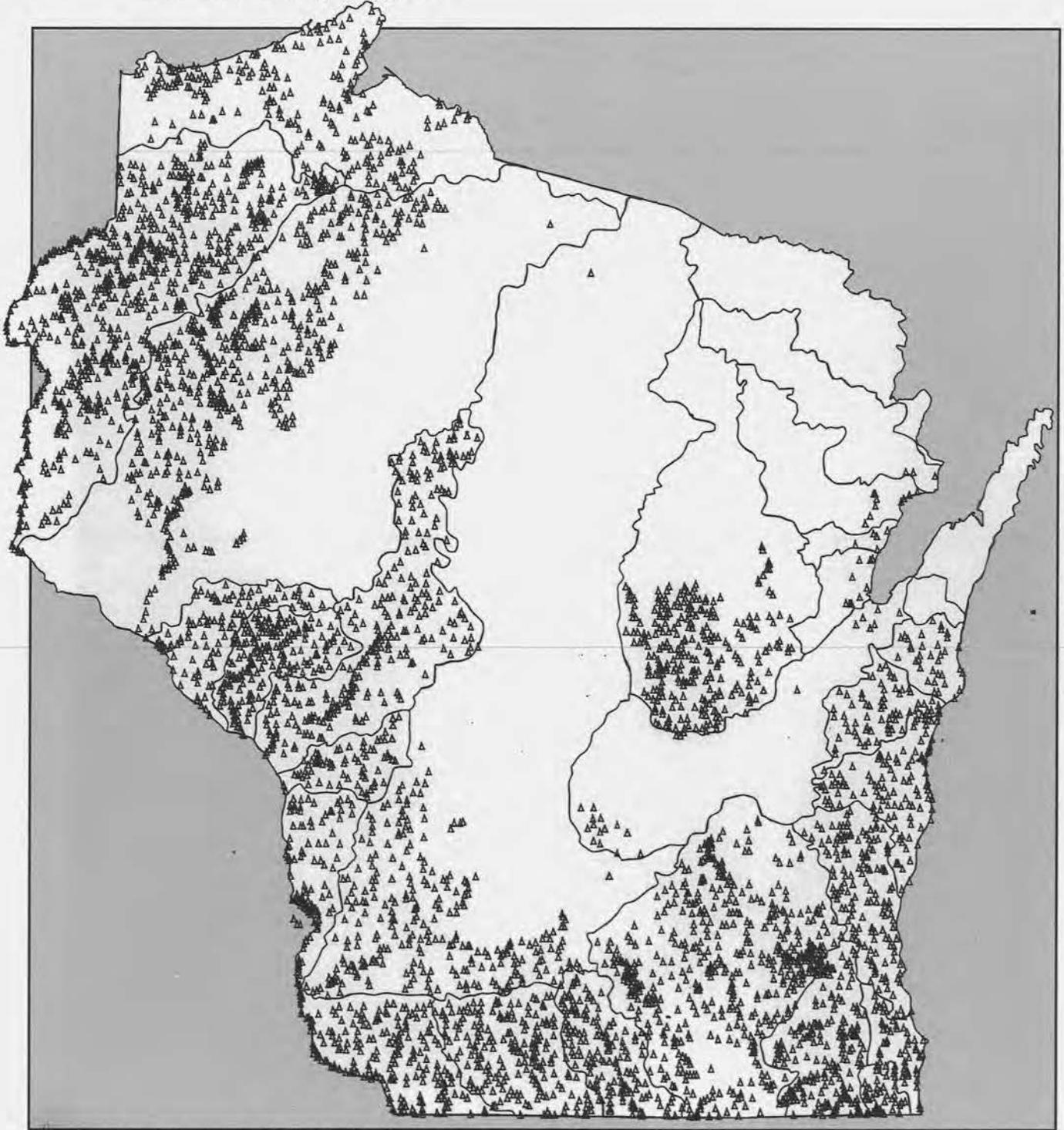


Distribution and Relative Abundance of Fishes in Wisconsin

VIII. Summary Report



Cover map shows location of stations sampled.

This report is dedicated to the nongame fish, whose interrelationship in the aquatic ecosystem is generally not well documented or appreciated.

PREFACE

Little attention has been given to nongame fish species, which compose over 75% of the 140 fish species with reproducing populations in the inland waters of Wisconsin. Yet many of these species play a major role in the maintenance of sport fish populations so vital to recreational and economic interests in the state. In essentially disregarding these species, we overlook their right to exist and their role in maintaining community stability through species diversity. This viewpoint is faulty because the nongame fish not only make up the majority of fish species in Wisconsin, but they are also more abundant than sport fish species in both total number and total biomass.

