"Willow Cats" for Sale? Madtoms (Genus *Noturus*) as Bait in the Upper Mississippi River Valley

Philip A. Cochran and Mark A. Zoller

(PC) Biology Department, Saint Mary's University of Minnesota, 700 Terrace Heights Winona, Minnesota 55987
(MZ) Coneco Engineers and Scientists, 4 First Street, Bridgewater, Massachusetts 02324

Abstract

We review the use of madtoms as bait in eastern North America, with an emphasis on the Upper Mississippi River. "Willow cats" have long been prized as bait for walleye and other game fish along the Upper Mississippi River and sell for as much as $1.00 apiece, but they have not even been mentioned in some regional reviews of bait species. A survey of bait shops in Minnesota and Wisconsin revealed that "willow cats" are sold in towns and cities along the Mississippi River significantly more often than in locations inland. Despite some earlier reports to the contrary, "willow cats" for sale at present are tadpole madtoms (*Noturus gyrinus*) rather than stonecats (*Noturus flavus*). Samples of tadpole madtoms from bait shops were compared to samples obtained by electrofishing from presumably unexploited populations in Wisconsin and Minnesota. As expected, the latter included individuals of greater size. In addition, a comparison of relationships between wet mass and total length revealed that madtoms from the wild weighed significantly more than bait shop madtoms of equal length. The latter result may reflect the stress of capture, handling, and captivity experienced by madtoms obtained from bait shops. Availability of "willow cats" in Minnesota was disrupted in 2004 when a conservation officer suggested that madtoms were not "minnows" and could not be harvested legally from inland waters. The ensuing controversy resulted in a change in the relevant statute by the state legislature in 2005. Because madtoms have relatively short life spans and display relatively low fecundity, and because our evidence suggests that pre-reproductive individuals are being included in the bait harvest, it is important to obtain a better understanding of the dynamics of exploited populations.

Introduction

North American catfishes of the family Ictaluridae have long played a significant role in local cultures, especially in the central U.S. The importance of the larger species, such as the flathead catfish (*Pylodictis olivaris*) and channel catfish (*Ictalurus punctatus*), is especially well documented. Although the importance of wild-caught catfishes in the commercial fishery (e.g., Lund 1995) may have declined with the rise of channel catfish aquaculture in the southern U.S. (Ziegenhorn 2000), these species remain an important source of recreation,

Fig. 1.
Bait shops advertising "willow cats" for sale in Winona, Winona County Minnesota, summer of 2003 (upper left, and close-up, upper right), LaCrescent, Houston County, Minnesota, 10 August 2006 (lower left), and Ferryville, Crawford County, Wisconsin, 11 August 2006 (lower left). Photographs by Philip A. Cochran.

as evidenced, for example, by the recent "noodling" craze (Beesley 2002).

Smaller catfish species may also figure prominently in local cultures. In cities and towns along the Upper Mississippi River, signs outside bait shops often advertise the availability of "willow cats" for sale as live bait (Fig. 1). One former bait shop in Winona, Minnesota, billed itself as "The Home of the Willow Cat." Willow cats are madtoms (genus *Noturus*), and their use constitutes an apparently substantial fishery that is not widely reported and has not been analyzed. The purpose of this account is to present preliminary data on the use of willow cats as bait.

A General Review of Madtoms as Bait

Despite the ability of madtoms to use their fin spines and associated venom to effect a painful sting, several species have been used as bait (Table 1). Some species are thought to have had their geographic ranges extended through bait-bucket release (e.g., Jenkins and Burkhead 1994, Robison and Buchanan 1988, Rubec and Coad 1974, Smith 1985, Taylor 1969). At the United States Geological Survey's Nonindigenous Aquatic Species website (USGS NAS 2008), four of the seven madtom species for which nonindigenous occurrences have been reported are thought to have been possibly or probably spread through use as bait. However, several reviews of the bait industry have failed to mention madtoms, even in geographic areas where there is a tradition of using them. These include Peterson and Hennagir's (1980) survey in Minnesota, LoVullo and Stauffer's (1993) in Pennsylvania, and a survey by Meronek et al. (1997) for an area that included Wisconsin, Minnesota, Illinois, Michigan, Ohio, and North Dakota.

