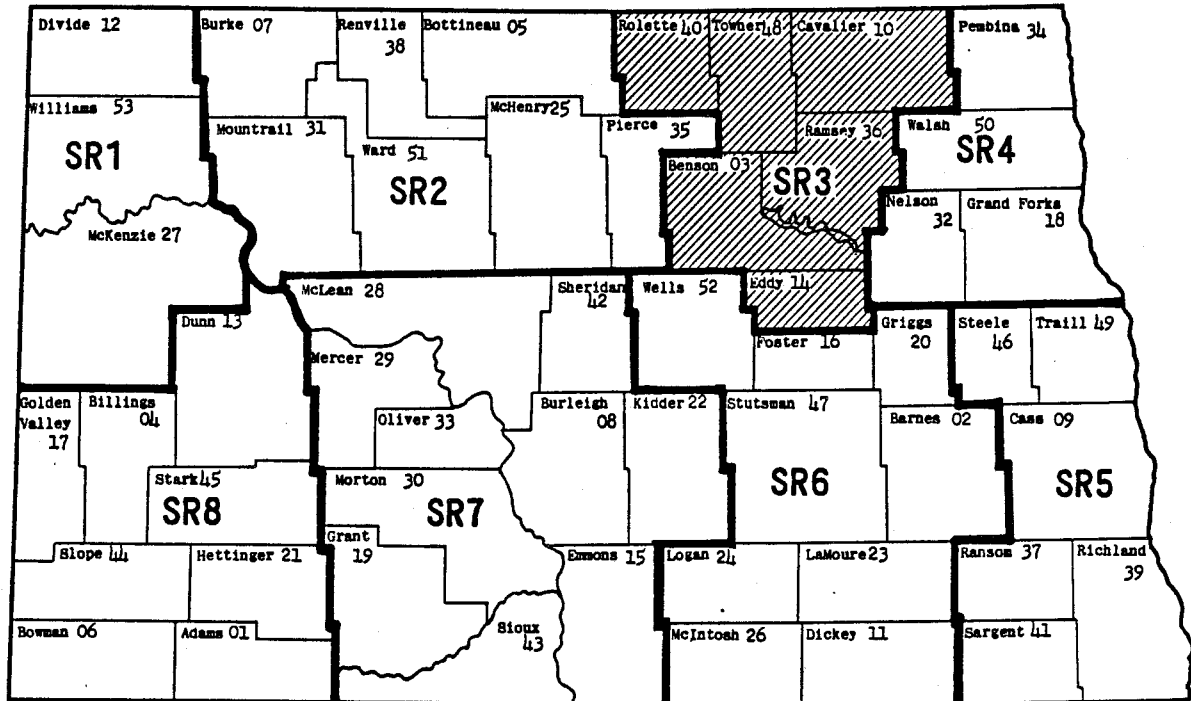


Figure 3. North Dakota State Planning Regions

Expenditure Categories

Expenditures made by summer and winter anglers can be separated into two general categories of goods: durable and variable goods (Table 3). Durable goods usually last for a relatively long period of time and are not used up after one use. Variable goods are items that can be used up over a short period of time or are consumed with one use, depending on the level of activity.

Leitch and Scott (1978) report that the amount of money spent by sportsmen on durable goods is fairly constant in the long run, since money spent for durable goods is not as closely related to time spent in the activity. Therefore, data collected for durable goods are seasonally based. In contrast, variable expenditures may not be constant in the long run because these expenditures vary with the amount of time spent in an activity. Therefore, data collected for variable goods are estimated on a daily basis.