Further attention by either research or management personnel to nongame fish species must be preceded by an inventory of what we have and where we have it. In 1974, the Bureau of Research of the Wisconsin Department of Natural Resources (DNR), with inputs from field fisheries management personnel, began a statewide research study assessing the distribution and relative abundance of fish species, emphasizing but not limited to nongame species. This assessment was begun using a basin approach to delineate location of sampling stations on the over 14,500 lakes (over 410,000 ha) and 12,500 streams (over 70,400 km) within the state. The 3 major basins (Mississippi River, Lake Michigan, and Lake Superior) were further divided into 27 minor inland basins. Great Lakes waters (Green Bay, Lake Michigan, and Lake Superior) were not included in the study.

The last report on the distribution of fish species throughout the state was made by C. W. Greene (1935) for the 1900-31 period. He covered about 1,400 sampling stations. Since then, other collectors, notably Dr. George Becker (1959, 1964a, 1964b, 1966, 1983), Professor Marlin Johnson (Johnson and Becker 1970), and students at the University of Wisconsin at Madison (including McNaught 1963) and Stevens Point, have added appreciably to knowledge of regional and statewide distribution of Wisconsin fishes.

The need to update our knowledge of statewide fish distribution is most clearly evident from the dearth of information available on nongame species in most watersheds for preparing environmental impact assessments and reports and DNR master plans. In addition, both federal and state laws now require the establishment of endangered and threatened species lists. Furthermore, the DNR has been directed to "conduct research on the endangered and threatened species of this state and . . . implement programs directed at conserving, protecting, restoring and propagating selected state-endangered and threatened species to the maximum extent practicable" [Sec. 29.415(7) as created by Chap. 275, Laws of 1971 and last amended by Chap. 370, Laws of 1977].

The research study initiated in 1974 had 2 objectives. The first and primary one was to survey current fish distribution. Field collecting for this survey was begun in 1974 and was essentially terminated in 1980 due to reduced funding, with only limited sampling from 1981-86. Of the 27 inland river basins in the state, sampling has now been completed in 15 basins and 1 sub-basin and has been nearly completed in 1 additional basin. Only scattered samples were taken in the other 11 basins. These samples enabled us to inventory about 50% of the inland geographic area of the state.

The second objective of the research study was to synthesize historical information on statewide fish distribution. Other fishery biologists and managers have made numerous collections over the years, and their published and unpublished records, when available to us, were included in the study. Most of these records we added were from completed basins. Therefore data from as early as 1900 are available for some basins, permitting comparisons between historical and current records.

The results of the work completed on fish distribution have been published in a series of separate bulletins dealing with one or more of the minor basins. Reports on the following basins are available: Greater Rock River basin (Fago 1982); Black, Trempealeau, and Buffalo river basins (Fago 1983); Red Cedar River basin (Fago 1984a); Root, Milwaukee, Des Plaines, and Fox river basins (Fago 1984c); Grant & Platte, Coon & Bad Axe, and La Crosse river basins (Fago 1985a); Sheboygan, Manitowoc, and Twin river basins (Fago 1985b); and St. Croix River basin (Fago 1986). The data presented in these reports refer primarily to the current collections made during this research study.

This series of reports, however, constitutes only an overview of a voluminous mass of data (over 17,500 collections) now permanently stored in computer files. These files, which can be accessed through use of DNR's official water body identification codes, provide fish data on specific waters or on waters in close proximity to those of immediate concern. Such information has already, in over 500 cases, proven to be very useful to field managers and investigators in several DNR bureaus, other state and federal agencies, environmental consulting firms, and universities. These persons have used the data for various purposes: e.g., to make assessments on past as well as potential changes in the aquatic environment, indicate water quality through fish species composition, and determine ranges in Wisconsin for particular fish species.

Sufficient data were collected during the research study to recommend revisions of Wisconsin's endangered and threatened fish species lists in 1979 and 1982. The first revision removed 5 species from the endangered list, added 7 new species to the endangered list, created a list of 8 threatened species, and changed the status of 2 species from endangered to threatened [Wis. Admin. Code NR 27.03(2)(e) and (3)(e), Sep 1979]. The second revision removed 3 species from the threatened list, changed the status of 1 species from endangered to threatened, and changed the status of 2 species from threatened to endangered [Wis. Admin. Code NR 27.03(2)(e) and (3)(e), Nov 1982].

The bulk of the preserved fish collections are curated at the Milwaukee Public Museum, further enhancing the value and significance of this study. There they are used by scientists and educators interested in taxonomy, systematics, and natural history. They also are serving as a baseline collection from which changes in fish community structure and environmental loads of pollutants and toxicants can be determined.