On the other hand, authors writing for an audience of anglers have sometimes extolled the virtues of madtoms as bait. For example, Bergman (1947) used stonecats as bait for smallmouth bass in New York: "We also used small stone cats which we got from under the rocks in shallow water. These had to be stunned by hitting the rock, grabbed quickly before they recovered, and put in the bait pail. They were much better than minnows, I believe principally because they lived well on the hook and could take the punishment of casting without becoming lifeless after the first few casts." He also quoted from the New York statutes for 1942: "Tadpole stone cats may be taken by stunning, which means tapping a stone with an implement or other stone." More recently, Rounds (2002) used stonecats to catch smallmouth bass in Pennsylvania

Table 1. Previous published reports of madtoms (genus *Noturus*) used as bait. See text for additional records.

Species	Source	Target species	Comments
Noturus insignis (margined madtom)	Clugston and Cooper (1960)	*Micropterus spp*. (bass)	
	Cooper (1983)	*Micropterus dolomieu* (smallmouth bass)	
	Jenkins and Burkhead (1994)	smallmouth bass	$1.00-1.50 each; demand exceeds supply
Noturus gilberti (orangefin madtom)	Jenkins and Burkhead (1994) and references therein		Suggested mode for range expansion
Noturus flavus (stonecat)	Eddy and Underhill (1974)	*Sander vitreus* (walleye) *Sander canadensis* (sauger) *Ictalurus punctatus* (channel catfish) *Pylodictis olivaris* (flathead catfish)	
	Becker (1983)	channel catfish, flathead catfish	Used along lower Wisconsin River; used as trotline bait on Ohio River prior to 1925
Noturus gyrinus (tadpole madtom)	Adams and Hankinson (1926) in Whiteside and Burr (1986)	*Micropterus spp*. (bass)	
Noturus exilis (slender madtom)	Becker (1983) Robison and Winters (1978)	bass, walleye	

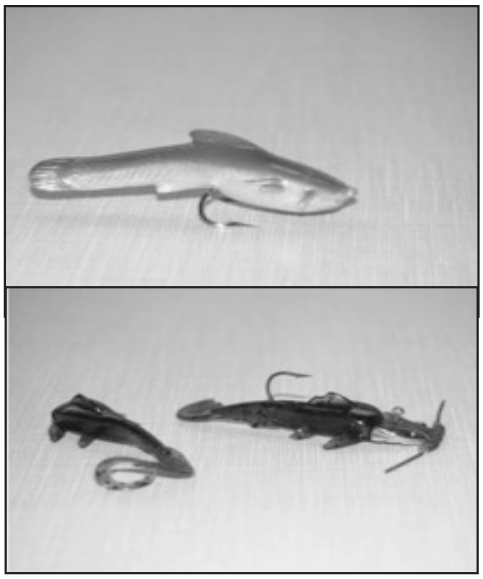

Fig. 2.
Artificial lures that imitate madtoms include the "Stone Catty Brown" (top) and the "Stone Caddy/Blue Eyes" (bottom). Photographs by Philip A. Cochran.

(judging from geographic distributions, he may have been using margined madtoms). He purchased them for $1.69 apiece at a bait shop, but they were not always available.

It is possible to purchase artificial lures fashioned to imitate madtoms. Examples include the "Stone Catty Brown" and the "Stone Caddy/Blue Eyes" (Fig. 2). Both are manufactured of soft plastic materials, the latter in China.

Previous Reports on the Use of Madtoms in the Upper Mississippi River Drainage

Ichthyologists have provided conflicting reports on the use of madtoms as bait in the Upper Mississippi River drainage. In their book on Minnesota's fishes, Eddy and Underhill (1974) emphasized the use of stonecats along the Mississippi River from Lake Pepin downstream as bait for walleyes, saugers, channel catfish, and flathead catfish, and they equated stonecats with the term "willow cats." They believed that tadpole madtoms were also used as bait, but to a lesser extent than stonecats.

