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MINNESOTA LIVE BAIT INDUSTRY ASSESSMENT STUDY^{1/}

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MINNESOTA LIVE BAIT INDUSTRY ASSESSMENT STUDY

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ABSTRACT

The Minnesota live bait industry was evaluated over the three year period 1976-1978. Emphasis was placed on the bait-fish portion of the industry. The industry was comprised of minnow dealers (wholesalers), minnow exporters, minnow retailers, and bait-fish hatchery operators. Through negotiations with industry members, a mandatory annual harvest and sales volume reporting system was developed and initiated.

The in-state sales volume of bait-fish for the three year period averaged 349,172 gallons of which 243,761 gallons were harvested and 105,411 gallons were purchased from other in-state wholesalers prior to resale. Fathead minnows, white suckers, shiners, chubs, and dace, in decreasing order of importance, were the principal bait-fish sold. Minnow exports (fathead and sucker) averaged 150,855 gallons annually. In 1978, the industry's in-state bait sales were conservatively estimated at \$24,932,467. The out state sales were estimated to be \$1,264,267.

Annual nonminnow live bait sales averaged 14,572 gallons of leeches, 1,144,954 dozens of night crawlers, 463,583 dozens of earthworms, and 807,658 dozens of grubs (insect larvae). Nonminnow live bait sales were reported on a voluntary basis.

Changes in laws and regulations affecting the live bait industry during

the study included altering the basic license structure to restrict bait-fish harvest, addition of a nonresident minnow hauler license classification, licensing leech harvesters, and allowing the export of suckers and leeches.

Minnow dealers were located in nearly every county of Minnesota. Dealers reported shortages of bait-fish in spring and summer because of high angler demand.

Minnow exporters were concentrated in the southern one-half of Minnesota, close to out-of-state markets. All exporters were unable to meet out-of-state demand for bait-fish.

Bait-fish hatchery operators raised mostly white suckers. Most rearing ponds were located in west-central Minnesota.

INTRODUCTION

The primary objectives of the study were to determine the general magnitude of the live bait industry in Minnesota including quantity and value of bait-fishes harvested and sold, number of people engaged in the industry, and overall industry stability. In addition, information was obtained on industry methods and techniques, geographic distribution of industry in the state, artificial propagation of bait-fish, and the relative importance of other live baits to the industry. Emphasis was placed on the bait-fish portion of the industry.

From its beginnings in the 1920's, the live bait industry in Minnesota has grown steadily to accommodate the increasing numbers of anglers. Throughout this history live bait dealers experienced shortages of desired species and grade sizes. The Department of Natural Resources (DNR) responded by investigating and promoting bait-fish propagation, restricting harvesting gear and waters, and altering license structures to promote improved utilization of the bait-fish resource. Concurrently, bait dealers encouraged minnow conservation by experimenting with artificial propagation as early as the 1940's, and by successfully introducing other live baits to fishermen.

The present-day industry has expanded to include many bait-fish hatchery operators and to allow the export of some bait species. To insure this healthy posture of the live bait business and protect a finite resource, the need to monitor the harvest of natural bait stocks has become apparent. Also, by maintaining continual communication with bait industry representatives, other problem areas can be identified and resolved quickly. Early in 1976, the Minnesota Section of Fisheries initiated this assessment project to describe Minnesota's live bait industry.

THE STUDY AREA

Minnesota lies near the geographic center of North America bounded by Manitoba and Ontario to the north, the Dakotas to the west, Iowa to the south, and Wisconsin and Lake Superior to the east. The most important event affecting Minnesota's physiography was the advance and retreat of the last glaciers 10,000 years ago. The scouring action of these large ice masses left Minnesota with over 12,000 lakes, numerous ponds, and over 15,000 miles of streams.

Minnesota is generally divided into two physiographic regions: the Superior Upland and the Central Lowlands which contains four sub-units. (Figure 1).

Superior Upland - This area is the western edge of the Laurentian Shield and is characterized by igneous parent rock, rugged topography, and numerous lakes and streams. The waters are of low fertility and the lakes are frequently deep. The land is heavily wooded with conifers and mixed hardwoods supporting little agriculture. (Hudson Bay and St. Lawrence drainage).

Central Lowlands - Most of the state is contained within the Central Lowlands. The area ranges from 1,000 to 1,500 feet in elevation, and is nearly level. Forests dominate the north grading into agricultural lands in the south and west. Waters range in fertility from moderate to high because of sedimentary parent rock and runoff from commercially fertilized agricultural lands. The four subdivisions of the Central Lowlands are the Red River Lowland, Western Lake Section, Dissected Till Plains, and the Wisconsin Driftless Area.

- 1) Red River Lowland - This is the old lake bed of Glacial Lake Agassiz. It is primarily agricultural land with some streams and few lakes. (Hudson Bay drainage).

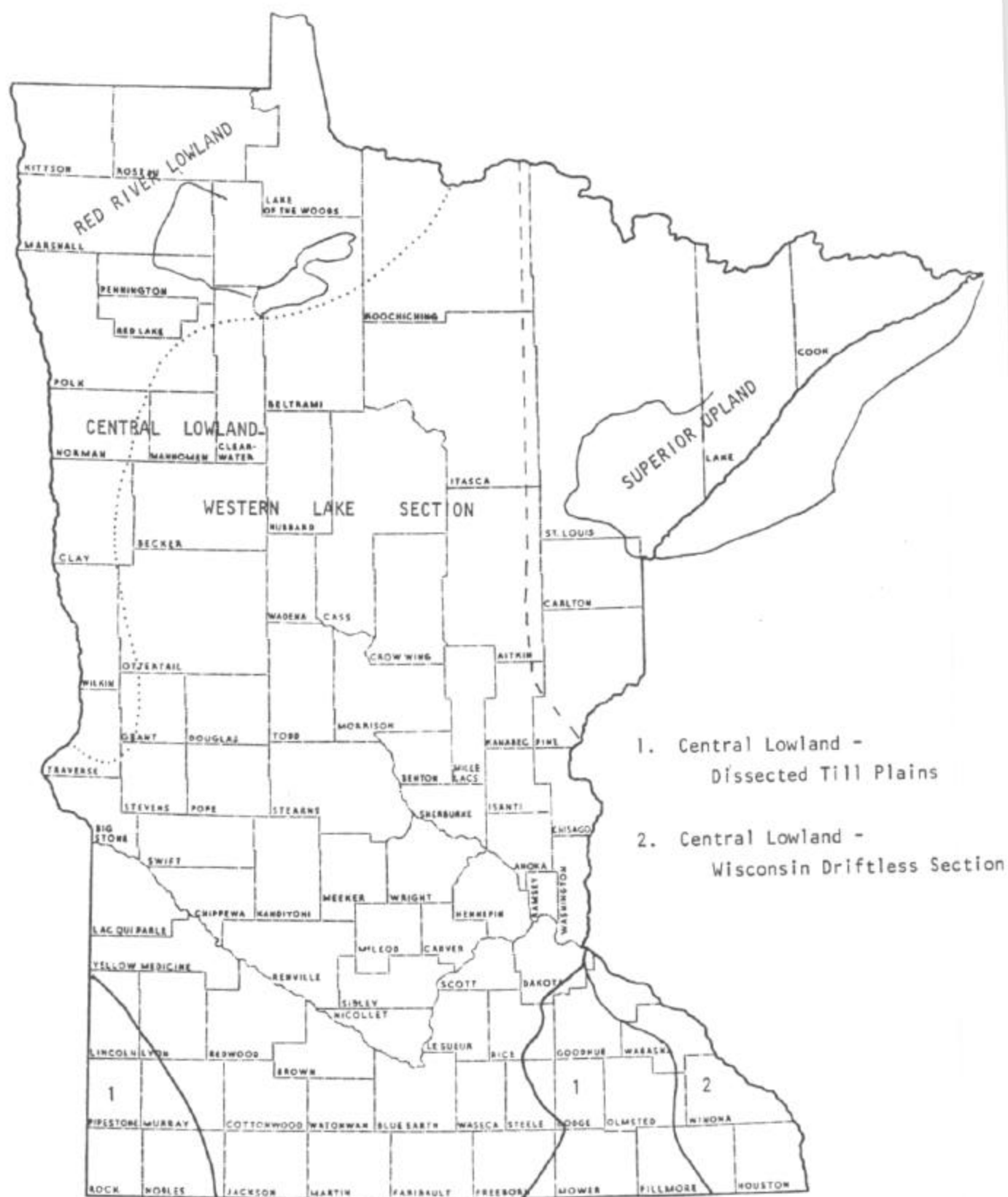


Figure 1. Map of major physiographic divisions of Minnesota. (After Fenneman.)

- 2) Western Lake Section - This is the "heart" of Minnesota and contains the majority of the lakes and ponds. It is best known as the headwaters drainage area of the Mississippi River. Moraines, eskers, and other glacial features occur frequently throughout the region. Agricultural land is common in the south and forested areas dominate the north.
- 3) Dissected Till Plains - This area has long been known as the Coteau des Prairies meaning "highland of the prairies." In Minnesota it is a relatively small area but represents some of the highest ground reaching elevations to 1,900 feet. It is covered by miscellaneous glacial rocks and debris divided by many ridges and valleys. Agricultural land is dominate with few lakes present.
- 4) Wisconsin Driftless Area - This is the only area of Minnesota untouched by glaciers. It is characterized by a heavily dissected landscape covered with mixed hardwoods and agricultural lands. Many streams characterize the area but few lakes exist.

PROCEDURE

The Minnesota live bait industry was evaluated during 1976, 1977 and 1978 using three methods:

- 1) Data from mandatory annual volume reports of bait-fish sales volumes (1976-1978) and leech sales volumes (1978) submitted by mail from live bait wholesalers were analyzed (Appendices 5-8). Information in these reports included species, source, grade size and volume. Some wholesalers also voluntarily reported other live bait sales volumes. These included leeches (1976, 1977), earthworms, night crawlers, grubs, frogs, salamanders, and crayfish. License renewal was dependent on submission of an annual report. Minnow

exporters were also required to file an annual report of bait-fish exported (Appendices 9-14). The total sales volume of any species was computed by adding private harvest volume, wild (public) harvest volume, and purchase volume. Purchase volume represents harvest volumes sold at least twice; wholesaler to wholesaler, wholesaler to retailer, or retailer to consumer. The total sales volume of any species indicates product volumes sold a minimum of once (harvester to consumer). The terms "privately owned water" or "privately owned land" indicate harvest sites owned or leased by minnow dealers. Bait-species harvested from terrestrial environments included night crawlers, earthworms, and insect larvae.

- 2) Field interviews were conducted with live bait wholesalers to obtain information not included on annual reports (Appendices 15-23). Interviews provided data on bait supplies and distribution, seasonal availability, business characteristics, and methods and techniques of harvesting, transporting, holding, and artificial propagation of bait-fish.
- 3) On-site inspections were conducted with dealer approval to observe equipment and methods used in harvesting, transporting, holding, and artificially propagating bait-fishes.

FINDINGS

Initiation of the Live Bait Reporting System and Initial Contact with the Industry

When the assessment project commenced in 1976, the license structure of the Minnesota live bait industry was as follows:

- 1) Local minnow dealer (1,674)

Local dealers could harvest and sell minnows at retail but were limited to harvest from waters within 15 miles of the retail place of business.

2) Itinerant minnow dealer (258)

Itinerant dealers serviced the local minnow dealer and had no restrictions on distance to harvest sites.

3) Private hatchery operator (55)

Hatchery operators are those who rear bait-fish.

4) Minnow exporter (35 Maximum)

Exporters were those allowed to transport fathead minnows only out-of-state. An itinerant dealer's license was a prerequisite to acquiring an exporting license (Figure 2).

Data collection was focused on itinerant minnow dealers since they accounted for the majority of the bait-fish harvest. The bait-fish sales volume reporting system was initiated in July, 1976 by mailing each itinerant dealer a supply of monthly volume reporting forms (Appendices 3, 4). Exporters were also required to submit an additional monthly report on bait-fish exported (Appendices 9, 10). This reporting system was instituted under a Minnesota statute that permits requiring of reports on the taking of wild animals for statistical purposes.