This report, the final one in the series, brings together all the data that the Fish Distribution Study staff collected and identified or gathered from other collectors from 1900-86 and put into a computer data base. It also sets out a plan for sampling the fish distribution in that part of the state that has not yet been sampled.

Distribution and Relative Abundance of Fishes in Wisconsin

VIII. Summary Report

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ABSTRACT

A statewide study of the inland waters of Wisconsin was initiated in 1974 by the Bureau of Research, Wisconsin Department of Natural Resources (DNR) to establish a comprehensive data base on the distribution and relative abundance of all fish species. Records composing this data base came mainly from a survey between 1974 and 1986 of current statewide fish distribution. Numerous historical records (from 1900-72) were also included in the data base.

Surveys to determine current distribution were primarily conducted in eastern, southern, west central, and northwestern Wisconsin. Sampling of basins in these areas during 1974-86 was accomplished at 5,396 stations by Fish Distribution Study personnel, at 4,174 stations by other DNR personnel, and at 271 stations by non-DNR personnel. These stations covered approximately 50% of the state. During this period, 143 species were collected. Of these 143 species, 140 are believed to have reproducing populations in the inland waters of Wisconsin. According to the Department's lists of endangered, threatened, and "watch" species, the fishes collected during the fish distribution survey between 1974 and 1986 included all 8 of the state's endangered species, all 6 of the threatened species, and 16 of the 21 species on the Department's watch list. These status designations were based on official listings of endangered and threatened species (per a 1982 Wisconsin Administrative Code) and an unofficial list (from 1985) of watch species for which a population problem was suspected but not known.

Data from the 1974-86 period for Wisconsin were compared to those from the 1900-72 period. The early period records consisted of 2,179 non-DNR collections and 1,456 DNR collections. Two species that had not been previously reported from the state were collected in the later period. Three species have apparently been extirpated from the state.

This report includes numerous tables, distribution maps of the species, and discussion on many aspects of fish distribution in Wisconsin. It also sets out a sampling plan for completing the state survey. The data base generated to date has been shown to be of great value for the preparation of environmental impact assessments, development of master plans for the aquatic resource, and preparation of research proposals on nongame species, fish communities, and ecosystems. Use and value of this data base would undoubtedly increase if the sampling of the state were to be completed. It is, therefore, recommended that completion of this study be considered in the near future. Other recommendations are to update the data base with information from historical fish surveys, to continue the systematic recording of fish collected during routine DNR surveys, and to protect the habitat of endangered and threatened fish species.

Key Words: fish, distribution, relative abundance, Wisconsin, nongame, data base, map plotting, endangered, threatened, rivers, lakes, sampling plan, sampling gear, electrofishing.

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Note: Also enclosed are clear base map overlays for use with the distribution maps for all species, which begin on page 88.

FOREWORD

This report is based on data collected through 1986. It does not reflect changes made in Wisconsin's endangered, threatened, and "watch" species lists between the time the manuscript was completed in 1988 and its publication date.

During that period, Wisconsin's endangered fish species list was expanded to include the skipjack herring. The threatened species list was enlarged to include the following 5 species: river redhorse, greater redhorse, pugnose shiner, redbfin shiner, and paddlefish. The watch list was renamed to "special concern" and now includes additional species including the following exotic fish species recently found in the Great Lakes: white perch (*Morone americana*)—in Lake Michigan and Green Bay—and ruffe (*Gymnocephalus cernua*)—in Lake Superior. The dispersal of these species should be closely monitored.

INTRODUCTION

In the mid-1970s, a research study was initiated by the Wisconsin Department of Natural Resources (DNR) to systematically sample the distribution and relative abundance of fishes throughout the inland waters of Wisconsin. The study focused primarily on a survey of current fish distribution but also synthesized historical distribution records where these were available and were mainly from completed basins.

In order to organize and permit retrieval of the massive amount of data to be collected, a water mileage system was devised to identify the location of sampling stations. This system involved dividing the state into major and minor water basins and establishing a unique series of mileages (codes) for each stream and non-landlocked lake. These codes, along with standard location information (name of water body, water body identification code, basin number, county, town, range, section, and quarter section), were stored in a computer file that has become known as the Master Stream and Lake File. A second computer file, the Master Fish File, was then created to store the biological and environmental data taken at each sampling station.

To date, over 17,500 collections have been added to this data base. These collections represent an inventory of about 50% of the state. Results have been published in a series of 7 separate reports on various minor basins.