Becker (1983) emphasized the importance of tadpole madtoms as bait for walleyes and black bass along the Mississippi River. They were collected by digging through detritus with a long-handled scoop of hardware cloth. Bait dealers took advantage of the thigmotropic tendencies of the madtoms to remove them from holding tanks by lowering tin cans into which the madtoms would voluntarily enter. According to Becker (1983), stonecats were used as bait for flathead and channel catfish along the lower Wisconsin River.

A few writers for popular audiences have mentioned the use of madtoms for bait in the Upper Mississippi River drainage. Madson (1985) stated that "mad toms" were excellent bait for walleye and smallmouth bass, but he emphasized their efficacy in smaller streams. He also used the term "willow cat." Bosanko (2007a, b) based his guides to Minnesota and Wisconsin fishes in part on Eddy and Underhill (1974) and Becker (1983). He equated the term "willow cat" with both stonecats and tadpole madtoms, but he stated that stonecats were more important as bait in southern Minnesota and Wisconsin. Dickson (1988) noted that tadpole madtoms in Minnesota were referred to as "willow cats' and were prized as bait for walleye.

Methods

We surveyed bait shops in Wisconsin (26 stores in 19 counties) and Minnesota (19 stores in 13 counties) in person or by phone in 2003 and 2004. A distinction was made between bait shops in Mississippi River towns and "inland" bait shops in counties that did not border the river.

To help document their current importance in the local culture, we collected contemporary articles referring to willow cats in the Winona Daily News (WDN). We also took advantage of a web site that permits electronic searches of Winona newspapers published during the 19th and early 20th centuries (up to 1939) (www.winona.edu/library/databases/winonanewspapers.htm).

We compared total length and wet body mass in samples of tadpole madtoms being sold or used as bait and samples collected from wild populations. Samples of madtoms were obtained from a bait store in Wabasha, Wabasha County, Minnesota (21 September 2003) and from anglers on the Mississippi River below Dam 5, Winona County, Minnesota (25 May 2007). Samples of "wild" madtoms were obtained by electrofishing in the Yellow River, Washburn County, Wisconsin (23-24 May 2003) and by seining in the county ditch at the outlet to Boller Lake, Goodview, Winona County, Minnesota (17 October 2006). Total length was measured to the nearest mm and wet mass was measured to the nearest 0.1 mg after blotting each madtom with a paper towel.