Expenditures in both summer and winter seasons were assigned to either the retail trade or personal service sectors. The retail trade sector consists of establishments that sell merchandise for personal, household, or farm consumption. It is made up of Division F Standard Industrial Code (SIC) 52-59. The personal service sector consists of firms that provide lodging, repair, credit, entertainment, and other personal services mainly geared to private individuals (Coon et al. 1983). The personal service sector includes Division

TABLE 2. INTERDEPENDENCE COEFFICIENTS FOR THE RETAIL, BUSINESS, AND PERSONAL SERVICE SECTORS, NORTH DAKOTA

Economic Sector	Retail	Business and Personal Service
1. Agriculture, livestock	0.09	0.04
2. Agriculture, crops	0.03	0.02
3. Sand and gravel mining	0.002	0.004
4. Construction	0.03	0.05
5. Transportation	0.01	0.01
6. Communication and utilities	0.05	0.11
7. Wholesale and ag processing	0.05	0.02
8. Retail	1.27	0.45
9. Finance, insurance, and real estate	0.06	0.11
10. Business and personal service	0.02	1.05
11. Professional and social service	0.03	0.05
12. Households	0.40	0.72
13. Government	0.04	0.08
Gross receipts multiplier	2.09	2.71

SOURCE: Leistritz et al. 1982.

H SIC 70, 72, 75, 76, 78, 79, 84, and 73 (excluding 7313 and 7391). All durable goods expenditures were assumed to be sales by the retail trade sector. Variable goods expenditures were assumed to be sales by either the retail trade or personal service sector.

New Money

A local community economic system serves two markets--local and export markets. The export market is defined as the sale of goods and services to people who live outside the local area. Dollars received from the export market are new money for the community and are also the driving force in the input-output model. The impact of new money flowing into the local economy

TABLE 3. DURABLE AND VARIABLE GOODS EXPENDITURES CATEGORIES FOR ANGLERS, DEVILS LAKE, NORTH DAKOTA, 1983-84 SEASON

Durable Expenditures	Variable Expenditures
Boat, Motor, Trailer	Food and Beverages
Depth or Fish Finder	Lodging
Rods and Reels	Transportation
Tackle Box	Boat/Motor Rental
Camping Equipment for Fishing	Bait
Special Clothing for Fishing	Boat Launching Fees
Other Fishing Equipment	Gas and Oil
Other	Repair/Maintenance
	Packing/Cleaning of Fish
	Film
	Ice
	Taxidermy
	Other

depends upon the multiplier effect which depends upon the amount of business integration in the community (Rajender et al. 1967).

Home origin of anglers who frequent Devils Lake has an important conceptual effect on the interpretation of local economic impacts. Local Devils Lake anglers may spend the dollars they used for fishing in SR3 whether or not the fishing opportunity was present. Conversely, all other anglers probably came to Devils Lake specifically to fish. Thus, recreational fishing exports to any angler other than local Devils Lake anglers is an important industry for the region. However, another scenario would be that the fishery keeps local anglers at Devils Lake who would fish elsewhere if the local fishery were not available. Therefore, local anglers may alternatively be viewed as an import substitution market.

Sample populations in both the summer and winter studies were divided into three groups (Devils Lake local anglers, North Dakota resident anglers, and nonresident anglers). Devils Lake local and North Dakota resident anglers were separated based on one-way distance traveled to get to Devils Lake. In-state resident anglers traveling up to 40 miles (one-way distance) for the fishing experience were classified as Devils Lake local anglers³; in-state anglers traveling more than 40 miles (one-way distance) to fish were classified as North Dakota resident anglers. Any angler holding a nonresident fishing license was classified as a nonresident angler. Henceforth, Devils Lake local anglers and North Dakota resident anglers will be referred to as local anglers and nonlocal anglers, respectively.

³Forty miles was chosen to separate local from resident anglers based on Vangness' (1974) delineation of the mileage that patrons will travel to shop in the Devils Lake trade area.

Three scenarios are played out in the subsequent analysis: the economic impacts of nonresident anglers (Scenario I); of nonresident anglers and North Dakota anglers, excluding local Devils Lake anglers (Scenario II); and of all anglers (Scenario III).

Results and Discussion

Survey data from 459 summer anglers and 381 winter anglers were used to develop the following results.

Species Preference

Walleye and northern pike were the fish species most sought after by summer anglers (Table 4). Winter anglers fished mainly for perch.