The initial response of the live bait industry to the newly instituted reporting system was one of hostility and lack of cooperation. Itinerant dealers and exporters returned completed reports at a rate of less than 30% for July, August, and September. Through extensive field contacts with bait dealers, a variety of reasons were uncovered that revealed the initial lack of cooperation. These included:

- 1) Form too long and complicated
- 2) Too time consuming
- 3) Invasion of privacy
- 4) Would be used to tax them on basis of sales

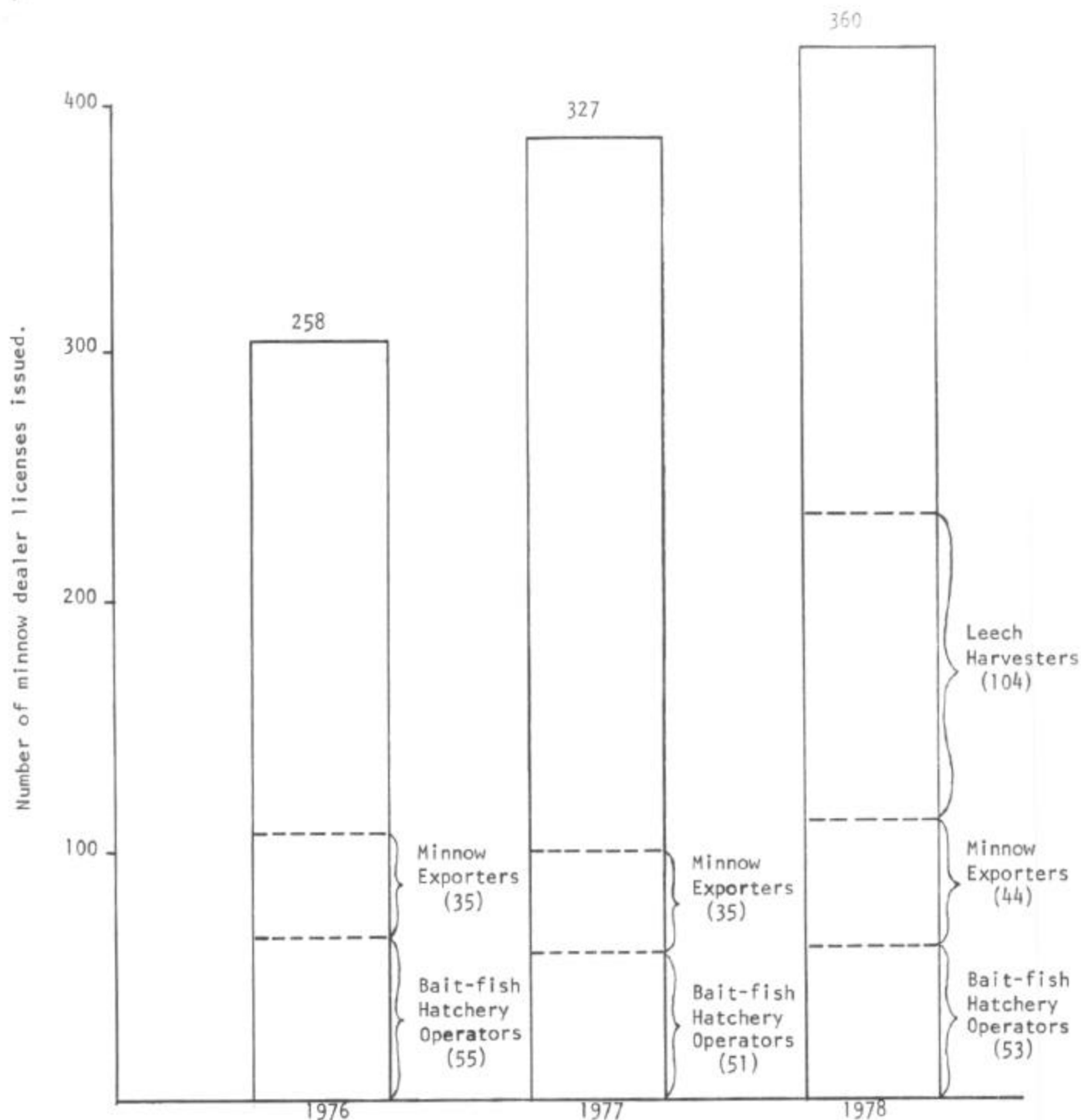


Figure 2. Number of minnow dealers that were also bait-fish hatchery operators^{A/}, minnow exporters^{B/}, or leech harvester^{C/} during 1976, 1977, 1978.

^{A/} All bait-fish operators also purchased a minnow dealers license.

^{B/} Purchase of a minnow dealers license was prerequisite to purchase of an exporters license. In 1978 statute provided for unlimited minnow exporters.

^{C/} Leech harvesters were first licensed during 1978.

- 5) The state has never paid any attention to their needs, why should they cooperate with the state.
- 6) Illegal to demand report.

To arbitrate these differences between the live bait dealers and the Fisheries Section of the Department of Natural Resources, which is responsible for the promulgation of rules and regulations pertaining to fish, a series of meetings were arranged. The bait dealers chose the Minnesota Live Bait Dealers Association as their representative.

By October 1976, an accord was reached between the two groups establishing an annual sales volume report due by February 1st of each year (Appendices 5, 6 and 9, 10). Grade sizes were defined for fathead minnows and white suckers. Chubs, shiners, and dace were to be reported ungraded with the wet-gallon^{1/} used as the standard unit of measure for all bait-fish. Other live bait species such as leeches, worms, and night crawlers were to be reported on a voluntary basis listing the respective units of measure. During 1976, 242 of 258 itinerant dealers (94%) and all 35 exporters filed annual reports.

During the initial period of field contact with the industry, nearly all bait dealers wanted state help in two problem areas:

- 1) All interviewed bait dealers wanted the sale of the bait-leech, Nepheleopsis obscura Verrill, to be restricted to licensed dealers. This leech has become a very popular fishing bait in recent years. Licensed dealers contended this resource was being wasted by non-licensed dealers who had neither the knowledge nor the facilities to harvest and handle this bait properly. Nonlicensed dealers also diverted business from licensed dealers.
- 2) Dealers felt they were losing many harvestable waters to the expansion of State Wildlife Management Areas (WMA's). Many of these

^{1/} See page 38.

Consequently, a better estimate of the total bait-fish harvest could be obtained. Former local minnow dealers that wished to continue harvesting minnows had to purchase a minnow dealer's license in 1977. As was expected, 1977 and 1978 showed a decline in minnow retailers and an increase in minnow dealers (Figure 3).

In 1977, bait-leeches were included in the licensing regulations governing minnows. Only licensed minnow dealers were permitted to harvest and sell leeches. The 1978 calendar year was the first year of mandatory leech reporting (Figure 2).

In 1978, at the live bait dealers' request and with DNR support, the license structure was enlarged to include:

Nonresident minnow hauler: Nonresident minnow haulers were defined as out-of-state persons licensed to transport bait-fish out of Minnesota. During 1978, 10 nonresident minnow haulers were licensed.

Exporting regulations changed during the study in the following ways:

- 1) In 1977, legislation declared suckers as a legal export bait-fish. This volume was first reported during the 1978 calendar year.
- 2) In 1978, the number of available exporting licenses became unlimited. Previously, the number available was restricted to thirty-five.
- 3) In 1979, leeches became legal for export. Estimates of this volume will not be available until 1980.

Annual Volume Report and Interview Analysis

As a product of the initial meetings between the live bait dealers and DNR personnel, an annual report format was agreed upon. Grade sizes for fat-head minnows (Pimephales promelas Rafinesque) and white suckers (Catostomus commersoni Lacepede) using industry terminology were established as follows:

areas have ponds and shallow lakes that can be managed for minnow harvest. Permission to harvest in these 848 areas (450,000 acres in 1975; 550,000 acres by 1980) was considered important to bait dealers for securing adequate bait-fish supplies in the future.

The first problem was alleviated by passage of legislation sponsored by the Minnesota Live Bait Dealer Association and supported by the DNR that provided for the harvest and sale of leeches by licensed dealers. The second problem was partially remedied by a Commissioner's Order where WMA's over 2,000 acres were opened to minnow harvest by permit.

This initial contact with the live bait industry proved very effective in gaining dealer confidence and in the implementation of an acceptable reporting system for evaluating the bait-fish resource.

Licensing and Legislative Changes Affecting the Live Bait Industry, 1976-1978.

As previously mentioned, data collection was initially concentrated on itinerant minnow dealers since they were the wholesalers and were also the principal bait-fish harvesters. Since local minnow dealers accounted for very little of the bait-fish harvest, they were not included with the reporting system. In 1977, the license structure of the live bait industry was changed as follows:

- 1) Local minnow dealer was renamed minnow retailer: Minnow retailers were permitted only sell bait-fish at retail and could not harvest bait-fish for sale.
- 2) Itinerant minnow dealer was renamed minnow dealer: Minnow dealers were the only persons permitted to harvest bait-fish and could also sell at retail or wholesale.

This license change greatly facilitated the annual reporting system by restricting minnow harvest to the segment of the industry required to report.

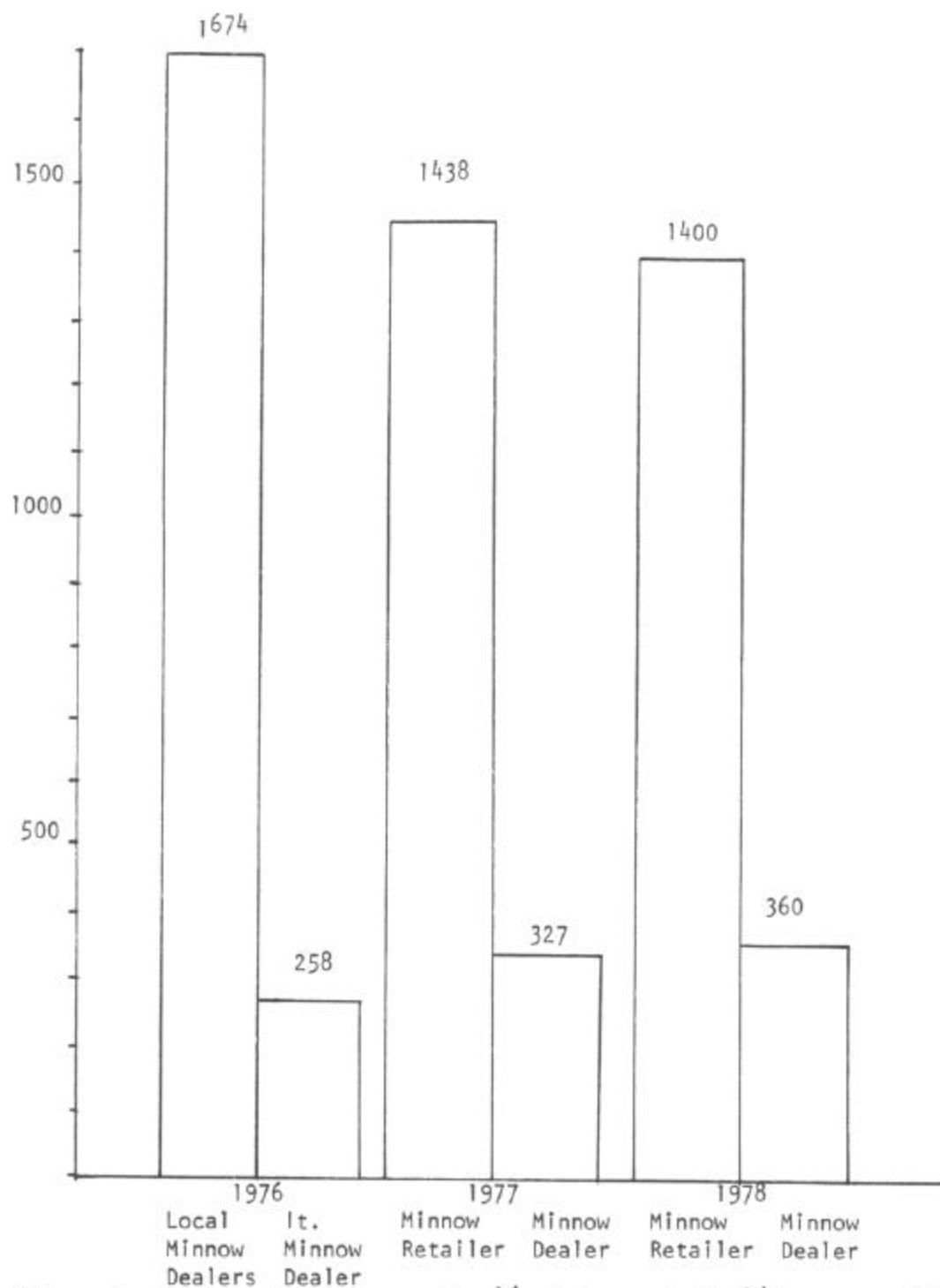


Figure 3. Number of minnow retailer^{1/} and minnow dealer^{1/} licenses sold during 1976, 1977 and 1978.

^{1/} In 1976 minnow dealers were licensed as "itinerant minnow dealers" and minnow retailers were licensed as "local minnow dealers."

Species	Grade Size	Approximate Length
Fathead	Crappie	1.5"
	Medium	2.0"
	Pike	2.5"
Sucker	Light Pike	3.0"
	Heavy Pike	4.5"
	Light Northern	5.5"
	Heavy Northern	6.0"

Chubs, shiners, and dace were also included as mandatory report items on the annual report. Species sold by live bait industry members included: creek chub (Semotilus atromaculatus Mitchill), hornyhead chub (Nocomis biguttatus Kirtland), common shiner (Notropis cornutus Mitchill), golden shiner (Notemigonus crysoleucas Mitchill), spottail shiner (Notropis spilopterus Cope), finescale dace (Chrosomus neogaeus Cope), and pearl dace (Semotilus margarita Cope). Bluntnose minnows (Pimephales notatus Rafinesque) were also harvested and sold by minnow dealers but were not differentiated from fatheads.

Live bait species other than bait-fish were reported on a voluntary basis with their respective units of measure. When bait-leeches were included in the minnow licensing laws, grade sizes were established as small, medium, large, and jumbo. Apparently, dealers visually determined grade sizes since no mechanical grading systems were known. In 1978, leeches were reported using the wet-gallon as the standard unit of measure. Other live bait species were reported in a variety of units but were converted to dozens for comparative purposes.

The 1976 live bait harvest, purchase and sales volume data were considered preliminary and conservative for the following reasons:

- 1) Dealers were not aware of the annual report requirement until October, 1976. Some did not have adequate records to supply

the information requested on the report forms and supplied estimates based on recall.

- 2) During 1976, the local minnow dealer was permitted to harvest minnows for sale within a fifteen mile radius of the place of business. There was no way of estimating this harvest volume. This was not a problem in 1977 and 1978 because all harvest was limited to minnow dealers who filed annual reports.

Minnow dealer and exporter compliance with annual report requirements was excellent during the study. Minnow dealers and exporters returned annual reports at an average rate of 88% and 93%, respectively. During 1977 and 1978 omissions and errors were evident on 21% and 15% of respective returned minnow dealer reports. Exporters erred on 17% and 16% of returned annual exporting reports in 1977 and 1978. Most omissions and errors were failure to indicate months of operation. Other omissions and errors included source of live bait species, undefined unit of measure, and lack of volume figures. Nearly all omissions and errors were easily corrected by phone calls, but in some cases it was impossible to make contact. Dealers completed the voluntary "Other Live Bait Sales" portion of the annual report at a rate of 61%, 69% and 45% during 1976, 1977 and 1978. The reduced return rate for 1978 reflects the mandatory reporting status of bait-leeches that year.