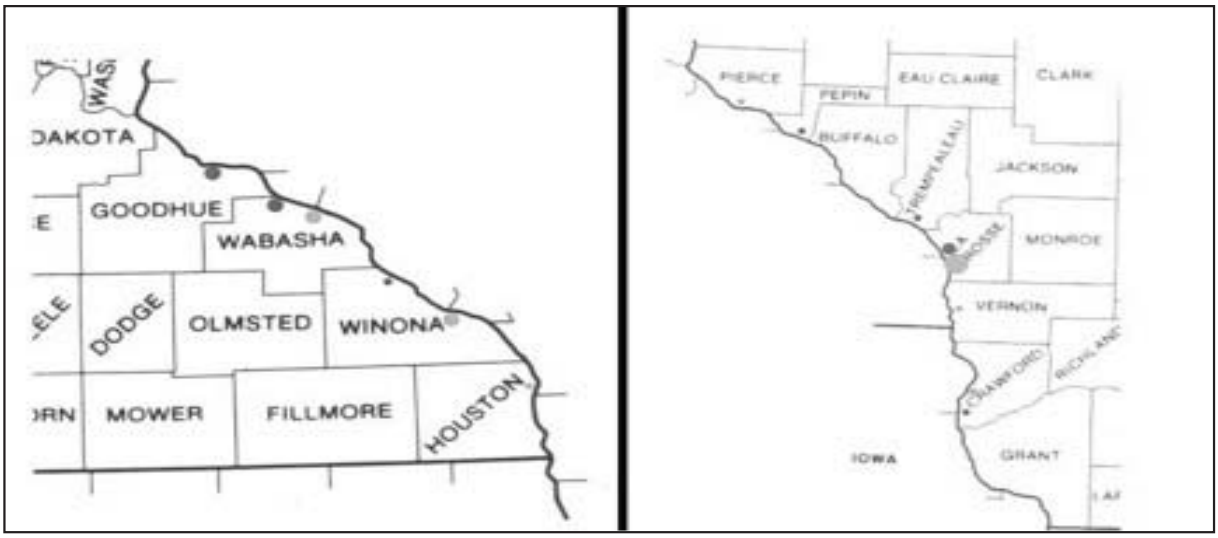

Fig. 3.
Locations of bait shops surveyed in Mississippi River towns in southeastern Minnesota (left) and southwestern Wisconsin (right). Grey dots indicate locations where tadpole madtoms were being marketed (as "willow cats"). Black dots indicate locations where willow cats were not for sale. The sizes of the dots indicate the numbers of bait shops in each category in each town. For Minnesota, smaller dots signify one shop and larger dots signify two. For Wisconsin, small, medium, and large dots signify one, two, and four shops, respectively.

Results and Discussion

Bait shop surveys We found only tadpole madtoms for sale in Minnesota and Wisconsin and only in Mississippi River bait stores. Differences between Mississippi River (Fig. 3) and inland bait shops (Fig. 4) with respect to the relative proportions that sold madtoms were statistically significant (Fisher's Exact Test, $P = 0.000$). Ten bait shops were surveyed in river towns in Minnesota, ranging from Goodhue County in the north to Houston County in the south. Five shops in Wabasha, Winona, and Houston counties had madtoms for sale. Twelve bait shops were surveyed in

Fig. 4.
Locations of bait shops surveyed in "inland" locations (away from the Mississippi River) in Minnesota (left) and Wisconsin (right).

river towns in Wisconsin, ranging from Pierce County in the north to Crawford County in the south. Seven shops in Pierce, La Crosse, Vernon and Crawford counties had madtoms for sale. Proprietors of most inland bait shops did not recognize the term "willow cat" and were not aware of the use of madtoms for bait, even though tadpole madtoms occurred in the same geographic regions and anglers in those areas often target fish species, such as walleye, for which madtoms are used as bait along the Mississippi River. It should be noted that our survey did not include bait shops in the lower Wisconsin River valley in Wisconsin, where Becker (1983) reported that stonecats were used for bait.

Conversations with bait dealers and anglers in river towns revealed some consistently reported beliefs. Madtoms were valued as bait because they survived well on the hook during repeated casts and they could be used to catch more than one fish. The difference between bullheads and madtoms was recognized by dealers and anglers, and they believed that fish preferred the latter. Some believed that the slime of the madtom made it attractive as bait; Bosanko (2007a,b) reported that the practice of rolling madtoms in sand to make them easier to handle was thought to reduce their effectiveness as bait by damaging the slime layer.

Prices obtained for tadpole madtoms have increased over the years but vary in season with their availability. One of the authors (PAC) first encountered the sale of tadpole madtoms in Winona in 1976, when the typical price was $0.50/dozen. Becker (1983) reported a price of $1.50/dozen in the late 1970s. On 12 July 1997, PAC noted willow cats for sale in Winona at a price of six for $2.75. By late summer, 2003, prices had risen to $1.00 each, and at that time a walleye tournament angler spent $400.00 to buy out a local shop's stock of approximately 40 dozen madtoms and keep them out of the hands of his competitors. Prices per dozen in 2004 were $7.00-8.00 on 30 May and $7.50 (unsorted by size) or $8.50 (sorted) on 22 June (WDN). In late summer of 2007, prices were $1.00 each or $10.00/dozen. In August, 2008, the price at one store was $13.00/dozen, but the dealer anticipated raising prices for an upcoming walleye tournament (on 14 September 2008, the WDN reported that the winners of the walleye tournament, who had traveled to Winona from Saginaw, Michigan, and Oshkosh, Wisconsin, had indeed used willow cats for bait).

