

# The Bait Leech *Nepheleopsis obscura* in North Dakota: An Economic Assessment

Christopher Pennuto

The predatory leech, *Nepheleopsis obscura* (Verrill), occurs throughout much of Canada but is restricted to the upper Midwest and Rocky Mountain regions in the United States (Davies, 1973). In the last two decades this leech species has become an important fish bait in the upper Midwest (Peterson 1982). A few states are capitalizing on the economic returns from sales of this bait species. In Minnesota alone, annual leech sales have an estimated retail value of \$1.5 million (Peterson and Hennagir, 1980). This figure suggests that leech harvesting can generate significant revenues and offer potential for economic development in North Dakota.

*Nepheleopsis* is a member of the Erpobdellidae, a family of free living, predatory and scavenging leeches. It is the species predominately sold in this country for fish bait. It occurs in ponds and sloughs throughout North Dakota and is an important component in pond ecology. *Nepheleopsis* functions in sanitation of ponds by consuming dead animal matter (Davies et al., 1978), is a food source for other aquatic organisms (Young, 1987), and may help regulate other invertebrate populations (Rasmussen, 1987).

In 1979, bait leeches became legal for commercial export in Minnesota and legislation was passed opening state wildlife management areas (WMA's) larger than 2,000 acres to harvest by permit only (Peterson and Hennagir, 1980). The demand for bait leeches by Minnesota anglers has intensified harvest of *N. obscura*, resulting in localized population declines and development of aquaculture techniques for commercial rearing (Peterson, 1982). Twenty-two percent of Minnesota's live-bait dealers harvest leeches; 56 percent are taken from public waters and the balance are taken from privately controlled sources (Peterson and Hennagir, 1980). Leech harvesters are able to remove as many as 4,000 leeches in a single trapping bout by baiting gunny sacks with fresh, bloody fish parts. Nearly 60 percent of Minnesota bait dealers report that bait leeches are periodically in short supply (Peterson and Hennagir, 1980). This is due, in part, to overexploitation by harvesters and the biology of the leech (Peterson, 1983).

Leech harvesting in North Dakota has not been documented and there are no current regulations concerning leech harvesting in North Dakota. The goal of this study was to assess the viability of a leech-harvesting industry in North Dakota by addressing three basic questions: (1) What is the demand for bait-leeches by North Dakota anglers? (2) Where do North Dakota bait vendors obtain their leeches? and (3) What is the current revenue generated by leech sales

in North Dakota? Answers to these questions may provide insight into the feasibility of commercial leech harvesting in North Dakota and lay groundwork for sound management. In a related study, field data were collected on in-state leech populations, distribution, habitat ecology, and trap vulnerability (Pennuto in prep). It should be emphasized that the ecology of this animal must be studied before overexploitation problems arise, as has happened in some Minnesota locations.

## PROCEDURES

A list of North Dakota bait vendors was obtained from the Licensing Division, North Dakota Game and Fish Department, and a telephone directory search supplemented this list. A mail questionnaire was sent to all located bait vendors in North Dakota in February and March 1987. In North Dakota, an annual bait-vending license is required of all retail and wholesale bait vendors. Smelters are also required to purchase a bait-vending license for the purposes of seining smelt, an activity which does not begin until April 1 (N.D. Game and Fish, 1987). The licensed-vendor list was obtained in February to reduce any possible overlap between smelters and actual bait vendors.

A total of 96 questionnaires surveys were mailed with follow-up mailings after two weeks. Eight bait shops were excluded from analysis because of insufficient mailing addresses. The questionnaire and a cover letter describing the scope and purpose of the study were included in all mailings. The survey contained nine questions for bait vendors. Questions ranged from yes/no responses indicating whether the vendor sold leeches during the previous year to where vendors purchased their leeches.

Total annual retail sale estimations were made by assuming the 72 percent response rate was an accurate reflection of the selling market. The number of vendors selling each size class could then be extrapolated to represent a 100 percent return rate (the number in parenthesis, Table 2). Estimates of total dozens sold by size class were obtained by multiplying the average number of dozens sold per vendor by the number of vendors selling a size class. Total sales were then determined by multiplying total dozens by the average price per dozen. The final annual retail sale estimate represents projected sales for 88 bait vendors responding to all questions in the same proportion as the original 64 returns.