One problem was inherent to the reporting system. Dealers and exporters leaving the industry were not required to report the sales volume for that calendar year. This attrition represented 9%, 17% and 13% of the minnow dealers during 1976, 1977 and 1978 respectively. Exporters during 1976 through 1978 also lost industry members at a rate of 0%, 6% and 16% for each of the corresponding years. Efforts were made each year to maximize report returns through form letter requests and phone calls.

The three years of data indicated similarity in harvest, purchase and sales volumes. With this in mind, it was less cumbersome and equally descriptive to deal with these data as three year averages. Narratives of live bait sales volume figures are therefore related as averages, and where these data show marked differences, variations are discussed on an annual basis. Volume data for individual years are presented in accompanying tables and figures.

Itinerant Minnow Dealer and Minnow Dealer Bait-fish Sales, Harvest and Purchase Volumes

During 1976, 1977, and 1978 the average in-state bait-fish total sales volume was 349,172 gallons (Table 1). Of this volume, minnow dealers harvested 243,761 gallons and purchased 105,411 gallons from other in-state wholesalers prior to resale. The fathead minnow was the principal bait-fish sold accounting for 59% of the total sales volume. Suckers ranked second at 34% of the total sales volume with the remaining 7% represented by chubs, shiners, dace, and other bait-fish species.

The mean total sales volume of fatheads was 204,448 gallons of which minnow dealers harvested 157,380 gallons and purchased the remainder before retail sale (Table 2). Fathead harvest was primarily from public waters (63%) and the balance procured from privately owned waters. Fathead minnows were sold in three grade sizes: crappie (1.5 inches), medium (2.0 inches), and pike (2.5 inches). The sales volume of crappie size was the greatest comprising nearly one-half (45%) of the market with medium constituting 25% and pike size assuming the balance.

The sucker total in-state sales volume averaged 117,963 gallons (Table 3). The harvest of this species was 69,808 gallons with the remainder of

the sales volume purchased from other wholesalers prior to retail sale. Bait-fish hatchery operators produced 95% of the total harvest and 5% was taken from public waters. Suckers were marketed in four grade sizes: light pike (3.0 inches), heavy pike (4.5 inches), light northern (5.5 inches), and heavy northern (6.0 inches). Light northern size was the most common accounting for 37% of total sales followed by light pike (21%), heavy pike (23%), and heavy northern (19%). Minnow dealers also sold suckers as decoys (6 to 12 inches) for northern pike spearing. This grade size represents an insignificant portion of total sucker sales and was not included on the annual report format during the study. Future annual report forms will include this grade size.

Minnesota minnow dealers harvested and sold bait-fish species other than fatheads and suckers including chubs, shiners, dace, and other bait-fish species. During 1976 through 1978, the mean total sales volume of these species was 26,703 gallons (Table 4). The total harvest added up to 16,574 gallons of which 70% was taken from public waters. Purchases from other in-state wholesales amounted to 38% of the total sales volume. Various species of shiners were the predominant bait-fishes in this group commanding 76% of the total sales. Other species followed in importance as follows: chubs (17%), dace (6%), and "other" (1%). Chubs, shiners, dace, and other bait-fish species were reported ungraded.

Itinerant Minnow Dealer and Minnow Dealer Other Live Bait Species Harvest, Purchase, and Sale Volume

Minnesota live bait dealers harvested and sold bait species other than bait-fish including leeches, night crawlers, earthworms, grubs, salamanders, crawfish and frogs. These species were reported in various units of measure but were converted to dozens for comparative purposes. In 1976 and 1977 leeches were generally reported in pounds, but the wet-gallon was adopted as

the standard unit of measure in 1978 when bait-leeches were a mandatory report item.

The total sales volume of leeches in 1976 was 7,770 gallons (62,157 pounds) and 8,172 gallons (65,376 pounds) in 1977 (Table 5). These figures represent voluntary reporting. In 1978, with mandatory reporting, the total sales volume was 27,775 gallons (220,200 pounds). This was a three-fold increase (Tables 5, 9).

The harvest of leeches in 1976 amounted to 3,277 gallons of which 87% were procured from public waters and the remainder taken from private waters. Purchases within the industry from licensed dealers and nonlicensed dealers contributed 58% of the total sales volume (Table 6).

The harvest of leeches in 1977 was 2,844 gallons where harvesters of private waters supplied 53% and the rest (47%) were taken in public waters. Purchases from licensed (73%) and nonlicensed dealers (27%) were 65% of the total sales volume (Table 7).

In 1978, minnow dealers were required to report the harvest and sale volumes of bait-leeches. The total sales volume of bait-leeches amounted to 27,755 gallons in 1978, of which 16,271 gallons (59%) were purchased prior to resale. The total harvest amounted to 11,483 gallons that were primarily taken from public waters (56%) with the balance procured from privately owned waters. Live-bait dealers marketed bait-leeches in four grade sizes: small, medium, large, and jumbo. The most commonly sold grade size was large size representing 33% of the total sales volume. Medium was second with 31% of the sales volume followed by jumbo size (21%) and small (14%) (Table 9).

The total sales volume of night crawlers in Minnesota averaged 1,144,954 dozen during 1976 through 1978 (Table 5). Night crawlers were generally imported (often from Canada) and constituted 48% of the total sales volume.

Purchases from licensed and nonlicensed dealer represented 42% and 2% of the sales volume respectively, with the balance harvested from public (4%) and privately owned lands (3%) (Tables 6, 7, 8).

Earthworms averaged a total sales volume of 463,583 dozen yearly (Table 5). Harvested earthworms supplied 77% of the total sales volume with the bulk taken from public lands (67%) and the remainder taken from privately owned lands (33%). The balance of the total sales volume was divided between imports (12%) and purchases from licensed (6%) and nonlicensed dealers (5%) (Tables 6, 7, 8).

During 1976 through 1978, the grub sales volume averaged 807,658 dozen (Table 5). Grubs were described by other common names such as "mousie", "waxie", "wiggler", and "white maggot". Grubs were usually imported by minnow dealers and imports represented 92% of the sales volume. Harvest of this live bait was minimal in Minnesota accounting for less than 6% of the sales volume with purchases from licensed and nonlicensed dealers filling the remaining 3% (Tables 6, 7, 8).

Salamander sales averaged 3,058 dozen annually of which the majority (55%) was harvested in public waters (Tables 5, 6, 7, 8). The average annual sales volume of crawfish was 5,546 dozen with harvesters of private waters supplying 94% of the volume. The mean total sales volume of frogs was 1,745 dozen. Over one-half of this volume (52%) was harvested from public waters (Tables 5, 6, 7, 8).

Itinerant Minnow Dealer and Minnow Dealer Business Characteristics

The following statistics were computed from 117 minnow dealer interviews conducted during 1977 and 1978.

Minnow dealers and their businesses were distributed in almost every county but occurred most frequently in areas of major lake concentration

(Figures 4, 6). Minnow retailers being dependant on minnow dealers for bait supplies had a similar distribution pattern (Figure 5, 6). Over one-third of businesses were operated year-round (35%) while many dealers (38%) operated businesses seasonally for six months or less (Table 12). The greatest number of dealers operated during June, July, and August (84%, 83%, 80% respectively), and a minimum of 43% of the dealers operated businesses during any given month of the year (Table 13).

Minnow dealers harvested bait-fish species year-round from lakes, ponds, and streams and applied the heaviest pressure to public waters. Some dealers also leased private ponds and lakes for the rearing and commercial harvest of bait-fish. Forty-three interviewed dealers indicated an average annual pond lease of \$110.00 regardless of acreage. Minnow dealers (81%) harvested fat-heads from lakes and ponds year-round, but primarily in the spring and summer. (Table 15). One-third of the dealers interviewed harvested suckers of which most were cultivated in hatchery rearing ponds. A few dealers acquired suckers from natural sources--usually in rivers and streams during spring, summer, and fall. Chubs, shiners, and dace were harvested by less than one-half of the minnow dealers (47%, 24%, and 15% respectively). Chubs and dace were commonly harvested in the spring while shiners were procured during summer from rivers and streams--common shiners in spring, golden shiners later. Dealers generally harvested either 0-25% (44%) or 76-100% (48%) of what they sold (Table 17). This indicates very little middle ground; either they purchased what they sold or they harvested what they sold. Many minnow dealers indicated shortages of fatheads, suckers and shiners during spring and summer. Fall and winter seasons have much lighter bait-fish demands, hence supplies are adequate.

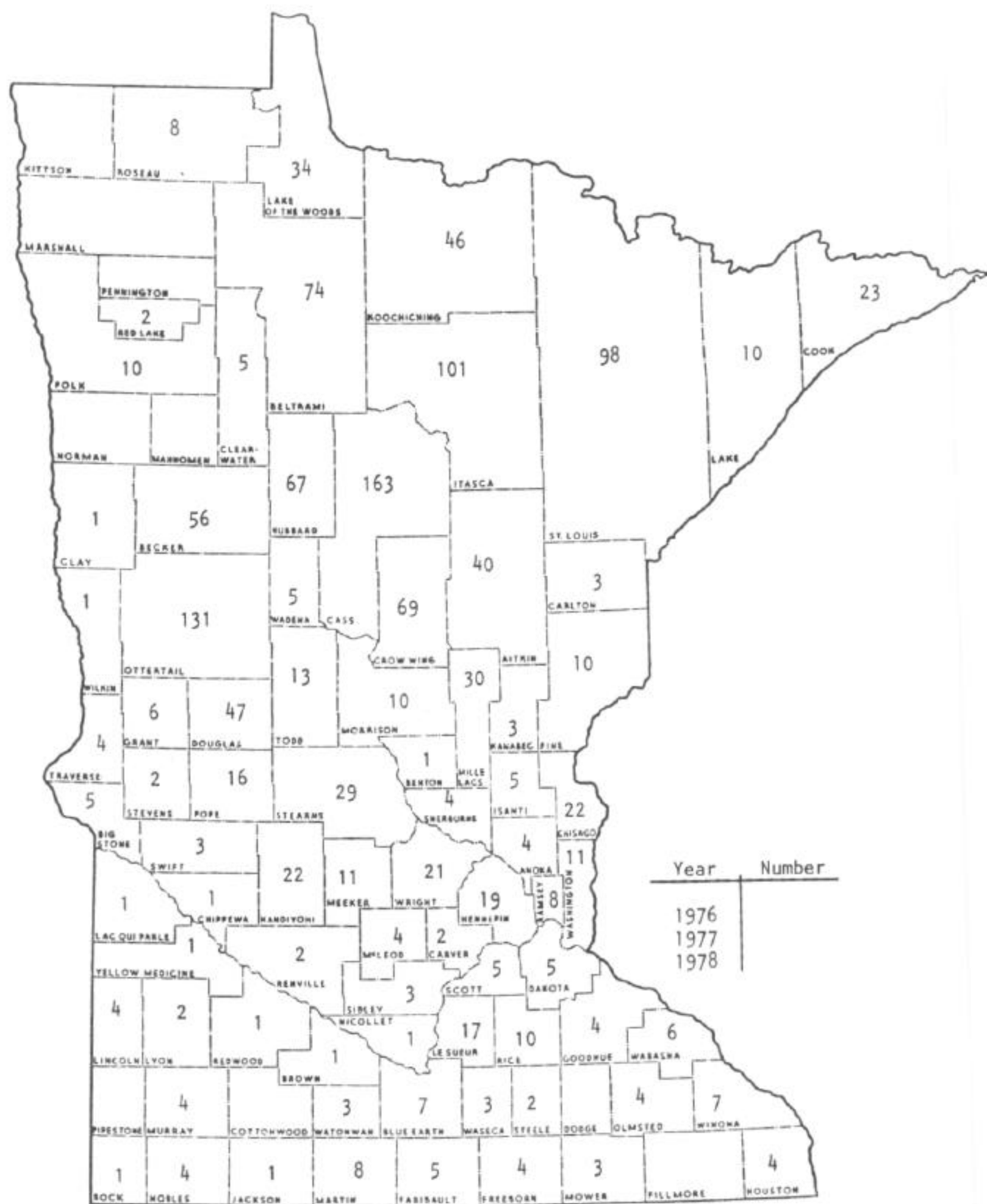


Figure 5. Number of retail minnow dealers in Minnesota by county, 1978.