Summer Fishing

Durable Goods Expenditures

Local anglers bought most durable goods locally (Table 5), which would be expected because most local anglers would make their boat, motor, and other durable good purchases within the Devils Lake trade area. Nonlocal anglers reported that they had also purchased durable goods within the Devils Lake trade area. These purchases may/may not be planned by nonlocal and nonresident anglers. For example, a nonlocal angler may need a landing net when he gets to Devils Lake, so he purchases a net in Devils Lake because he was planning to buy one anyway. Or, a nonlocal angler who fishes Devils Lake frequently may find it to be the most natural place to purchase durable equipment. Boats, motors, or trailers, which made up 90 percent of the total durable expenditures, were purchased by nonlocal anglers in the Devils Lake trade area (Table 6). Nonresident summer anglers spent an average of \$31.50 each for durable goods during the season. Nonresident anglers spent less than one-third as much for durable goods as nonlocal anglers and less than one-fourth as much as local anglers.

Variable Expenditures

Nonlocal anglers spent approximately twice as much, and nonresident anglers spent about three times as much, as local anglers per day for variable goods and services (Table 5). Based on the estimated total days of participation (Table 7), nonlocals spent the most money for variable goods and services per season while nonresident and local anglers spent approximately the same amount for variable goods and services per season. Most of the revenue generated from variable expenditures was due to nonlocal and nonresident anglers.

Local and nonresident anglers' variable purchases were split almost evenly between the retail trade and personal service sectors (Table 8). Food and beverages (personal service sector) and transportation (retail trade sector) were the main sectors where variable goods were purchased.

TABLE 4. ANGLER SPECIES PREFERENCES IN FISHING DEVILS LAKE, NORTH DAKOTA, 1983-84 SEASON

Fish Specie	Summer Anglers			Winter Anglers		
	Local	Nonlocal	Nonresident	Local	Nonlocal	Nonresident
	----- percent ^a -----					
Walleye	67	80	73	32	25	8
Northern Pike	40	34	40	3	3	--
Perch	3	3	7	68	70	88
Bass	2	3	--	--	--	--
Any	31	24	47	31	26	8

^aTotals add up to more than 100 percent because some anglers responded with more than one specie choice.

SOURCE: Survey of summer and winter anglers, June-September 1983 and December 1983-March 1984.

TABLE 5. AVERAGE INDIVIDUAL ANGLER EXPENDITURES IN DEVILS LAKE, NORTH DAKOTA, 1983-84 SEASON^a

Angler Type	Summer Expenditures			Season Total	Winter Expenditures			Season Total
	Durable Seasonal	Variable Daily	Variable Seasonal		Durable Seasonal	Variable Daily	Variable Seasonal	
Local	\$140.71	\$19.26	\$274.46	\$415.17	\$49.14	\$ 5.10	\$ 66.30	\$115.44
Nonlocal	108.93	38.19	572.85	681.78	38.85	18.05	135.37	174.22
Nonresident	31.50	55.59	311.30	342.80	5.51	44.30	88.60	94.11

^aThese figures represent only expenditures made within the Devils Lake trade area. Total expenditures per day of fishing or season are higher than those locally spent.

SOURCE: Survey of summer and winter anglers, June-September 1983 and December 1983-March 1984 and Tables 6, 7, 8, 10, and 11.

TABLE 6. SEASONAL DURABLE EXPENDITURES PER SUMMER ANGLER IN DEVILS LAKE, NORTH DAKOTA, 1983 SEASON

Durable Goods	Direct Expenditures			Economic Sector
	Local Angler \$ Spent	Nonlocal Angler \$ Spent	Nonresident Angler \$ Spent	
Boat, Motor, Trailer	\$119.57	\$ 97.88	\$ 5.70	Retail Trade
Depth/Fish Finder	0.00	1.66	2.85	Retail Trade
Rods and Reels	13.99	3.03	6.69	Retail Trade
Tackle Box	0.38	0.30	9.07	Retail Trade
Camping Equipment for Fishing	1.64	1.88	4.26	Retail Trade
Special Clothing for Fishing	0.59	0.77	1.69	Retail Trade
Other Fishing Equipment	<u>4.54</u>	<u>3.41</u>	<u>1.24</u>	Retail Trade
Totals	\$140.71	\$108.93	\$31.50	

SOURCE: Survey of summer anglers, June-September 1983.