**Table 1. 1987 North Dakota bait vendor surveys mailed and returned.**

	Mailed	Returned	Percent
<b>Retailers</b>			
Source:			
List	63	51	74%
Phone directory	21	11	
<b>Wholesalers</b>	4	2	50%
<b>TOTALS</b>	88	64	72%

**Table 2. Estimated total retail sales of leeches in North Dakota determined from 1987 bait leech survey.**

	Small	Medium	Large	Jumbo	Total
<b>Vendors*</b>	7(9.7)	18(25)	31(43)	22(31)	
Mean number of dozen sold per vendor	221.6	372.2	474.6	579.5	
<b>Total dozens**</b>	2,150	9,305	20,400	17,960	49,815
Mean price per dozen	\$1.25	\$1.37	\$1.35	\$1.73	
<b>Total</b>	<b>\$2,690</b>	<b>\$12,750</b>	<b>\$27,540</b>	<b>\$31,140</b>	<b>\$74,100</b>

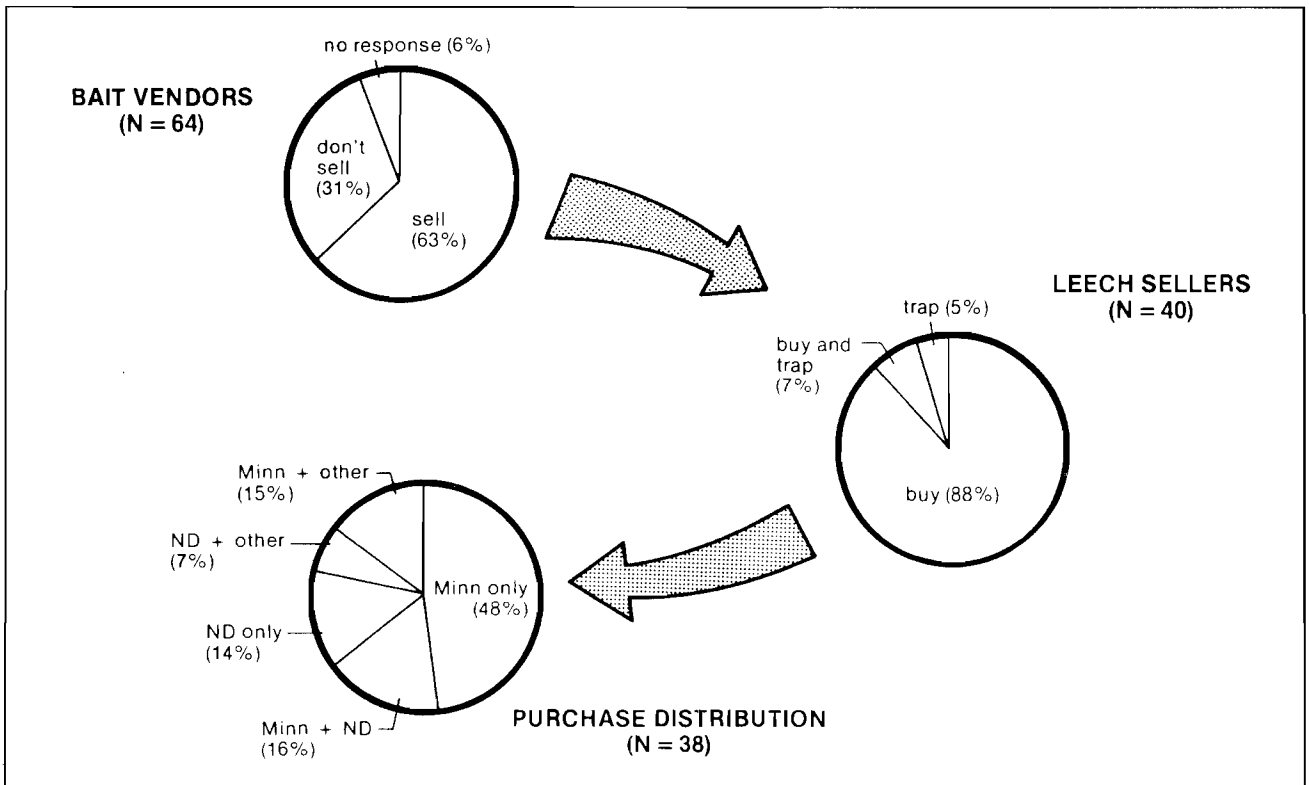
\* Number of parenthesis represents the actual number reporting sales in this category multiplied by 0.72 to project a 100% return.  
 \*\* Projected number of vendors multiplied by the average number of dozens sold.