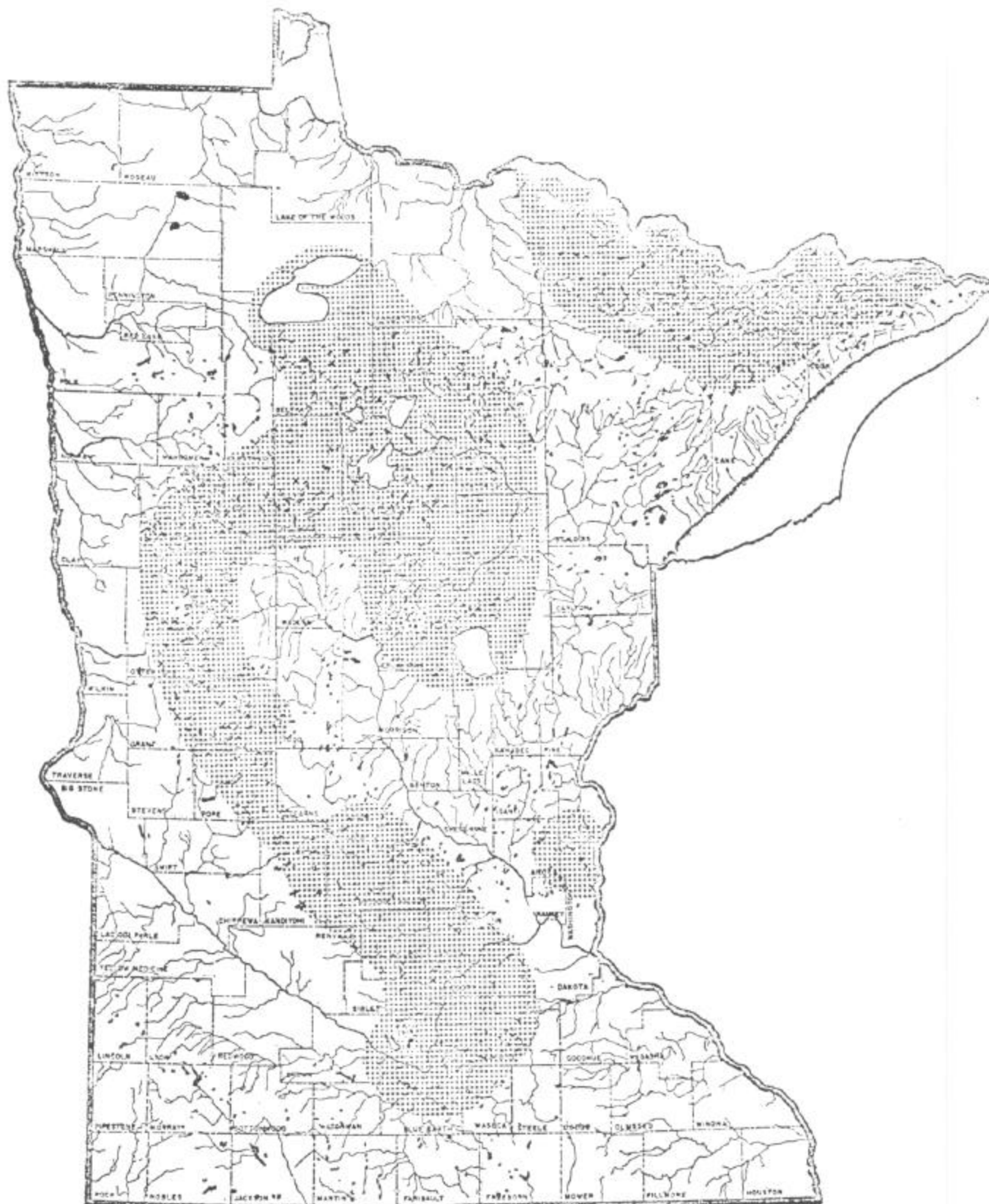


Figure 6. Areas of major lake concentration.

Virtually every dealer interviewed (97%) sold fatheads (Table 16). Suckers and shiners were also popular bait-fish species being sold by 79% and 68% of the dealers, respectively, while some dealers also sold chubs (35%) and dace (21%). The greatest demand for fatheads, suckers, shiners, and dace was in the spring. The peak seasons for chubs were spring and summer (Table 16). Minnow dealer retail sales of harvested bait-fish species varied for 0-25% (51% of minnow dealers) to 76-100% (37% of the dealers) (Table 17). Wholesalers sold at retail either very few or most of the minnows they harvested. Here again this was a nearly all or none situation.

Minnesota minnow dealers harvested and sold other live bait species as well as bait-fish (Table 18). Leeches and night crawlers were harvested by 22% and 13% of the dealers, respectively, but over 70% sold these live baits. This difference between night crawler harvest and sale can be partially accounted for since 48% of the night crawlers were imported. Less than 10% of the dealers harvested earthworms, grubs, salamanders, frogs and crawfish, while 15-30% would sell these same species. A portion of this disparity can also be attributed to imports of earthworms and grubs. Over one-half of the dealers (56%) harvested only bait-fish. Approximately one-third of the dealers (34%) selling night crawlers indicated shortages, and nearly 6 out of 10 dealers (58%) said that leeches were periodically in short supply.

The service area of a live bait business was usually contained within a fifty mile radius (65% of interviewed dealers), and the remainder worked radii of either 51-100 miles (9%) or greater than 100 miles (9%). Seventeen percent of the dealers provided no information (Table 19). Within the service area, a dealer frequently accommodated 0-25 retailers (75%) and 0-10 wholesalers (86%). Many minnow dealers (39%) logged 0-25,000 miles annually

to run their businesses. Some dealers (16%) accumulated 25,001 to 50,000 miles while eight percent totalled 50,001 to 75,000 miles, and twelve percent reported 75,001 to 100,000 miles yearly. Three percent operated businesses that turned in over 100,000 miles annually (Table 19) and 21% provided no information.

Minnow dealers normally employed 0 to 2 full-time employees (78%) and 0 to 2 part-time employees (73%). Family members frequently comprised a dealer's total work force. Many dealers (40%) had operated their businesses for 10 years or less, twenty percent were in business for 11 to 20 years and seventeen percent for 21 to 30 years (Table 20).

Bait-fish were commonly held for sale in concrete tanks (69% of interviewed dealers). Steel tanks were used by twenty-five percent of the dealers with wood, fiberglass and other construction materials less prevalent. Six percent indicated they held bait-fish in ponds prior to sale. All dealers equipped holding tanks with aeration devices. Water sources for holding facilities included wells (75%), city supply (15%), springs (7%), and ponds or lakes (2%). Dealers filtered water for chlorine, iron, calcium and magnesium depending on the type and location of the water source.

Some dealers reported mortality problems while transporting and holding bait-fish (67%), and the rest indicated little or no mortality. Most problems were encountered while holding bait-fish and dealers cited summer as the problem season because of hot weather and consequent water temperature increases (Table 21). Disease treatments were practiced by forty percent of the interviewed dealers and the remainder practiced none. Of those implementing treatments, 91% used preventative measures and 19% employed therapeutic techniques. Preventive methods included tank disinfection, salting, and application of

Bait-Saver, Acriflavin or other related commercial aquatic fungicides. Therapeutic practices usually were "dipping" diseased fish in concentrated salt solutions or commercial fungicides.

Minnow Exporter Bait-fish Sales, Harvest and Purchase Volume

During 1976, 1977 and 1978, minnow exporters shipped an average of 148,011 gallons of fatheads out-of-state (Table 1). Of this sales volume 60% was harvested by exporters and 40% was purchased from other-in-state wholesalers prior to export. Harvest of fatheads for export was primarily from public waters (93%), and the remainder was procured from privately owned waters. Crappie size comprised 55% of the exports followed by medium size (32%) and pike size (13%) (Table 10).

Legislative changes in bait-fish exporting laws allowed the export of suckers from Minnesota for the first time in 1978. The total out-of-state sales volume of suckers was 8,534 gallons of which sucker propagators raised 4,673 gallons and the rest were purchased from other in-state wholesalers. Light northern size was the predominant grade size exported and accounted for 53% of the total sales volume (Tables 1, 11).

Minnow Exporter Business Characteristics

Exporters were also minnow dealers as required by law and as a consequence, many characteristics of an exporting business were the same as a minnow dealer's operation. Only characteristics common to minnow exporters are discussed. Percentages computed reflect 19 businesses representing 30 exporting licenses. Frequently an exporting business was operated by a group of brothers, or the wife of an exporter also held an exporting license but was not actively involved in exporting.

Minnow exporters were generally located in the southern one-half of Minnesota close to out-of-state markets and operated their business year-round (53%) or seasonally for six months or less (24%) (Figure 7, Table 12). The average percentage of exporters operating during any given month of the year varied from 55% in January to 78% in May through August (Table 13).

In 1978, of 37 exporters reporting, 89% sold fatheads and 35% sold suckers. Exporters (43%) generally harvested most (81-100%) of the bait-fish exported. To help satisfy out-of-state demand, exporters purchased bait-fish from other in-state wholesalers located up to 150 miles distant (63% of exporters) (Tables 22, 23).

Minnesota exporters shipped fatheads and suckers to over twelve states located generally to the south and east of Minnesota. Dealers normally made less than 60 out-of-state trips (80%) to service 1-5 out-of-state wholesalers (78%) (Table 24). The annual mileage necessary to operate an exporting business was usually less than 20,000 miles (29%) but some traveled 20,001-40,000 miles (18%) or 40,001-60,000 miles (18%) (Table 25). Exporters (95%) usually did not service out-of-state retailers. An exporting business normally employed 1 to 2 (74%) or 3 to 5 (26%) full-time employees. Many exporters hired 0 to 2 part-time workers (68%) while the remainder hired up to six (Table 26).

All exporters reported peak demand during summer and none could meet the out-of-state demand for bait-fish.

Bait-fish Hatchery Operator Business Characteristics

Minnesota bait-fish hatchery operators primarily raised suckers for bait (97% of 30 operators interviewed). Golden shiners were reared by 23% of the operators. Fathead, chub and dace propagation was less common. The methods and techniques of sucker hatchery operators were documented during the course

of the study since sucker culture represented nearly 90% of the water acreage employed for bait-fish rearing in Minnesota (Table 14).

Hatchery operators and their helpers seined and stripped suckers of eggs and milt during major spawning runs under DNR supervision. Permits were issued for sucker egg taking to operators by the DNR or Indian Tribal Organizations depending on the land jurisdiction of the spawning site. One operator imported sucker eggs from Wisconsin under permit from the State of Minnesota. Some operators collected and hatched eggs cooperatively and divided the fry among themselves.

Fertilized sucker eggs were transported to hatcheries by two methods. Ten gallon milk cans were used by some operators to haul ten quarts of eggs at a time or else plastic bags were partially filled with eggs and water and then inflated with oxygen.

Hatcheries were located in a variety of places depending on the water source. Some were situated below mill ponds and river dams which offered the advantage of a gravity feed water source, while others pumped water from ponds or lakes. Hatchery water temperatures were not regulated and were dependent on the water source.

Approximately three quarts of eggs were placed in plastic, glass, or metal hatching jars of six to seven quart volumes. Flow rates through hatchery batteries were crucial and had to be continually monitored and adjusted so the eggs maintained a gentle rolling motion during the incubation period. Eggs hatched in eight to thirteen days, depending on water temperature. Fry required four to five days to reach the swim-up stage of development. Free swimming fry were then flushed from hatching jars into troughs and finally transferred to fry holding tanks.

Sucker egg hatching success ranged from 60% to 99%, and 60% of the op-

erators interviewed indicated hatching success greater than 75% (Table 27). One operator stated that hatching success less than 80% was inexcusable and resulted from poor egg harvest procedure or poor hatchery operation. Mortality problems encountered by operators in their hatcheries included: using eggs that were not all ripe, rough handling of eggs during harvest, allowing eggs to clump together in hatching jars, incorrect water flow rate and not removing dead eggs.

Stocking rates of 17,000 to 65,000 five-day old fry per acre were used by four hatchery operators. Operators varied their fry stocking rates depending on the pond productivity, and the size of bait desired at a specified harvest time. Low stocking rates were used to obtain saleable suckers in one season. Hatchery operators felt the lowest acceptable survival rate of pond stocked fry was from 20 to 30 percent.

Some operators cited mortality problems occurring in rearing ponds. Losses were attributed to summerkill, winterkill, agricultural spraying and bird predation.

Winterkill caused by oxygen depletion was dealt with by operators in two ways. Those operators using shallow freeze-out ponds for summer rearing usually moved suckers to deeper ponds to insure adequate dissolved oxygen. Other hatchery operators ran aerators or plowed snow off the ice on ponds in attempt to prevent winterkill.

Ponds in west-central Minnesota were the best for sucker rearing. The land is rolling with fertile soil and is generally unwooded. This last feature allows for greater wind aeration of ponds. The water supply for most of the ponds is from surface runoff. Many ponds in this area are of above average fertility and few of the operators fertilized their ponds.

The demand for sucker grade sizes varied with the seasons (Table 29). Light pike (3.0 inches) and heavy pike (4.5 inches) sizes were in greatest demand during the summer while light northern (5.5 inches) and heavy northern (6.0 inches) sizes were most in demand in the fall. All operators selling decoys (6 to 12 inches) indicated winter as the season of peak demand. These were for dark house spearing. Of 25 operators interviewed, 52% could not meet consumer demand, 46% could, and 4% did not respond.

The service area of a sucker hatchery operation was usually contained within a 50 mile radius (60%), but some operators (28%) would service radii of 101 to 200 miles. A hatchery operator normally supplied 0 to 25 (44%) or 26 to 75 (41%) retailers within the service area. Most operators (32%) logged 50,001 to 75,000 miles annually and some (28%) logged 25,001 to 50,000 miles (Table 28). Long distance travel was often necessary if an operator located in the western part of the state had customers in the eastern area of the state. Hatchery operators usually employed 1 to 2 full-time and 1 to 2 part-time employees (Table 30). As expected, bait-fish hatchery operators and their rearing ponds were located in areas of major lake concentration (Figures 6, 8, 9).

Economic Importance of Minnesota's Live Bait Industry

The overall importance of Minnesota's live bait industry to the economy of Minnesota and the Department of Natural Resources' budget can be measured by computing the estimated dollar sales generated by the industry and by totalling the revenue received from licensing fees. The following text summarizes the license revenue received and the dollar value of sales generated within the industry.