Although tadpole madtoms are apparently marketed in Minnesota only along the Mississippi River in southeastern Minnesota, we spoke to a 72-year old Winona native (J. Bronk, pers. comm., 22 August 2005) who mentioned bringing willow cats to northern Minnesota, where locals knew nothing about them, and using them to catch fish. He would sell what he had left to other anglers for $1.00 apiece (but did not tell them about their ability to "sting"). He liked to use willow cats because he could catch many fish with one willow cat and because they were so hardy in the bait bucket that if he brought extras home they would survive overnight.

A bait dealer from the Brainerd region who was shown a preliminary draft of this manuscript (Barry Thoele, Lincoln Bait Live Aquatics, Staples, Minnesota, pers. comm.) commented that madtoms were available from bait shops along Mille Lacs Lake when he was a child 40 years ago. He sold them for the first time in 2008 and received $10.00 per dozen wholesale. He was not aware of anyone using them in the Brainerd area or anywhere else north of the Twin Cities, but anglers buy them in the Brainerd area to use in fishing tournaments on the Mississippi River from the Twin Cities down to La Crescent.

Willow cats in the news The importance of tadpole madtoms in the Winona region can be assessed by stories that have appeared in the WDN, especially during 2004-2005. Prior to this time, the term "willow cat" could be encountered with regularity during the fishing season in the weekly outdoor column on the back page of the Sunday newspaper (e.g., 23 June 2002). There, in a somewhat self-serving arrangement, local bait shop owners would often be quoted with respect to where fish were being caught and what bait they were taking. In 2004, however, willow cats moved to the front page (Table 2). A conservation officer new to southeast

Table 2. Headlines referring to willow cats in the *Winona Daily News*.

Date	Headline
30 May 2004	"DNR outlaws willow cats"
11 June 2004	"City lobbies for willow cats"
22 June 2004	"Wisconsin picks up willow cat bait slack"
24 July 2004	"State says there's no way around willow cat ban – for now"
17 February 2005	"Bill would allow willow cat return"
6 June 2005	"Willow cats now on legal bait list"

Fig. 5.
A placard placed on the sidewalk outside a Winona baitshop during the summer of 2004. Photograph by Philip A. Cochran.

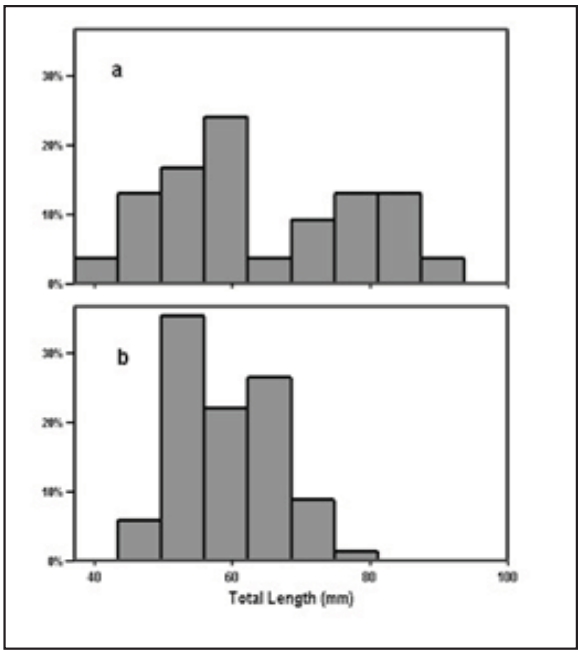

Fig. 6.
Histograms of tadpole madtom total length (mm) for (a) fish caught in the wild (n = 54) and (b) fish obtained from bait shops (n = 68). In each case, data from two samples have been pooled.