TABLE 7. ESTIMATED NUMBER OF FISHING DAYS AND NUMBER OF ANGLERS BY TYPE THAT FISHED DEVILS LAKE, NORTH DAKOTA, 1983-84 SEASON

	Summer			Winter		
	Number of Anglers	Average Days	Total Days	Number of Anglers	Average Days	Total Days
Local	5,400 ^a	14.25 ^b	76,950	2,100 ^f	139	27,300
Nonlocal	9,200 ^c	15	138,000	9,200	7.5 ^h	69,000
Nonresident	4,000 ^d	5.6 ^e	<u>22,400</u>	4,000	2.0 ⁱ	<u>8,000</u>
			237,350			104,300

^aThe number of local summer anglers was estimated by multiplying the population in the Devils Lake trade area 16 years of age or older by the percentage of anglers in the population (27 percent from Mittleider et al. 1980, Table 2).

^bAverage days by local summer anglers is statewide average days (1980 National Survey of Fishing, Hunting, and Wildlife Associated Recreation 1982, Table 45) multiplied by the percent of time SR3 residents fish within their home region (95 percent from Mittleider et al. 1980).

^cNumber of nonlocal summer anglers was estimated by subtracting the number of local angler days (76,950) from the total angler days by resident anglers at Devils Lake (215,199 from Kerestes and Leitch 1983, Table 66), then rounding to the nearest thousand, then dividing by the average number of days fished (15). It is unlikely that 9,200 nonlocal anglers spend an average of 15 days fishing Devils Lake each summer, rather 9,200 nonlocal angler equivalents fish 138,000 days total.

^dThe number of nonresident summer anglers is the number of nonresident licenses sold during the 1982-83 season (19,290), multiplied by the percentage of nonresident anglers who fished Devils Lake (22 percent, from Anderson and Leitch 1984, Table 14), rounded to the nearest thousand.

^eFrom Anderson and Leitch 1984, Table 27.

^fThe number of local winter anglers was estimated by multiplying the population in the Devils Lake trade area 16 years of age or older by the percentage of winter anglers in the SR3 population (10.5 percent from Mittleider et al. 1980, Appendix Table D-9).

^gWinter angler survey data indicated each local angler fished approximately 13 days throughout the winter season.

^hWinter angler survey data indicated nonlocal anglers each fished approximately 7.5 days during the winter season.

ⁱWinter angler survey data indicated an average of approximately two with a range of from one to six days fished for nonresident winter anglers.

Major purchases for variable goods by nonlocal anglers were in the retail trade sector. Petroleum, oil, and maintenance for vehicles were the areas in the retail trade sector where the majority of the purchases were made. Because the nonlocal anglers must travel a greater distance, it is likely that they will purchase gasoline within the Devils Lake trade area before returning home.

TABLE 8. DAILY VARIABLE EXPENDITURES PER SUMMER ANGLER IN DEVILS LAKE, NORTH DAKOTA, 1983-84 SEASON

Variable Goods	Local	Nonlocal	Nonresident	Economic Sector
Food and beverages	\$ 8.42	\$11.63	\$19.65	Personal Service
Lodging	0.85	3.14	7.23	Personal Service
Transportation for land vehicle	5.88	13.23	20.55	Retail Trade
Boat and motor rental	0.00	0.43	0.85	Personal Service
Bait	2.05	2.94	1.65	Retail Trade
Boat launching fees	0.07	0.34	0.38	Personal Service
Gas/oil for boat motor	1.38	2.07	1.91	Retail Trade
Repairs and maintenance of equipment	0.61	0.62	0.65	Personal Service
Packing, cleaning of fish	0.00	0.04	0.09	Personal Service
Film	0.00	0.00	0.88	Retail Trade
Taxidermy	0.00	0.00	0.17	Retail Trade
Other	0.00	3.75	1.56	Retail Trade
TOTALS				
Personal service	9.95	16.20	28.87	
Retail trade	<u>9.31</u>	<u>21.99</u>	<u>26.72</u>	
	\$19.26	\$38.19	\$55.59	

SOURCE: Survey of summer anglers, June-September 1983.