Data gathered from minnow dealer annual reports and field interviews pro-

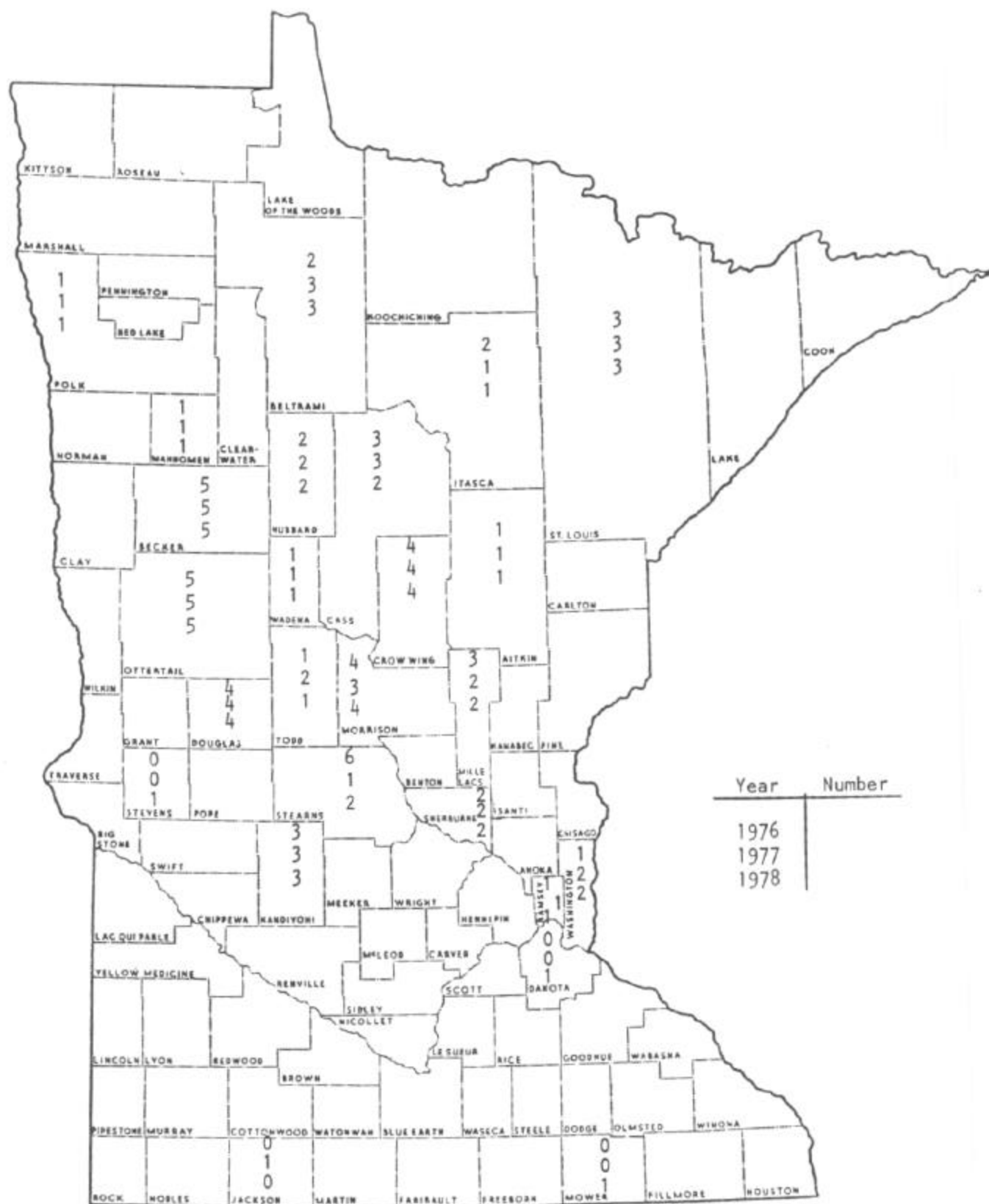


Figure 8. Number of bait-fish hatchery operators in Minnesota by counties during 1976, 1977, 1978.

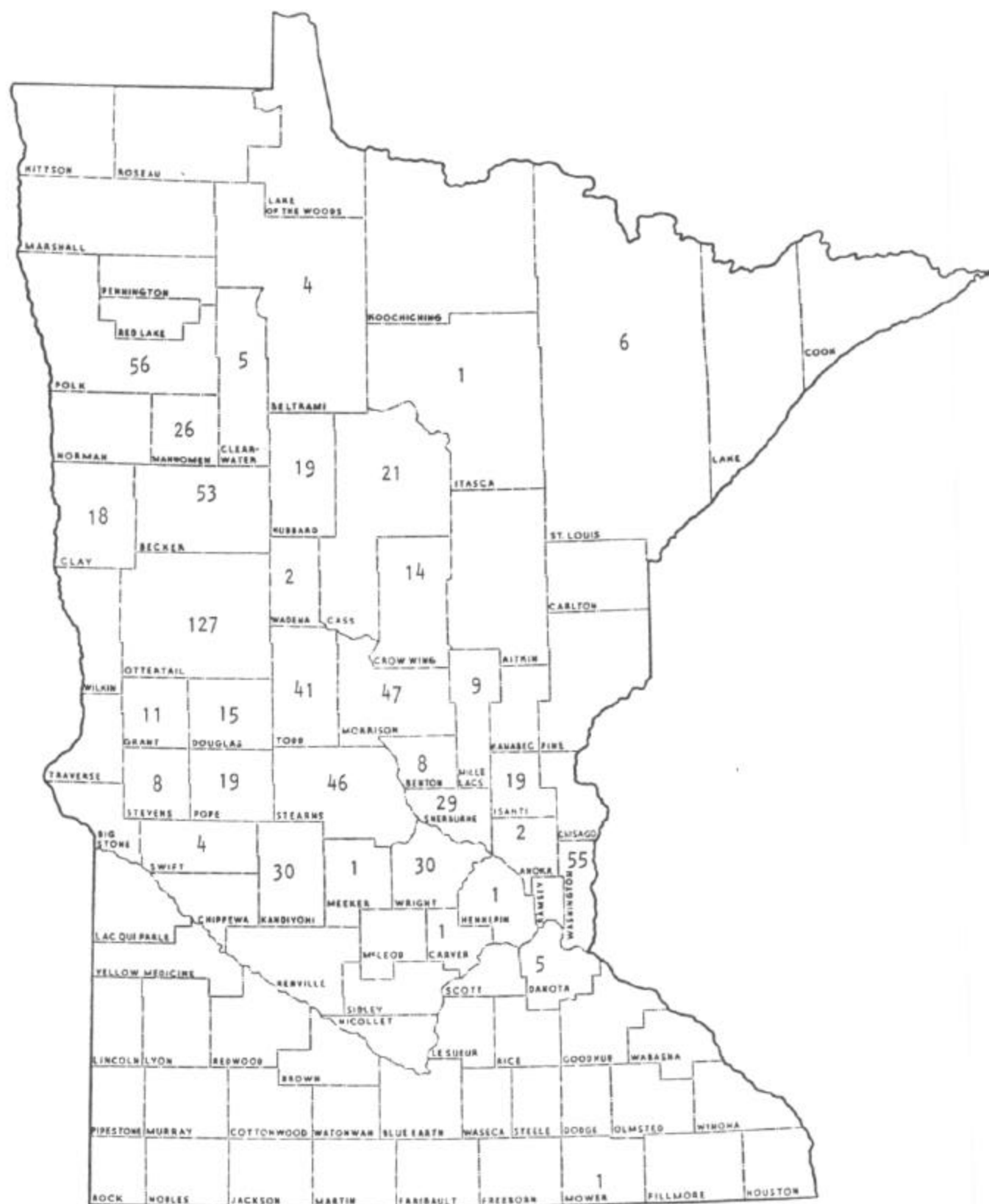
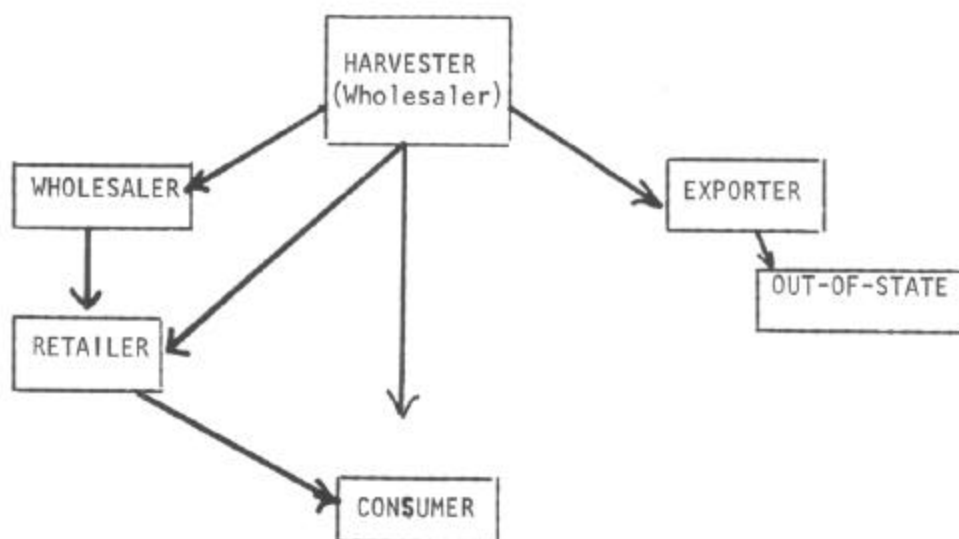


Figure 9. Average number of bait-fish rearing ponds in Minnesota by county during 1975 through 1978.

vided information from which a conservative estimate of dollar sales of the live bait industry could be calculated. The live bait industry's contribution to the DNR budget was calculated from license lists and fees furnished by the DNR License Center. License revenue for 1978 amounted to \$60,181.00. A breakdown of this revenue is shown in Table 31. This total represented 76% of the total Commercial Fish license revenue. Revenue receipts during 1978 are shown in Table 33.

Mandatory volume reports received from minnow dealers reported harvest and sales of bait-fish, bait-leeches and some voluntarily supplied information on other live baits. Annual reports indicated whether product volumes were harvested or purchased from other dealers. "Other Live Baits" included an extra category for imported volumes which were combined with harvest volumes for calculation purposes. Field interviews with industry members provided wholesale and retail prices for live baits, and the percentage of bait-species a harvester would directly sell at retail (Table 17).

A model was devised to describe bait transactions of the Minnesota bait business. Live bait can "flow" through one of the following channels:



From this model two equations were developed to compute the dollar value generated by the industry. The formulae were developed from bait-fish annual report data and interview data, and were arbitrarily assigned to leeches, night crawlers, earthworms and grubs. Figures used in calculations are found in Table 32.

The in-state dollar value generated by each species and grade size were calculated from the following formula:

Total in-state dollar value =

$$(H \times R_p) + ((0.55 \times H) \times W_p) + (P \times W_p) \quad \text{where,}$$

H = (Harvest volume) - (Export purchases)

P = Wholesaler purchases

W_p = Wholesale price

R_p = Retail price

(0.55) is the weighted average value for the percentage of wholesale sales to retailers. This is computed from Table 17.

The exporting dollar value generated (outside money brought into Minnesota) was calculated by the following formula:

$$\text{Total exporting dollar value} = (H' + P') \times W_p \quad \text{where,}$$

H' = Harvest volume by exporters for exporting

P' = Export purchases volume (from other in-state wholesalers)

W_p = Wholesale price

In 1978, the following potential dollar values were generated by each bait classification:

Bait-fish	\$20,237,705
Leeches	2,695,622
Night crawlers	1,315,171
Earthworms	211,788
Grubs	<u>472,181</u>
Total (in-state)	\$24,932,467
Exports (Fatheads and suckers)	<u>\$ 1,264,277</u>
Total (in-state + export)	\$26,196,744

The above figures were considered conservative for the following reasons:

- 1) The annual report format can identify only one transaction between wholesalers of a product volume. A gallon of minnows sold more than once between wholesalers is not included in the figures.
- 2) Of the 360 minnow dealers licensed in 1978, 15% did not report, thus harvest and sale volumes cannot be estimated for this group.
- 3) The volumes of night crawlers, earthworms, and grubs were reported on a voluntary basis and we know that all transactions involving these baits were not reported. DNR's experience with bait-leech licensing demonstrated this.
- 4) The estimate of total sales does not include the sale of frogs, crawfish and salamanders and other nonminnow live baits. Some estimates of these baits are available on a voluntary basis (as in 3) but price data is incomplete and volumes are small.

DISCUSSION

A recurring problem with bait industry surveys has been the reported unreliability of data (Warnick 1973, Brandt and Schreck 1974, Van Eeckhout 1978, La Bar 1976). These investigators cited the following difficulties: inadequate report (survey) returns, lack of adequate records, misunderstanding of questions, and not specifying the size of fish to facilitate conversion to a standard unit of measure.

In Minnesota it was possible to circumvent most of these problems and obtain a reasonable, although conservative, estimate of the volume of bait-fish harvested and sold. Minnow dealer cooperation and support for the assessment project proved crucial for securing meaningful data, and extensive field contacts were necessary to meet these ends. By opening channels of communication between Fisheries personnel and bait-industry members, units of measure were standardized and grade sizes were defined for the major bait-species sold.

The problem of inadequate report returns was solved by making license renewal dependent on receipt of minnow dealers' "Annual Report of Live Bait Sales." Also to maximize the validity of the reporting system the license structure was altered so minnow dealers (those required to report) were the only license classification allowed to harvest bait-fish. The license structure change concurrently promoted bait-fish conservation by placing bait-fish harvest in the hands of the most qualified and experienced operators.

Total harvest, purchase, and sale data for the three years of the study appeared consistent and varied less than 15% from year to year in each category. First, this indicates reliable reporting from minnow dealers and secondly, suggests a stable industry. Various factors, presently apply

pressure to this stability which include: 1) the trend of government agencies to appropriate harvestable bait-fish waters, and 2) the annual increase of sportfishermen in Minnesota. Minnow dealers are presently applying more intensive pressure on available waters and traveling greater distances to secure supplies to offset these trends. Increased artificial propagation of bait-species is an obvious alternative for the future.

In the future, governmental agencies of whatever level, should become aware of the economic impact the Minnesota live bait industry represents when proposed legislation may affect this group. The live bait business is a vital support industry to Minnesota's billion dollar tourism and encompasses over \$26,000,000.00 in-state and probably approaches \$1,500,000.00 with the exporting segment. This "new" money the exporters bring to Minnesota is an economic asset and bait-fish should be viewed as an abundant renewable resource like timber and agricultural products.

Presently, the Fisheries Section maintains continual and open communication with industry members. The process identifies problem areas quickly and insures a good rapport between the two groups which is necessary for evaluation of the bait-fish resource.

1/ The standard measurement for minnow transactions in the wholesale market is the wet-gallon. This is a water displacement method where a 3 U.S. gallon container is marked first at the 1 gallon water level point and again at the 2 gallon water level point. Water is removed to the 1 gallon marking and minnows are added till the 2 gallon mark is reached. Thus a gallon of minnows. This is a rapid accurate method to measure minnows from which the arithmetical extraction of volume, weight and numbers can readily be obtained.