Minnesota determined that madtoms were not among the minnows authorized by statute for harvest and sale, and when this interpretation was backed at higher levels within the Minnesota Department of Natural Resources (DNR), the harvest and sale of madtoms within the state was suspended (note that harvest of madtoms and other bait from boundary waters shared with Wisconsin was already banned because of the threat of spreading exotic species infesting these waters). Bait shop owners in Winona were faced with losing what they claimed was a substantial business to stores in Wisconsin (indeed, a new advertisement announcing the availability of willow cats at a bait shop in Alma, Wisconsin, appeared on 30 May 2004 in the Winona paper on the same page as a major article on the Minnesota ban). Although some bait shop owners had obtained their willow cats from independent collectors, others had invested the $357.00 annual fee for a license to collect their own, and they were angry that the fee was not refunded. They helped raise a public outcry, circulated petitions, and placed placards on sidewalks directing citizens to call the appropriate DNR bureaucrat in St. Paul (Fig. 5). Communications passed between the offices of the mayor and city manager of Winona and the governor of Minnesota, but it became apparent that it would take a change in the law by the Minnesota Legislature to rescind the ban. Accordingly, a bill to define willow cats as minnows was passed early in 2005 and signed into law by the governor on 3 June. Since that time, willow cats have returned to the back page of the Sunday newspaper (e.g., 4 September 2005, 7 May 2006).

During the time that willow cats were banned in Minnesota, a letter to the editor of the WDN (4 June 2004) suggested that the use of willow cats as bait extended back several generations to the early 1900s and that they were also known at one time as "yellow bellies." We found no mention of the term "willow cat" during our electronic search of early Winona newspapers, but the following quote appeared in a column on fishing (Winona Republican-Herald, 20 May 1926): "Frogs, dog fish minnows, [and] yellow bellied bullhead minnows have been used to provide the pike with a change at different seasons." It is possible that the term "yellow belly" has been applied to black or yellow bullheads in addition to the tadpole madtom; a modern article in the WDN (22 July 2007) mentioned the use of small bullheads (< 180 mm) as bait for flathead catfish on the Mississippi River near Red Wing, Minnesota.

Length and mass Samples of tadpole madtoms that we collected from wild populations contained larger individuals

than those obtained as bait (Fig. 6). The sample from the Yellow River (n = 26) had a mean total length of 74.3 mm (range: 56-90 mm, S.E. = 1.9 mm) and a mean wet mass of 5.93 g (range: 2.28-9.54 g, S.E. = 0.46 g). The sample from the outlet of Boller Lake (n = 28) had a mean total length of 54.0 mm (range: 37-88 mm, S.E. = 2.0 mm) and a mean wet mass of 2.02 g (range: 0.59-7.67 g, S.E. = 0.29 g). Judging from length-at-age data summarized by Becker (1983), it appeared to be dominated by young-of-the-year but included some older fish. The sample from the Wabasha bait shop (n = 46) had a mean total length of 62.4 mm (range: 51-79 mm, S.E. = 0.9 mm) and a mean wet mass of 2.38 g (range: 1.22-4.83 g, S.E. = 0.11 g). Finally, the sample from anglers below Dam 5 (n = 22), with a mean total length of 52.8 mm (range: 45-68 mm, S.E. = 1.0 mm) and a mean wet mass of 1.40 g (range: 0.99-2.36 g, S.E. = 0.08 g), appeared to be dominated by juveniles produced the previous summer.

Some evidence suggests that anglers prefer relatively large madtoms. For example, a Wisconsin dealer was reported to supply tadpole madtoms 76-127 mm in length and offered them at a higher price if they were sorted by size (WDN, 22 June 2004). Although we would expect sustained size-selective harvest to eliminate larger, older individuals from the populations being exploited, it is not clear whether a sample of madtoms from a bait shop that lacks large individuals reflects such changes in the harvested population or merely the selective removal of larger individuals from the bait shop's tanks by anglers purchasing bait. However, the sample we obtained from anglers below Dam 5 early in the 2007 fishing season suggests that large madtoms may be in short supply. These anglers had driven an extra 108 miles (174 km) prior to fishing to purchase tadpole madtoms, which were of the smallest size class possible at that time of year (and at $1.00 apiece, they had paid the equivalent of over $300.00 /pound live weight). It would appear that many tadpole madtoms are being harvested before having an opportunity to reproduce.