Summer Secondary Impacts

Secondary impacts of anglers' expenditures can be estimated in terms of gross business volume (GBV), personal income (PI), employment, and tax revenues generated. The North Dakota input-output model was used to estimate the additional economic activity (the secondary or indirect effects) stimulated by first-round or direct expenditures by anglers. Employment was also estimated using a ratio of the gross business volume (productivity) to employment. The

number of employees in an economic sector is directly related to the sales volume in that same sector (Leistriz et al. 1982).

Gross Business Volume. Gross business volumes generated from expenditures per fishing day and per season are found in Table 9.

Personal Income. Personal income, that part of the gross business volume that ends up in households, generated in the Devils Lake trade area in the summer of 1983 as a result of durable good expenditures averaged \$37.64 per season (Table 9). Personal income generated on a daily and seasonal basis from variable expenditures is reported in Table 9.

Winter Fishing

Durable Goods Expenditures

Local winter anglers spent the most for durable goods; nonlocals spent about \$10.00 less on durable goods in the Devils Lake trade area than did local anglers (Table 10). Spending by winter anglers was considerably lower in summer than winter (Table 6).

Variable Expenditures

Nonresident winter anglers spent twice as much for variable goods and services as did nonlocal anglers and nearly nine times as much as local anglers per fishing day (Table 11). Nonlocal anglers spent more than three and one-half times as much as local anglers per fishing day for variable goods.

A greater proportion of money was spent in the personal service sector than in the retail trade sector by local and nonresident anglers; the converse was true for nonlocal anglers (Table 11). Over 60 percent of local anglers' variable good purchases were for food and beverages. Over 80 percent of nonresident anglers' variable expenditures were for food and beverages (39 percent) and lodging (42 percent). The difference in the spending patterns is probably because most nonlocal anglers are within a reasonable driving distance of Devils Lake and have the option of returning home after a day of fishing; hence, a greater amount of money is spent for fuel. Nonresident winter anglers, unless they stay with friends or relatives, will likely stay at motels; hence a greater amount is spent for lodging and less for fuel. Transportation was the main item in the retail trade sector where nonlocals made over 43 percent of their purchases for variable goods and services.

Winter Secondary Impacts

Nonresident winter anglers' variable expenditures generated the highest gross business volume per day, but their durable goods expenditures generated the lowest (Table 12).

TABLE 9. SECONDARY ECONOMIC IMPACT PER SUMMER ANGLER'S EXPENDITURES, DEVILS LAKE, NORTH DAKOTA, 1983 SEASON

Angler Type	Summer Expenditures						Totals	
	Durable		Variable				Seasonal Total Gross Business Volume	Seasonal Total Personal Income
	Seasonal Gross Business Volume	Seasonal Personal Income	Daily Gross Business Volume	Seasonal Gross Business Volume	Daily Personal Income	Seasonal Personal Income		
Local	\$293.68	\$ 56.78	\$ 46.43	\$ 661.63	\$10.88	\$155.04	\$ 955.31	\$211.82
Nonlocal	228.00	43.57	89.12	1,336.80	20.44	306.60	1,564.80	350.17
Nonresident	65.97	12.60	132.78	743.57	31.48	176.29	809.54	188.89

SOURCE: Survey of summer anglers, June-September 1983.

TABLE 10. SEASONAL DURABLE EXPENDITURES PER WINTER ANGLER IN DEVILS LAKE, NORTH DAKOTA, 1983-84 SEASON

Durable Goods	Local Angler \$ Spent	Nonlocal Angler \$ Spent	Nonresident Angler \$ Spent	Economic Sector
Ice Auger	\$16.77	\$16.73	\$0.00	Retail Trade
Fish House/Shelter	3.77	8.97	0.00	Retail Trade
Fish House Heater	7.24	3.19	0.00	Retail Trade
Depth Finder	0.68	0.96	0.00	Retail Trade
Rods and Reels	5.38	4.15	0.67	Retail Trade
Tackle Box	1.28	0.83	1.88	Retail Trade
3-Wheeler Snowmobile Used for Fishing	4.45	0.36	0.00	Retail Trade
Special Clothing Used for Fishing	7.08	2.05	2.50	Retail Trade
Other	<u>2.49</u>	<u>1.61</u>	<u>0.46</u>	Retail Trade
Totals	\$49.14	\$38.85	\$5.51	

SOURCE: Survey of winter anglers, December 1983-March 1984.