MANAGEMENT RECOMMENDATIONS

Three years of harvest and sale data suggest a stable bait-fish industry in Minnesota. The industry is considered to be in healthy condition, but means for improvement are suggested through the following management recommendations:

- 1) Permit minnow dealers access to waters closed to them by the land appropriations of municipal, county, state, and federal agencies if the commercial harvest of bait-fish is compatible with the management plans of these areas. The trend of land acquisition by government agencies has reduced the acreage of harvestable bait-fish waters in many areas of Minnesota. Bait-fish, a crop like any other, can be harvested to an extent that is not detrimental to populations or other wildlife that may be dependant on it. Permits could be issued by agencies managing these areas citing appropriate controls (number of permits, preferred seasons, access sites, methods of harvest, etc.). Presently the Fisheries Section is communicating with some of these agencies to obtain access to these areas by minnow dealers. Where permit systems already exist, minnow dealers can cultivate relations with the respective agencies.
- 2) Increase the culture efforts of suckers and golden shiners. Both of these bait-fish species have market demands greater than available supplies.
- 3) Improve handling techniques for bait-fish during harvesting and transporting. Rough and improper handling of bait-fish is one of the major causes of loss over which a dealer can exercise control.
- 4) Improve water quality in transport, holding, and retail tanks.

Dealers should make sure that more than adequate aeration, circulation, temperature control, and filtration systems are in good working order on all tanks. Periodic checking of oxygen concentrations is cheap insurance against a potential loss.

- 5) Land owners should be apprised of the consequences of improper application of chemicals on land adjacent to bodies of water. Runoff from the watershed tends to concentrate chemicals in ponds and lakes. Excessive and improper application of fertilizers, pesticides, and herbicides degrades water quality and can endanger bait-fish populations.

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Table 2. Fathead harvest, purchase and sale volume by minnow dealers within the state during 1976, 1977, 1978.

Fathead Grade Size	S O U R C E						P u r c h a s e						TOTAL SALES (Gallons)	
	H a r v e s t						P u r c h a s e							
	Private			Public			1976			1977				1978
	1976	1977	1978	1976	1977	1978	1976	1977	1978	1976	1977	1978		
Crappie (1.5 inches)	37,079	34,579	22,088	38,624	48,879	43,804	13,974	19,755	19,603	89,677	103,213	85,491		
Medium (2.0 inches)	19,744	7,238	16,897	26,353	25,354	33,707	8,520	11,973	6,246	54,617	44,565	56,850		
Spike (2.5 inches)	16,292	12,391	10,432	21,075	24,472	33,134	18,486	21,909	20,738	55,853	58,772	64,301		
TOTAL	73,115	54,208	49,417	86,052	98,705	110,645	40,980	53,637	46,587	200,147	206,550	206,645		

Table 3. Sucker harvest, purchase and sale volume by minnow dealers within the state during 1976, 1977, 1978.

Sucker Grade Size	S O U R C E			P u r c h a s e (Gallons)			TOTAL SALES (Gallons)
	H a r v e s t (Gallons)			P u r c h a s e (Gallons)			
	1976	Private 1977	1978	1976	Public 1977	1978	
Light Pike (3.0 inches)	14,469	12,795	11,846	405	444	1,175	25,16
Heavy Pike (4.5 inches)	18,909	14,356	13,395	528	658	964	25,49
Light Northern (5.5 inches)	28,640	25,692	23,775	1,820	1,338	1,927	43,57
Heavy Northern (6.0 inches)	17,534	7,784	9,636	585	211	579	21,16
TOTALS	79,552	60,584	58,652	3,338	2,651	4,645	115,29
				44,825	47,542	52,099	127,715
				26,059	24,449	25,092	110,777
				45,967	42,726	18,510	21,16
				26,293	18,510	21,16	115,29

Table 4. Chub, shiner, dace and other bait-fish species harvest, purchase and sales volume by minnow dealers within the state during 1978, 1977, 1978.

SPECIES	S O U R C E				P u r c h a s e (Gallons)			TOTAL SALES (Gallons)		
	H a r v e s t (Gallons)		P u b l i c		1976	1977	1978	1976	1977	1978
	1976	1977	1978	1976						
Chub	122	883	620	1,421	2,556	2,191	1,295	2,562	1,985	2,838
Shiner	2,581	4,609	5,103	9,756	7,677	7,459	8,032	7,043	8,550	20,369
Dace	619	157	155	1,311	348	1,471	407	171	196	2,337
Other	0	58	0	87	343	194	0	146	3	87
TOTAL	3,322	5,707	5,878	12,575	10,924	11,315	9,734	9,922	10,734	25,631
										27,927

Table 5. Total sales volume of other live bait species by minnow dealers within the State during 1976, 1977, 1978.

SPECIES	UNITS	TOTAL SALES		
		<u>1976</u>	<u>1977</u>	<u>1978</u>
Earthworm	Dozen	95,364	879,292	416,093
Night Crawler	Dozen	1,248,611	955,980	1,230,272
Leech ^{a/}	Dozen	808,041	874,405	2,888,600
	Pound	62,157	65,376	222,200
	Gallon	7,770	8,172	27,775
Grub	Dozen	774,094	851,277	797,601
Salamander	Dozen	5,568	3,014	592
Crawfish	Dozen	12,807	1,808	2,022
Frog	Dozen	1,836	2,035	1,363

^{a/} Leeches were processed by the pound by minnow dealers. Volume data in dozens were conversions based on 13 dozen leeches per pound.

Table 6. Harvest, purchase and sale volume of other live bait species by minnow dealers within the State during 1976.

SPECIES	UNITS	S O U R C E				TOTAL SALES	
		Harvest		Imported	Purchased from Dealer		
		Private	Public			Licensed	Nonlicensed
Earthworm	Dozen	3,815	21,283	22,716	30,752	16,798	95,364
Night crawler	Dozen	86,086	8,186	786,099	332,074	36,166	1,248,611
Leech ^{a/}	Dozen	45,240	295,594	---	226,369	240,838	808,041
	Pound	(3,480)	(22,738)	---	(17,413)	(18,526)	(62,157)
	Gallon	(435)	(2,842)		(2,177)	(2,316)	(7,770)
Grub	Dozen	83,333	---	672,485	16,365	1,911	774,094
Salamander	Dozen	833	2,274	---	1,861	600	5,568
Crawfish	Dozen	12,667	110	30	---	---	12,807
Frog	Dozen	---	1,132	---	---	706	1,836
TOTAL	Dozen	231,974	328,579	1,481,330	607,421	297,019	2,946,321

^{a/} Leeches were processed by the pound by minnow dealers. Volume data in dozens were conversions based on 13 dozen leeches per pound.

Table 7. Harvest, purchase and sale volume of other live bait species by minnow dealers within the State during 1977.

SPECIES	UNITS	S O U R C E					TOTAL SALE	
		Harvest		Imported	Unknown	Purchased from Dealer		
		Private	Public			Licensed		Nonlicensed
Earthworm	Dozen	139,200	602,926	83,333	---	24,632	29,201	879,292
Night Crawler	Dozen	16,744	104,712	281,346	2,688	530,920	19,570	955,980
$\frac{1}{4}$ a/ p Leech	Dozen	161,624	142,578	---	1,819	414,063	154,321	874,405
	Pound	12,084	10,660	---	136	30,958	11,538	65,376
	Gallon	1,511	1,333	---	17	3,870	1,442	8,172
Grub	Dozen	300	458	780,958	---	68,478	1,083	851,277
Salamander	Dozen	220	2,624	---	---	127	43	3,014
Crawfish	Dozen	1,532	276	---	---	---	---	1,808
Frog	Dozen	15	1,238	---	---	329	453	2,035
TOTAL DOZEN		319,635	854,812	1,145,647	4,507	1,038,549	204,671	3,567,811

a/ Leeches were processed by the pound by minnow dealers. Volume data in dozens were conversions based on 13 dozen leeches per pound.

Table 8. Harvest, purchase and sale volume of other live bait species by minnow dealers within the State during 1978.

SPECIES	UNITS	S O U R C E					TOTAL SALES
		Harvest		Imported	Purchased from Dealer		
		Private	Public		Licensed	Nonlicensed	
Earthworm	Dozen	204,273	91,971	66,667	32,475	20,707	416,093
Night Crawler	Dozen	3,089	25,331	583,748	605,914	12,190	1,230,272
Grub	Dozen	775	1,320	787,942	7,444	120	797,601
Salamander	Dozen	341	144	---	106	---	591
Crawfish	Dozen	1,381	416	---	225	---	2,022
Frog	Dozen	110	357	---	462	434	1,363
TOTAL DOZEN		209,969	119,539	1,438,357	646,626	33,451	2,447,942

Table 9. Leech harvest, purchase and sale volume by minnow dealers within the state during 1978.

Leech Grade Size	S O U R C E		TOTAL SALE (gallons)	
	HARVEST (gallons)		PURCHASE (gallons)	
	<u>Private</u>	<u>Private</u>		
Small	1,759	615	1,597	3,971
Medium	1,083	2,104	5,544	8,731
Large	1,550	2,496	5,179	9,225
Jumbo	<u>690</u>	<u>1,886</u>	<u>3,952</u>	<u>5,827</u>
TOTAL	5,082	6,401	16,272	27,755

Table 11. Sucker harvest, purchase and sale volume by minnow exporters during 1978.

Sucker Grade Size	S O U R C E			TOTAL SALES (gallons)
	HARVEST (gallons)		PURCHASE (gallons)	
	<u>Private</u>	<u>Public</u>		
Light pike (3.0 inches)	715	0	564	1,279
Heavy pike (4.5 inches)	1,500	0	100	1,600
Light northern (5.5 inches)	1,508	0	3,013	4,521
Heavy northern (6.0 inches)	950	0	184	1,134
	<hr/>	<hr/>	<hr/>	<hr/>
TOTAL	4,673	0	3,861	8,534

Table 12. Number of minnow dealers and exporters in operation during zero to twelve months of the year for 1976, 1977, 1978.

Number of months	Number of Dealers			Number of Exporters		
	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>
12	69	101	121	15	19	23
11	4	6	7	1	2	1
10	11	8	9	2	0	1
9	12	12	4	2	0	1
8	12	15	11	2	3	1
7	10	17	15	2	1	2
6	17	29	28	1	0	1
5	24	35	38	0	4	0
4	13	18	30	2	1	1
3	7	8	16	1	0	3
2	6	5	12	1	0	0
1	0	2	5	0	0	0
0	14	5	11	6	3	3
Unknown (not reported and unable to contact)	<u>43</u>	<u>10</u>	<u>7</u>	<u>0</u>	<u>2</u>	<u>0</u>
TOTAL	242	271	314	35	35	37

Table 13. Number of minnow dealers and exporters in operation per month during 1976, 1977, 1978.

Months	Number of Dealers			Number of Exporters		
	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>
January	100	136	144	15	20	24
February	97	122	144	15	22	26
March	90	120	141	16	24	27
April	101	139	160	19	27	30
May	177	240	180	23	29	32
June	177	247	284	23	29	32
July	177	243	276	24	29	31
August	170	239	262	24	29	31
September	154	222	178	23	28	30
October	106	170	181	22	25	30
November	106	132	147	16	22	26
December	115	142	162	15	21	25
No Months	14	5	11	6	3	3
No Information (not reported or unable to contact)	43	10	7	0	0	0

Table 14. Number and acreage of bait-fish ponds used 1975-1978 by hatchery operators.

Species	<u>1975</u>		<u>1976</u>		<u>1977</u>		<u>1978</u>	
	Number	Acreage	Number	Acreage	Number	Acreage	Number	Acreage
Fathead	20	1,276	19	1,055	21	1,308	22	1,226.5
Sucker	707	14,240	693	14,227	648	13,777	669	14,576
Chub	1	10	1	48	3	51	5	270
Shiner	38	431	36	360	36	436	34	492.5
Dace	--	--	--	--	--	--	1	2.5
Other	4	4	--	--	4	4.5	--	--
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
TOTALS	770	15,961	749	15,690	712	15,576.5	731	16,567.5

Table 15. Percentage of minnow dealers harvesting bait-fish species and percentage harvested by these dealers by season and source. (Fourteen percent of 117 dealers interviewed provided no information or did not harvest bait-fish.)

Species	% and number of minnow dealers harvesting species		% of minnow dealers harvesting species in each season <u>a/</u>				% of minnow dealers harvesting species from each source <u>a/</u>			
	%	Number	Spring	Summer	Fall	Winter	Hatchery	Pond	Lake	River/Stream
Fathead	81	95	91	80	68	54	0	65	56	17
Sucker	33	39	31 ^{b/}	33 ^{b/}	31 ^{b/}	15 ^{b/}	56	15	21	31
Chub	44	52	81	29	33	17	2	31	50	60
Shiner	24	28	46	82	32	14	0	14	4	86
Dace	15	18	100	39	39	22	0	61	44	33

a/ Percentage by season and source were calculated from the number of dealers harvesting each species.

b/ These seasonal percentages were low because they did not include hatchery reared suckers.

Table 16. Percentage of minnow dealers selling bait-fish species and percentage having highest demand during seasons. (Three percent of 117 interviewed provided no information.)

Species	% and number of minnow dealers selling species		% of dealers having highest demand in each season <u>a/</u>			
	%	Number	Spring	Summer	Fall	Winter
Fathead	97	113	90	46	20	32
Sucker	79	92	76	60	27	30
Shiner	68	79	85	11	11	33
Chub	35	41	44	56	17	22
Dace	21	24	88	25	33	29

a/ Percentages were calculated from the number of dealers selling each species.

Table 17. Percentage of minnow dealer bait-fish sales sold at retail and percentage of sales harvested by minnow dealers. (Percentages are based on 117 interviews.)