A plot of wet mass versus total length (Fig. 7) revealed that madtoms collected from the wild tended to weigh more than madtoms of equal length obtained from bait shops. Comparison of simple linear least squares regressions of the natural logarithm of wet mass on the natural logarithm of total length revealed that this tendency reflected significant differences in both slope ($F_{1,118} = 5.794$, $P < 0.025$) and y-intercept ($F_{1,119} = 137.429$, $P = 0.000$). Lower condition of bait shop fish may reflect the stress of capture, transport, and maintenance under crowded bait shop conditions.

We emphasize that our results with respect to length and mass are preliminary. We recommend more thorough studies by which data can be collected in localities known to be harvested and compared to data from localities not subject to harvest. It would also be beneficial to sample bait dealers' catches at the time of harvest in addition to sampling stocks on hand in bait stores after known periods since harvest. Finally, information on the ages of individual madtoms would complement measurements of size. As in any other exploited species, the dynamics of madtom populations should be assessed in a way that permits sustainable management.

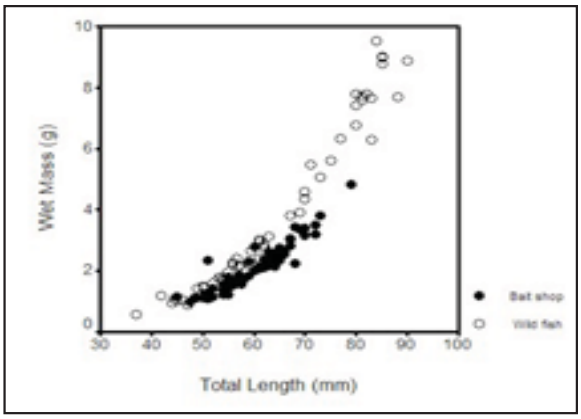

Fig. 7.
Wet body mass (g) versus total length (mm) of tadpole madtoms caught in the wild (open circles, n = 54) or obtained from bait shops (solid circles, n = 68). In each case, data from two samples have been pooled.

General Discussion

Madtoms as a group combine relatively low fecundity with relatively short life spans (Burr and Stoeckel 1999). Populations of species with this combination of traits might be vulnerable to overharvest, especially if their value increases with scarcity. Our evidence suggests that pre-reproductive individuals are currently included in the harvest. It would be desirable to obtain more information about madtom populations at locations actually being exploited by bait dealers. Dealers are generally not very specific about where they obtain their madtoms, indicating only that they scoop or seine them from northern lakes, streams, or flowages (WDN, 30 May 2004). We have heard that some anglers collect madtoms in local ditches and tributaries to the Mississippi River, but we have not confirmed this by direct observation.

Because harvest of bait is currently banned in the Mississippi River boundary waters between Minnesota and Wisconsin to reduce the spread of invasive exotic species, this

area is in theory a refuge for madtoms. However, it is rumored that madtoms are harvested illegally at night on sandbars in the Mississippi River off the mouth of Trout Creek, where reflectors are set on the waterline to guide the nocturnal poachers. We have not confirmed this rumor.

We have tried to portray the unique significance of tadpole madtoms in geographically localized cultures. We may be poised at a time, however, when the homogenizing effects of the communications media, including cable television and the internet, may lead to more widespread use of madtoms for bait. We are aware that use of willow cats was demonstrated on television during an episode of a Twin Cities-based hunting and fishing program. If greater publicity of this sort leads to increased demand for madtoms, it will become even more important to understand the effects of harvest on their populations, and we might also expect that populations will be established in new areas through bait bucket release.

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