TABLE 11. DAILY VARIABLE EXPENDITURES PER WINTER ANGLER IN DEVILS LAKE, NORTH DAKOTA, 1983-84 SEASON

Variable Goods	Local Angler \$ Spent	Nonlocal Angler \$ Spent	Nonresident Angler \$ Spent	Economic Sector
Food and Beverages	\$3.08	\$ 6.04	\$17.21	Personal Service
Lodging	0.00	1.63	18.50	Personal Service
Transportation for Land Vehicle	0.04	7.70	5.38	Retail Trade
Fish House Rental	0.01	0.00	0.00	Personal Service
Bait	1.30	2.09	2.42	Retail Trade
Repairs and Maintenance of Equipment	0.14	0.30	0.46	Personal Service
Packing, Cleaning of Fish	0.00	0.00	0.00	Personal Service
Film	0.01	0.00	0.33	Retail Trade
Taxidermy	0.05	0.29	0.00	Retail Trade
Other	0.47	0.00	0.00	Retail Trade
<u>Totals</u>				
Personal Service	3.23	7.97	36.17	
Retail Trade	<u>1.87</u>	<u>10.08</u>	<u>8.13</u>	
	\$5.10	\$18.05	\$44.30	

SOURCE: Survey of winter anglers, December 1983-March 1984.

TABLE 12. SECONDARY ECONOMIC IMPACT PER WINTER ANGLER'S EXPENDITURES, DEVILS LAKE, NORTH DAKOTA, 1983 SEASON

Angler Type	Winter Expenditures						Totals	
	Durable		Variable				Seasonal Total Gross Business Volume	Seasonal Total Personal Income
	Seasonal Gross Business Volume	Seasonal Personal Income	Daily Gross Business Volume	Seasonal Gross Business Volume	Daily Personal Income	Seasonal Personal Income		
Local	\$102.56	\$19.82	\$ 12.51	\$162.62	\$ 3.08	\$40.04	\$265.18	\$59.86
Nonlocal	81.08	15.67	42.30	317.25	9.77	73.27	398.33	88.94
Nonresident	11.50	2.22	113.46	226.89	29.29	58.57	238.39	60.79

SOURCE: Survey of winter anglers, December 1983-March 1984.

Aggregate Seasonal Impacts

The overall direct and secondary economic impacts of freshwater fishing on the Devils Lake area economy for the 1983-84 fishing season were \$12,107,000 and \$28,088,000 (Table 13), respectively, based on Scenario III and estimated expenditures, numbers of anglers (Table 7), and days of participation by angler type (Table 7).

If nonresident anglers (Scenario I) were the only group considered as an export market for the Devils Lake fishery, \$1,747,640 in nonresident fishing expenditures would be added to the regional economy (Table 13). These fishing expenditures would generate an additional \$4,267,000 of gross economic activity. If nonlocals and nonresident anglers (Scenario II) were both viewed as export markets, then the total new expenditures made by anglers would be \$9,622,840, which results in \$22,367,000 of additional business activity (Table 13). If all anglers' expenditures were considered exports or import substitutions (Scenario III), then freshwater fishing in Devils Lake would result in \$12,107,000 of new economic activity for the Devils Lake local area economy. The secondary impact is estimated at \$28,088,000, which represents an average multiplier of 2.3. Nonlocal and nonresident expenditures were responsible for generating 80 percent of the Scenario III impact.

Employment

Gross business volume as a result of anglers' expenditures can be used to estimate employment in SR3 from money flowing through sectors in the SR3 economy. Because of the interdependencies within the economy, even though anglers did not purchase goods in the wholesale and agriculture processing sector (Table 14, row 7), the amount of gross business volume (sales) flowing into this sector supported employment for 11 people. The total number employed due to anglers' expenditures in 1983-84 was estimated to be 130 under Scenario I, 584 under Scenario II, and 730 under Scenario III (Table 13). Because retail trade and personal service sectors received the largest portion of anglers' expenditures, more people are employed in these sectors (Table 14).