**RESULTS**

In total, 96 surveys were mailed and eight of these were excluded, leaving 88 surveys for analysis. Sixty-four surveys were returned, a response rate of 72 percent. The return rate of the survey was higher for retailers than for wholesalers (74 percent vs 50 percent, Table 1). Sixty-three percent (n=40) of bait vendors responding reported selling leeches in 1986 (Figure 1). The average number of dozens sold by a vendor ranged from 222 for small leeches to 580 for jumbo leeches (Table 2). The average price per dozen ranged from \$1.25 for small leeches to \$1.73 for jumbo leeches (Table 2).

Vendors who sold leeches were asked to identify whether they purchased or trapped the leeches they sold. Ninety-five percent (n=38) indicated they purchased some proportion of their stock: 88 percent solely bought and 7 percent combined trapping with purchases. Five percent (n=2) trapped exclusively (Figure 1). No information was obtained regarding the purchase-to-trap ratio for vendors who combined these two methods. Therefore, a 50:50 purchase to trap ratio was assumed. As a result, estimates of Minnesota-purchased leeches may be inflated (deflated), potentially underestimating (overestimating) internally generated income by vendors trapping in North Dakota.

North Dakota bait vendors who purchased leeches in 1986 were asked to describe the source of their purchases. Sixty-three percent (n=24) bought them entirely from sources outside of North Dakota (Figure 1), six from Minnesota and other, plus 18 from Minnesota only. Another 23 percent (n=9) of the vendors who purchased leeches obtained some proportion from outside of North Dakota.



**Figure 1. Estimates of purchase and trap patterns by North Dakota vendors.**

About 14 percent of vendors purchased their leeches exclusively from within North Dakota (Figure 1). Responses indicating purchases from greater than one source were assumed to be divided evenly between the purchase sources.

Bait vendors sold four size categories of leeches in 1986: small, medium, large, and jumbo. Total sales increased with size class ranging from about \$3,000 for small leeches to over \$31,000 for jumbo leeches. However, it appears that the "large" leeches were sold most often (Table 2). The average price of bait leeches also increased by size class with small leeches selling for \$1.25 per dozen and jumbo leeches for about \$1.75 per dozen. The estimated total annual retail sale of bait leeches in North Dakota was \$74,100.

## DISCUSSION

The bait leech *Nepheleopsis obscura* is a highly demanded fish bait in the upper Midwest. Harvest pressure in Minnesota has led to local population declines and an intricate system of pond leasing, commercial harvesting, and an aquaculture industry (Peterson, 1982). The economic incentives for this activity are large; Minnesota generated \$1.5 million in retail sales in 1979 (Peterson and Hennegir, 1980). North Dakota vendors are presently purchasing up to 71 percent of their leeches from Minnesota (Figure 1). This translates into roughly \$52,500 in potential annual leech sales in North Dakota.

Anglers purchase greater numbers of "large" leeches than any other size class, but the "jumbo" size accounts for a greater proportion of total sales. Jumbo leeches sell for around \$0.40 more per dozen than the "large" size, amounting to greater sales though the total quantity less. Populations containing a disproportionate number of "jumbo" leeches compared to animals of other size classes may be more susceptible to overexploitation because harvesters receive a greater return per unit effort for "jumbo" leeches relative to other size classes. But, the "jumbo" sizes typically represent mature animals having just reproduced or about to reproduce. This species experiences post-reproductive mortality (i.e., they die after reproduction) (Davies and Everett, 1977; Peterson, 1983; Holmstrand and Collins, 1985). Thus, "jumbos" may sire the bulk of future leech populations in a given habitat and warrant some protection.

Anglers account for over half of the total expenditures by licensed recreationists and summertime anglers spend more per person on a seasonal basis than almost all other categories of recreationists (Baltezare and Leitch, 1988). Baltezare and Leitch (1988) estimate that summer anglers spend \$127 per day. It is probable that expenditures for live bait are part of an angler's daily cost.

Any expenditure for in-state harvested bait should reduce the total need for out-of-state purchases by wholesale and retail vendors. Thus, North Dakota may experience some revenue generation by supporting in-state leech harvesting.

The average landowner is not likely to experience a significant increase in income by raising leeches for retail sale, but wholesale vendors may expect to pay less for leeches from local bait trappers compared with out-of-state trappers. Retail vendors raising their own leeches will eliminate costs passed on from wholesale dealers and could possibly pass these savings on to the angler. More research needs to be conducted on the reproductive biology and habitat requirements of bait leeches in North Dakota.

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