% of sales harvested by minnow dealers	% of minnow dealers harvesting portion of sales	% of sales sold at retail	% of minnow dealers selling portion of sales at retail
0 - 25	44	0 - 25	51
26 - 50	12	26 - 50	6
51 - 75	15	51 - 75	6
76 - 100	48	76 - 100	37
No information	13		

Table 18. Percentage of minnow dealers harvesting and selling other live-bait species. (Percentages are based on 117 interviews.)

Species	% of minnow dealers harvesting other live baits	% of minnow dealers selling other live- bait species
Earthworms	6	26
Night crawlers	13	73
Leeches	22	72
Grubs	1	28
Salamander	9	23
Frog	6	21
Crawfish	9	15
Only bait-fish	56	21
No information	6	2

Table 19. Service area, annual mileage, number of minnow retailers and wholesalers serviced by minnow dealers in Minnesota. (Percentages are for 117 interviewed dealers.)

Area Serviced (Radius in miles)	% of Minnow Dealers	Annual mileage	% of Minnow Dealers	Number of Minnow Retailers Serviced	% of Minnow Dealers	Number of Minnow Wholesalers Serviced	% of Minnow Dealers
0-50	65	0-25,000	39	0	30	0	46
51-100	9	25,001-50,000	16	1-25	45	1-10	40
101-Statewide	9	50,001-75,000	8	26-50	12	11-20	7
No Information	17	75,001-100,000	12	51-75	3	21-30	0
		100,001+	3	76-100	3	31-40	0
		No Information	21	100+	1	41-50	1
				No Information	7	No Information	6

Table 20. Number of full-time and part-time employees employed by minnow dealers and the number of years the minnow dealers were in business. (Percentages are for 117 interviewed dealers.)

Number of Full-time Employees	% of Minnow Dealers	Number of Part-time Employees	% of Minnow Dealers	Years in Business	% of Minnow Dealers
0	23	0	24	1 - 10	40
1 - 2	55	1 - 2	49	11 - 20	23
3 - 4	10	3 - 4	15	21 - 30	17
5 - 6	4	5 - 6	3	31 - 40	6
7 - 10	3	7 - 10	4	41 - 50	7
No Information	5	No Information	5	51 +	2
				No Information	5

Table 21. Percentage of minnow dealers experiencing mortality problems while transporting and holding bait-fish during spring, summer, fall, winter. (Twenty-five percent of 117 interviewed minnow dealers had no mortality and 14% provided no information. Percentages are for 71 dealers indicating mortality problems.)

Mortality Type	% and Number of Dealers by Mortality Type		% of Minnow Dealers Having Mortality Problems by Season <u>a/</u>			
	%	Number	Spring	Summer	Fall	Winter
Transporting	38	27	4	93	4	0
Holding	89	64	5	91	5	0

a/ Percentages were calculated from the number of minnow dealers having each type of mortality problem.

Table 22. Percentage of exported bait-fish harvested by minnow exporters. (Percentages are for 19 businesses interviewed during 1976, 1977, 1978).

% Harvested for Export	% of Minnow Exporter Businesses
0 - 20	10
21 - 40	16
41 - 60	10
61 - 80	21
81 - 100	43

Table 23. Number of wholesalers minnow exporters purchased from and the radii minnow exporters traveled to purchase bait-fish. (Percentages are for 19 businesses interviewed during 1976, 1977, 1978.)

Number of Wholesalers Purchased From	% of Minnow Exporting Businesses	Radius in Miles Exporters Traveled to Purchase Bait	% of Minnow Export Businesses
0 - 5	58	0 - 50	10
6 - 10	16	51 - 100	32
11 - 15	16	101 - 150	21
16 - 20	11	151 - 200	16
		201 - 250	21

Table 24. Number of out of state wholesalers and retailers serviced by exporters. (Percentages are for 19 businesses interviewed during 1976, 1977, 1978.)

Number of Wholesalers	% of Exporting Businesses	Number of Retailers	% of Exporting Businesses
0	0	0	95
1 - 5	78	1 - 5	0
6 - 10	11	6 - 10	0
11 - 15	11	11 - 15	0
		16 - 20	5

Table 25. Number of out-of-state trips and annual mileage for minnow exporters.
(Percentages are for 19 businesses interviewed during 1976, 1977, 1978.)

Number of Out-of-State Trips	% of Exporting Businesses <u>a/</u>	Annual Mileage	% of Exporting Businesses <u>b/</u>
0 - 20	17	0 - 20,000	29
21 - 40	33	20,001 - 40,000	18
41 - 60	33	40,001 - 60,000	18
61 - 80	11	60,001 - 80,000	12
81 - 100	0	80,001 - 100,000	12
100 +	6	100,000 +	12

a/ 18 of 19 businesses answered question.

b/ 17 of 19 businesses answered question.

Table 26. Number of full-time and part-time employees employed by minnow exporters. (Percentages are for 19 businesses interviewed during 1976, 1977, 1978.)

Number of Full-time Employees	% of Export Businesses	Number of Part-time Employees	% of Export Businesses
0	0	0	31
1 - 2	74	1 - 2	37
3 - 4	26	3 - 4	21
5 - 6	0	5 - 6	11

Table 27. Percent hatch of sucker eggs in hatchery batteries. (Percentages are for 25 interviewed hatchery operators.)

% of sucker eggs hatching	% of hatchery operators
100	0
95 - 99	8
90 - 94	16
85 - 89	12
80 - 84	20
75 - 79	8
70 - 74	12
65 - 69	12
60 - 64	8
0 - 59	0
No information	4

Table 28. Service area, annual mileage, number of minnow retailers and wholesalers serviced by hatchery operators in Minnesota. (Percentages are for 25 interviewed hatchery operators.)

Area Served (Radius in miles)	% of Hatchery Operators	Annual Mileage	% of Hatchery Operators	Number of Minnow Retailers Served	% of Hatchery Operators	Number of Minnow Wholesalers Served	% of Hatchery Operators
0 - 50	60	0- 25,000	8	0	16	0	20
51 - 100	8	25,001 - 50,000	28	1 - 25	28	1 - 10	48
101 - 200+	28	50,001 - 75,000	32	26 - 50	24	11 - 20	20
No Information	4	75,001-100,000	8	51 - 75	17	21 - 30	0
		100,001-175,000	8	76 - 100	8	31 - 40	0
		No Information	16	No Information	8	41 - 50	4
						No Information	8

Table 29. Percentage of hatchery operators experiencing demand for sucker bait-fish to five sizes by season. (Percentages are for 25 interviewed hatchery operators. Four percent provided no information.)

Size of Sucker Bait-Fish	% and Number of Hatchery Operators Selling Each Size		% of Hatchery Operators Experiencing Demand for Five Sucker Bait-Fish Sizes by Season ^{a/}			
	%	Number	Spring	Summer	Fall	Winter
Light Pike (3.0 inches)	68	17	65	82	59	59
Heavy Pike (4.5 inches)	56	14	79	93	71	86
Light Northern (5.5 inches)	72	18	83	78	89	50
Heavy Northern (6.0 inches)	64	16	38	44	69	44
Decoy (over 6 inches)	40	10	0	0	0	100

^{a/} Percentages were calculated from the number of hatchery operators selling each size.

Table 31. Minnow industry license fee contribution to 1978 Department of Natural Resources budget.

Classification	Number	Fee	Revenue
Minnow Dealer	360	\$ 50.00	\$18,000.00
Minnow Retailer	1,400	5.00	7,000.00
Exporter	44	200.00	8,800.00
Hatchery Operator	53	25.00	1,325.00
Sucker Eggs:			
1st 100 quarts	40	100.00	4,000.00
Each additional quart	2,648	2.00	5,296.00
Helper (dealer, exporter)	714	5.00	3,570.00
Vehicle License (dealer, exporter, retailer, nonresident)	819	10.00	8,190.00
Nonresident Minnow Hauler	10	400.00	4,000.00
TOTAL			\$60,181.00

Table 30. Number of full-time and part-time employees employed by Minnesota hatchery operators. (Percentages are for 25 interviewed hatchery operators.)

Full-Time Employees	% of Hatchery Operators	Part-Time Employees	% of Hatchery Operators
0	8	0	8
1 - 2	44	1 - 2	36
3 - 4	20	3 - 4	28
5 - 6	16	5 - 6	8
7 - 18	4	7 - 10	8
No Information	8	No Information	8

Table 32. Bait species grade sizes, wholesale and retail market prices and calculations used to determine the economic importance of the Minnesota live bait industry to the State of Minnesota in 1978.

Species	Grade Size	Wholesale Price	Retail Price	Harvest (less export purchases)	Purchases	Harvest x (less export purchases) Retail Price	(.55) Harvest x Wholesale Price	Purchases x Wholesale Price	Total \$
Fathead	Crappie	\$ 8/gal.	\$.25/doz.	37,440	19,603	4,614,480	164,736	156,824	5,932.3
	Medium	8/gal.	.50/doz.	36,208	6,246	3,620,800	159,315	49,968	3,830.0
	Pike	8/gal.	.75/doz.	37,442	20,738	2,808,150	164,744	165,904	4,126.1
	* Exports	8/gal.	---	99,853	48,968	---	---	---	1,190.1
Sucker	Lt. pike	\$15/gal.	\$.75/doz.	12,457	12,142	738,077	102,770	182,130	2,279.6
	Hvy. pike	15/gal.	1.00/doz.	14,258	11,136	285,160	117,628	167,040	569.8
	Lt. northern	12/gal.	1.50/doz.	22,689	17,873	340,335	149,747	214,476	704.5
	Hvy. northern	8/gal.	2.00/doz.	10,031	10,947	160,496	44,136	87,576	513.4
	* Lt. pike	15/gal	---	715	564	---	---	---	19.1
	* Hvy. pike	15/gal	---	1,500	100	---	---	---	24.0
	* Lt. northern	12/gal.	---	1,508	3,013	---	---	---	21.8
	* Hvy. northern	8/gal.	---	950	184	---	---	---	9.0
Chub Shiner Dace	All	16/gal.	2.00/doz.	2,811	1,985	342,942	24,736	31,760	399.4
	All	16/gal.	1.50/doz.	12,562	8,550	1,469,754	110,545	136,800	1,717.0
	All	15/gal.	1.50/doz.	1,625	195	148,687	13,406	2,925	165.0
Leeches	Small	\$40/gal.	\$1.00/doz.	2,374	1,597	246,896	52,228	63,880	363.0
	Medium	40/gal.	1.25/doz.	3,187	5,544	414,310	70,114	221,760	706.1
	Large	40/gal.	1.75/doz.	4,046	5,179	736,372	89,012	207,160	1,032.5
	Jumbo	40/gal.	2.00/doz.	1,895	3,951	394,160	41,690	158,040	593.6
Night crawler		\$48/1000	\$1.25/doz.	612,168	618,104	765,210	193,934	356,027	1,315.1
Earthworm		\$7.50/750	\$.50/doz.	362,911	53,182	181,455	23,952	6,381	211.1
Grub		4.00/275	\$.50/doz	790,037	7,564	395,018	75,843	1,320	472.1
								TOTAL	26,196.1

Table 33. Minnesota Department of Natural Resources Commercial Fish License Receipts, 1978.

Fishery	Total	Percent of Annual Receipts
International	\$ 1,835.00	2
Interstate	5,689.00	7
Lake Superior	3,097.00	4
Minnows	60,181.00	76
Turtles	1,550.00	2
TOTAL (Commercial Fisheries)	\$72,352.00	
TOTAL (Plus other commercial fish licenses) e.g., fish buyers fish peddlers, fish packers	\$79,239.00	

APPENDIX

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MINNESOTA DEPARTMENT of NATURAL RESOURCES
DIVISION of FISH and WILDLIFE
MONTHLY REPORT of LIVE BAIT SALES

Month _____, 19____

Licensee: _____

NAME _____

ADDRESS _____

CITY _____

ZIP _____

Itinerant Minnow Dealers License No. _____

WEEK	FATHEAD					SUCKER					CHUB					SHINER					DACE					OTHER					WORMS		LEECHES		GRUBS			
	Tuffy Minnow					White (common)					Creek Hornyhead (Redtail)					Golden Spottail Emerald Common (sk. piack) Spotfin (blue)					Longnose Northern red belly Southern red belly Pearl (leatherback) Blacknose (slicker) Finescale (rainbow chub)					Western mud minnow Blunt nose Stone cat Grassy (grass) Stoneroller (racehorse chub) Mad tom (willow cat)					Angle Night-Crawler		Leopard Tree Green		Horse Blood-sucker		Cr. Sal ant	
	Not to exceed 12 inches in length.					Not to exceed 12 inches in length.					Not to exceed 12 inches in length.					Not to exceed 12 inches in length.					Not to exceed 12 inches in length.					Not to exceed 12 inches in length.					Not over 7"		Not over 7"		Not over 7"		Not over 7"	
	1"-2"	2"-3"	3"-4"	4"-6"	6"-12"	1"-2"	2"-3"	3"-4"	4"-6"	6"-up	1"-2"	2"-3"	3"-4"	4"-6"	6"-up	1"-2"	2"-3"	3"-4"	4"-6"	6"-up	1"-2"	2"-3"	3"-4"	4"-6"	6"-up	1"-2"	2"-3"	3"-4"	4"-6"	6"-up	Doz.	Doz.	Doz.	Doz.				
1																																						
2																																						
3																																						
4																																						
5																																						
Total Sold Excluding Exports																																						
Private Pond Harvest																																						
Wild Harvest																																						
Purchased																																						

NOTE: This report is confidential and no information will be released revealing private enterprise.