Tax Revenue

As business and personal income increase, the amount of government revenue also increases. Tax revenue as a result of anglers' expenditures was \$517,100 for the 1983-84 fishing season (Table 13).

Policy Implications

Devils Lake sport fishing generates economic activity and promotes jobs within the regional trade area by exporting recreational services. Other firms could be encouraged to locate in the area and use water from the lake, but possible effluent disposals may have a deleterious effect on the lake and the community.

The Devils Lake fishery is a clean industry that stimulates economic sectors interrelated with recreational activities. The main sectors impacted are retail trade and personal services. Nonmanufacturing industries, like

TABLE 13. AGGREGATE IMPACTS FOR THE 1983-84 FISHING SEASON, DEVILS LAKE, NORTH DAKOTA

Impact	Angler Grouping				
	Local	Nonlocal	Nonresident (Scenario I) ^a	Nonlocal and Nonresident (Scenario II) ^b	All Anglers (Scenario III) ^c
			Low Estimate		High Estimate
Expenditures	\$2,484,342	\$ 7,875,200	\$1,747,640	\$ 9,622,840	\$12,107,182
Gross Business Volume	5,721,000	18,100,000	4,267,000	22,367,000	28,088,000
Personal Income	1,275,000	4,067,000	1,041,000	5,108,000	6,383,000
Tax Revenue	116,500	333,200	67,400	400,600	517,100
Employment	146	454	130	584	730

^aScenario I assumes only "new money" from nonresident anglers generates additional regional economic activity. The expenditure of locals and nonlocals are assumed to be merely displacements from other areas of the state.

^bScenario II assumes a regional perspective whereby expenditures of both nonresident and nonlocal anglers represent "new money" to the region.

^cScenario III assumes a regional perspective in that all fishing expenditures represent either pure exports or import substitutions. Therefore, all regional economic activity of anglers can be attributed to the fishery.

TABLE 14. EMPLOYMENT BY SECTOR FROM ANGLER EXPENDITURES, DEVILS LAKE, NORTH DAKOTA, 1983-84 SEASON, SCENARIO III (HIGHEST ESTIMATE)

Economic Sector	Grand Total Employment
1. Agriculture, livestock	11.4
2. Agriculture, crops	4.2
3. Sand and gravel, mining	0.1
4. Construction	17.8
5. Transportation	13.7
6. Communication and utilities	16.9
7. Wholesale and agricultural processing	9.0
8. Retail	166.8
9. Finance, insurance, and real estate	11.6
10. Business and personal service	376.0
11. Professional and social service	38.4
12. Households	--
13. Government	<u>64.1</u>
Totals	730.0

SOURCE: Survey summer and winter anglers, June-September 1983 and December 1983-March 1984.

recreation, have been cited as the key to future employment growth (Cotter 1984).

The absolute level of expenditures or business activity, which is subject to judgment regarding total days fished, is not as important as relative changes in the number of activity days. Business people and fisheries' managers can quickly estimate the change in business activity brought about by the addition or loss of another 100 or 1,000 anglers of each type using the data presented above.

To increase sales and employment in the retail trade and personal service sectors, businesses and firms may want to attract more anglers to Devils Lake. Alternatively, businesses could encourage anglers to spend more time fishing, yet not to the extent that local anglers are crowded out. If the quality of the fishing experience is reduced, fewer anglers may visit the area.

Summary

Personal interviews and a mail survey were used to obtain data on selected socioeconomic characteristics and expenditures from anglers who fished Devils Lake, North Dakota, during the entire 1983-84 fishing season. Anglers were classified into three types based on a one-way distance traveled to fish Devils Lake or on type of fishing license: local (Devils Lake local), nonlocal (North Dakota resident), and nonresident anglers.

Local anglers spent an average of \$415.00 during the 1983-84 summer fishing season, and \$115.00 during the winter season. Of the three angler types, nonlocal anglers spent the largest amount during both the 1983-84 summer fishing season (\$681.78) and during the winter fishing season (\$174.22). Nonresident anglers' average expenses during the 1983-84 fishing season amounted to \$342.80 in summer and \$94.11 in winter.

Impact estimates range from a conservative low in Scenario I to an optimistic high in Scenario III. Depending on assumptions regarding local and nonlocal anglers' activities without the lake, aggregate total expenditures during the 1983-84 season were from \$1.7 million to \$12.1 million. These direct expenditures resulted in additional regional gross business volume of from \$4.3 million to \$28.1 million due to spending and respending within the economic sectors. Personal income generated within the Devils Lake trade area was from \$1.0 million to \$6.4 million. The amount of business stimulated within the Devils Lake trade area from anglers' expenditures and the secondary impact from these expenditures resulted in employment for 130 to 730 people. Tax revenue generated from fishing expenditures during the 1983-84 fishing season was estimated at \$67,400 to \$517,100.

It is important, from an economic standpoint, to manage the Devils Lake fishery as a component of the regional economy. Economic activity associated with the fishery generates wealth, jobs, and taxes in an area where few alternatives to agricultural-based industry exist.

Literature Cited

- Anderson, R.S. and J.A. Leitch. 1984. "Nonresident Sportsmen in North Dakota, Characteristics, Expenditures, Harvest." Department of Agricultural Economics Miscellaneous Report No. 77, North Dakota Agricultural Experiment Station, North Dakota State University, Fargo.
- Cotter, C.M. 1984. "Nonmanufacturing Industries: The Key to Future Employment Growth." Community Economics No. 95, Department of Agricultural Economics, University of Wisconsin, Madison.
- Devils Lake Basin Advisory Committee. 1976. The Devils Lake Basin Study. Devils Lake, ND.
- Hughes, J.M. 1970. Forestry in Itasca County's Economy: An Input-Output Analysis. Miscellaneous Report 95, Agricultural Experiment Station, Forestry Service, University of Minnesota, St. Paul.
- Kerestes, D.E. and J.A. Leitch. 1983. Development and Implementation of A Periodic Data Collection System for Game and Fish Management and Policy Analysis: Second Annual Report. AE83009, Department of Agricultural Economics, Agricultural Experiment Station, North Dakota State University, Fargo.
- Leistritz, F.L.; W. Ransom-Nelson; R.W. Rathge; R.C. Coon; R.A. Chase; T.A. Hertsgaard; S.H. Murdock; N.E. Toman; R. Sharma; and P.S. Yang. 1982. North Dakota Economic-Demographic Assessment Model (NEDAM): Technical Description. Agricultural Economics Report No. 158, Department of Agricultural Economics, North Dakota State University, Fargo.
- Leitch, J.A. and D.F. Scott. 1978. Nonresident Hunters in North Dakota, Characteristics, Expenditures, and Harvest. Agricultural Economics Report No. 126, Department of Agricultural Economics, North Dakota State University, Fargo.
- 1980 National Survey of Fishing, Hunting, and Wildlife--Associated Recreation. 1982. U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, Bureau of the Census, Government Printing Office, Washington, D.C.
- Pietsch, W.H. 1968. Interindustry Analysis of the Devils Lake, North Dakota, Trade Area. Unpublished M.S. Thesis, North Dakota State University, Fargo.
- Rajender, G.R.; F.K. Harmston; and D.W. Blood. 1967. A Study of the Resources, People and Economy of Teton County. Division of Business and Economic Research, College of Commerce and Industry, University of Wyoming, Laramie.
- Schwinden, C.J. 1984. Socioeconomic Analysis of the Devils Lake Fishery. Plan B, M.S. paper. North Dakota State University, Fargo.

- Strang, W.A. 1970. Recreation and the Local Economy: An Input-Output Model of a Recreation-Oriented Economy. Sea Grant College Technical Report WIS-SG-71-204, Department of Business, Madison, Wisconsin.
- Swenson, H.A. and B.R. Colby. 1955. Chemical Quality of Surface Waters in Devils Lake Basin, North Dakota. Geological Surface Water Supply Paper 1295, Government Printing Office, Washington, D.C.
- Vangsness, E.C. 1974. Retail Trade and Service Area Survey and Report, Devils Lake, North Dakota. Extension Agricultural Economics, North Dakota State University, Fargo.
- Whitman, W.C. and M.K. Wali. 1975. Prairie: A Multiple View. University of North Dakota Press, Grand Forks.