REPORTED BY: _____

INSTRUCTIONS:

1. Report must be submitted before the 10th of the month following,

To: Commercial Fisheries Coord.
Section of Fisheries
3rd Floor Centennial Bldg.
St. Paul, MN 55155

2. A report must be submitted each month, unless no sales were made and the Section of Fisheries was notified in writing of this fact.
3. License may be suspended for failure to report.
 - A. Enter month, year, name, address and lic. no.
 - B. Do not report exported minnows on this form.
 - C. Enter each week the number of gallons of minnows sold, by size class, for each species in the respective box. If minnows are over 6 inches long enter the number sold. For worms, frogs, leeches and grubs enter the number of dozen sold.
 - D. When 1 week occurs in 2 months, use the month covering the greatest number of days.
 - E. Add columns and enter the figure on total line in respective box.
 - F. Enter the number of gallons of minnows sold that were harvested from ponds owned or leased by you.
 - G. Enter the number of gallons of minnows sold that were harvested from public waters by you.
 - H. Enter the number of gallons of minnows sold that were purchased by you.
 - I. Any observations or comments may be reported in the REMARKS space. The need for more forms, first report of season, final report of season, etc. may be indicated here.
 - J. Sign report (lower right front corner) and submit.

ANNUAL REPORT OF LIVE BAIT SALES

for year of: _____ (Due February 1)

Lic. No. _____

Name _____

Address _____

City _____

Circle Months of Operation* - - - J F M A M J J A S O N D

MINNOW SALES

Species	Grade Size	Approx. Length	Total (Excluding Exports) -Gallons-	Source		
				Private Harvest -Gallons-	Wild Harvest -Gallons-	Purchase -Gallon
Fathead	Crappie	1.5"				
	Medium	2"				
	Pike	2.5"				
Sucker	Light Pike	3"				
	Heavy Pike	4.5"				
	Light Northern	5.5"				
	Heavy Northern	6"				
Chub	All					
Shiner	All					
Dace	All					
Other*	All					

Voluntary Information*

OTHER LIVE BAIT SALES

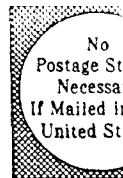
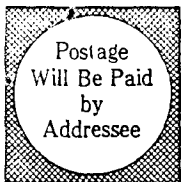
Live Bait	Unit of Measure*	Total Units Sold	Source				
			Harvest		Purchased		
			Private	Wild	Licensed Dealer	Nonlicensed Dealer	Imp
Earth Worms							
Night Crawlers							
Leeches							
Grubs*							
Salamanders							
Crawfish							
Frogs							

*Instructions on Reverse Side

-A5-

Reported by _____

Signature _____



BUSINESS REPLY MAIL
FIRST CLASS PERMIT NO. 171, ST. PAUL, MINN.

Minnesota Department of Natural Resources
Division of Fish & Wildlife
Section of Fisheries
Third Floor — Centennial Building
St. Paul, MN 55155

Fold

INSTRUCTIONS

1. This report must be submitted each year by February 1st.
2. License may be delayed or suspended for failure to report minnow sales.
3. If you choose to leave "Other Bait Sales" section blank, it will not interfere with license renewal.
 - A. Enter License Number, Name, Address, City and Zip Code.
 - B. Circle the months you were operating. (Example: JFMAMJJASOND).
 - C. **DO NOT REPORT EXPORTED MINNOWS ON THIS FORM.**
 - D. **TOTAL SOLD:** Enter the gallons of minnows sold, by size class, for each species in the respective box.
 - E. **PRIVATE HARVEST:** Enter the gallons of minnows sold that were trapped or seined from ponds owned or leased by you.
 - F. **WILD HARVEST:** Enter the gallons of minnows sold that were trapped or seined from public waters.
 - G. **PURCHASED:** Enter the gallons of minnows sold that were purchased by you.
 - H. **OTHER MINNOWS** would include: Western mud minnow, Blunt nose, Stone cat, Grassy (grass), Stoneroller (racehorse chub), Mad tom (willow cat); and also Bullheads, Yellow Perch, Tullibeas, Herring, Whitefish, Gold eyes, and Moon eyes, if not over 7 inches in length.

Fold

- I. Any observations or comments may be reported in the REMARKS space below.
- J. Sign report (lower right front corner) fold, staple and mail.

***VOLUNTARY INFORMATION:** We would appreciate information on those other types of live bait listed in the lower section of this form. Since this part is voluntary information, it will not jeopardize your license renewal if you wish to leave it blank. When filling out the lower portion of the form, please indicate the unit of measure, a given bait is sold by, like: gallons - pounds - dozens - 1,000's - flats - etc. In the source columns (harvest - purchased) percentages of the total units sold are perfectly acceptable.

GRUBS would include: mousie, Wiggler, White-maggot, Grubworm, etc.

REMARKS: _____

ANNUAL REPORT OF LIVE BAIT SALES

for year of: _____ (Due February 1)

Name _____

Address _____

City _____

Zip _____

Months of Operation* --- J F M A M J J A S O N D

MINNOW SALES

Grade Size	Approx. Length	Total (Excluding Exports) -Gallons-	Source		
			Private Harvest -Gallons-	Wild Harvest -Gallons-	Purchased -Gallons-
Crappie	1.5"				
Medium	2"				
Pike	2.5"				
Light Pike	3"				
Heavy Pike	4.5"				
Light Northern	5.5"				
Heavy Northern	6"				
All					
All					
All					
All					
Small					
Medium					
Large					
Jumbo					

Other Information*

OTHER LIVE BAIT SALES

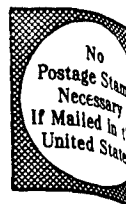
Bait	Unit of Measure*	Total Units Sold	Source				
			Harvest		Purchased		
			Private	Wild	Licensed Dealer	Nonlicensed Dealer	Imported
Worms							
Crawlers							
Minnows							

Instructions on Reverse Side

-A7-

Reported by _____

Signature _____

**BUSINESS REPLY MAIL**

FIRST CLASS PERMIT NO. 171, ST. PAUL, MINN.

Minnesota Department of Natural Resources
 Division of Fish & Wildlife
 Section of Fisheries – Box 12
 Third Floor – Centennial Building
 St. Paul, MN 55155

Fold

INSTRUCTIONS

1. This report must be submitted each year by February 1st.
2. License may be delayed or suspended for failure to report minnow sales.
3. If you choose to leave "Other Bait Sales" section blank, it will not interfere with license renewal.
4. For purposes of this report – Leeches shall be considered minnows.
 - A. Enter License Number, Name, Address, City and Zip Code.
 - B. Circle the months you were operating. (Example: JFMAMJJASOND).
 - C. **DO NOT REPORT EXPORTED MINNOWS ON THIS FORM.**
 - D. **TOTAL SOLD:** Enter the gallons of minnows sold, by size class, for each species in the respective box.
 - E. **PRIVATE HARVEST:** Enter the gallons of minnows sold that were trapped or seined from ponds owned or leased by you.
 - F. **WILD HARVEST:** Enter the gallons of minnows sold that were trapped or seined from public waters.
 - G. **PURCHASED:** Enter the gallons of minnows sold that were purchased by you.
 - H. **OTHER MINNOWS** would include: Western mud minnow, Blunt nose, Stone cat, Grassy (grass), Stoneroller (racehorse chub), Mad tom (willow cat); and also Bullheads, Yellow Perch, Tullibees, Herring, Whitefish, Gold eyes, and Moon eyes, if not over 7 inches in length.

Fold

- I. Any observations or comments may be reported in the REMARKS space below.
- J. Sign report (lower right front corner) fold, staple and mail.

***VOLUNTARY INFORMATION:** We would appreciate information on those other types of live bait listed in the lower section of this form. Since this part is voluntary information, it will not jeopardize your license renewal if you wish to leave it blank. When filling out the lower portion of the form, please indicate the unit of measure, a given bait is sold by, like: gallons - pounds - dozens - 1,000's - flats - etc. In the source columns (harvest - purchased) percentages of the total units sold are perfectly acceptable.

GRUBS would include: mousie, Wiggler, White-maggot, Grubworm, etc.

REMARKS: _____

Minnesota Department of Natural Resources
Division of Fish and Wildlife

GF-156
REV. 1

MONTHLY REPORT OF MINNOWS EXPORTED

Month _____, 19____

Licensee: _____
Name Address City Zip

Exporting Minnow Dealers License No. _____

FATHEAD MINNOWS

WEEK	1" - 2" - GALLONS -	2" - 3" - GALLONS -	3" - 4" - GALLONS -	NO. OF LOADS	STATE OF DESTINATION
1					
2					
3					
4					
5					
TOTAL					This Report is <u>CONFIDENTIAL</u>
Harvested from Private Ponds				REPORTED BY:	
Harvested From Public Waters				SIGNATURE _____	
Purchased			-A9-	Instructions on Reverse Side	

INSTRUCTIONS:

1. Report must be submitted before the 10th of the month following,
To: Commercial Fisheries Coord.
Section of Fisheries
3rd Floor Centennial Bldg.
St. Paul, MN 55155
2. A report must be submitted each month, unless no exports were made and the Section of Fisheries was notified in writing of this fact.
3. License may be suspended for failure to report.
 - A. Enter month, year, name, address and lic. no.
 - B. Enter each week the number of gallons of minnows exported by size class in the respective box.
 - C. When 1 week occurs in 2 months, use the month covering the greatest number of days.
 - D. Add columns and enter the figure on total line in respective box.
 - E. Enter number of loads hauled and state of destination
 - F. Enter the number of gallons of minnows exported that were harvested from ponds owned or leased by you.
 - G. Enter the number of gallons of minnows exported that were harvested from public waters by you.
 - H. Enter the number of gallons of minnows exported that were purchased by you.
 - I. Any observations or comments may be reported in the REMARKS space. The need for more form, first report of season, last report of season, etc. may be indicated here.
 - J. Sign report (lower right front corner) and submit.

REMARKS:

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife

ANNUAL REPORT OF MINNOWS EXPORTED

for year of _____ (Due February 1)

Lic. No. _____ Name _____ Address _____ City _____

Circle months of operation: *J F M A M J J A S O N D

FATHEAD MINNOWS

GRADE SIZE	TOTAL EXPORTED -Gallons-	SOURCE		
		Private Harvest -Gallons-	Wild Harvest -Gallons-	Purchased -Gallons-
CRAPPIE				
MEDIUM				
PIKE				

Reported By: _____
Signature

*Instructions on Reverse Side.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES

ANNUAL REPORT OF MINNOWS EXPORTED

for year of _____ (Due February 1)

Lic. No. _____		Name _____		Address _____		City _____	
Circle months of operation: * J F M A M J J A S O N D							
SPECIES	GRADE SIZE	TOTAL EXPORTED —Gallons—	SOURCE				
			Private Harvest	Wild Harvest	Purchased		
			—Gallons—	—Gallons—	—Gallons—		
FATHEAD	CRAPPIE						
	MEDIUM						
	PIKE						
SUCKER	HEAVY PIKE						
	LIGHT PIKE						
	HEAVY NORTHERN						
	LIGHT NORTHERN						

Reported By: _____
Signature

BAIT INDUSTRY SURVEY

Harvest and Sales

1. What species do you sell?

(Circle)

Local Names

When demand highest

Fathead

Sucker

Shiner

Chub

Dace

Other

2. What species do you harvest?

(Circle)

Time of Year

Where (ponds, lakes, rivers)

Fathead

Sucker

Shiner

Chub

Dace

Other

What percent of sales do you harvest yourself?

3. What species are in short supply and at what time of year?

4. How many ponds, lakes to you harvest from?

Public -

Private -

Cost to you

5. What percent of sales is retail?

Holding

6. How do you hold minnows for sale?

Ponds (number)

Tanks (type)

Other

7. What is your source of H₂O?

Do you filter?

Volume

8. Do you use disease treatments?

a. What type?

Preventative

Therapeutic

b. Procedure

9. What problems do you have with mortality?

a. Approximate percent

Transporting

Holding

b. Time of year

Distribution

10. What areas of the state do you service?

11. What is the approximate mileage per year?

12. How many retailers do you service?

Wholesalers?

Operation

13. How many employees do you have?

Full-time -

Part-time -

What part of the year are you operating your bait business?

14. How long have you been in the bait business?

Do you have any other occupation?

15. Historical information

Other Live Bait

16. What other live bait do you sell?

17. What other live bait do you harvest or culture?

18. What has the highest demand?

19. What is in short supply?

20. Characterize a good leech lake

Clear, murky, lots of emergent vegetation, bog, sand, mud, deep,
shallow, other

Species present -

21. What problems do you have with leech mortality?

When highest

How best to keep

22. Do you grade for size?

How?

23. Do you get any large bait leeches during summer?

24. Do leeches die after period when there is a swelling at one end?

EXPORTING

Operation

1. What is the capacity of your exporting truck?

Refrigerated?

Special Equipment -

2. What do you export besides fathead minnows?

Example--leeches, night crawlers, etc.

3. What do you import? Leeches, etc.

4. How many employees in exporting operation?

Part-time -

Full-time -

5. How many wholesalers do you buy from?

From what areas of the state?

6. How much of what you export do you harvest yourself?

7. What percent mortality do you have in:

Transporting _____

Holding for export _____

Distribution

8. What areas do you ship to?

9. How many out-of-state trips per year?
10. What is your mileage per year?
11. What are your transportation costs per year?
12. How many out-of-state wholesalers do you service?
Retailers?

Supply & Demand

13. What are the peak periods of demand for fatheads out of state?
14. How does this compare with the availability of minnows - (How it affects prices paid to suppliers)?
15. Are you able to meet the out-of-state demand for minnows?

HATCHERY

1. What species do you culture?
2. What other species have you tried?
3. Percent success of hatch?
4. What is the lowest acceptable percent survival in ponds?
 - a. What is your percent survival from pond to consumer?
5. Do you feed or fertilize ponds?
6. How many ponds to you have?
Natural
Artificial
Source of H₂O
7. Do you regulate growth by stocking density or fertilization rates to get desired size at different seasons?
8. Do you use any disease treatments?
Preventative
Therapeutic
9. Do you hold bait over winter?
How?

10. What is the size (species) demand for bait?

Spring

Summer

Fall

Winter

Are you able to meet this demand?

11. How many dealers do you service?

Wholesalers -

Retailers -

12. Do they pick up or do you deliver?

13. To what areas of the state do you supply bait?

Estimate annual mileage

14. How many employees do you have?

Full-time -

Part-time -

15. Historical

16. What specific problems do you have?