Because reduced funding terminated the research study before the entire state could be surveyed and because it was unknown if or when the survey might be resumed, a decision was made to present findings to date in a summary report for the fish distribution study. This report is that document.

For consistency with the previous reports on fish distribution, presentation of data in this summary report follows the same general approach as that used in the earlier reports. Focus in the report continues to be on results of the current surveys. One major difference, however, is that the distribution maps are less detailed because of the increase in the amount of data being shown. In addition a large, new appendix section prescribes sampling effort for completion of the fish distribution survey in those portions of the state that have not yet been inventoried. Smaller differences also exist between this report and the earlier ones. These differences include new approaches to reporting

the findings and corrections of a few errors in the earlier publications. Furthermore, additional records have been added to the data base after publication of these earlier reports. Readers are therefore urged to consult this report as the final authority on the Fish Distribution Study.

Users of this summary report are also cautioned from the outset to remember that only half of the state's geographic area was surveyed. Findings and conclusions thus apply only to the area that was inventoried and do not reflect what might be true for the state as a whole.

The considerable mass of summary tables, figures, and maps that supplement the findings given in the text have been organized into a sequence of appendixes on related topics. Appendix A documents the sampling effort used by Fish Distribution Study staff in their completed surveys and recommends sampling effort for completing the statewide survey. Appendix B lists fish species found and who collected them. Appendix C illustrates sampling forms and examples of print-outs that can be run from the computerized data base. Appendix D shows locations of sampling stations. Appendix E illustrates types of sampling gear used and the uncommon fish species collected. Appendix F lists frequency of species occurrence by water type. Appendix G shows historic and current distribution maps for all species. To assist readers in locating certain material within the 2 longest of these appendixes, indexes to them are given at the back of the report.

Together, the text and appendixes can be put to a variety of uses. The tables and maps in this report can give readers an idea of the present distribution of fish in the 15 basins and 1 sub-basin in which sampling has been completed. This same information can also suggest distribution changes that may have occurred between the current survey period (1974-86) and earlier records (1990-72). The examples of computer print-outs can give those who want to access this data base (Master Fish File) an idea of possible applications to their own work. A common application is compiling a species list for a particular sub-basin. Finally, the pictures of the endangered, threatened, and watch species can give readers a better awareness of these rare fish, which face serious problems jeopardizing their existence.

STUDY AREA

The geographic area of Wisconsin excluding the Great Lakes and Green Bay is approximately 149,000 km² (Henrich and Daniel 1983). Within this area, the Master Stream and Lake File (Fago 1984b) lists over 12,500 streams with a total length of over 70,400 km and over 14,500 lakes with a total surface area of over 410,000 ha. Lakes in this report refer to naturally occurring lakes as well as impoundments (bodies of water with dams at their outlets) unless otherwise specified.

Regarding which basins were selected and in which order, no specific criteria determined selection. However, sampling tended to occur mainly in southern Wisconsin because habitat there was believed likely to change the most. Of the 27 river basins in the state, sampling in 15 basins (10, 20, 30, 40, 50, 200, 210, 220 [includes sub-basins 221, 222, 223], 230, 250, 260, 270, 280, 290, and 310) has been completed (Fig. 1). In addition, sampling has also been completed in the Red Cedar River basin, a sub-basin of basin 300 (the Chippewa River basin). The total area of the completed basins and sub-basins plus the

sampled portions of partially completed basins represents about 50% of the geographic area of the state (Table 1). The completed basins and sub-basins contain 4,274 streams of which 85% are 5 miles or less in length (Append. Table A.1) and 4,258 lakes of which 84% are 50 acres or less in size (Append. Table A.2). In the uncompleted basins of the state (excluding the Red Cedar River sub-basin and that portion of basin 240 below the Prairie du Sac dam), there are 7,489 streams of which 86% are 5 miles or less in length (Append. Table A.3) and 10,259 lakes of which 87% are 50 acres or less in size (Append. Table A.4). The uncompleted basins thus contain a greater proportion of smaller streams and lakes than are found in the completed basins.

For additional information about the area surveyed, see the published reports for the basins involved (Fago 1982, 1983, 1984a, 1984c, 1985a, 1985b, 1986). This information consists of average annual precipitation, average gradient and discharge, substrate composition, major land uses, and population size.

METHODS

Data Sources and Time Periods

All collections are divided into 2 time periods: 1900-72 and 1974-86. The earlier records were separated from current ones in order to provide the basis for assessment of change over time in distribution of fish species within a basin. The later records also include data collected in 1973 from 45 stations in basin 20. These data resulted from a small survey done the year before the Fish Distribution Study began. Because these are the only records for 1973, because they were collected by Fish Distribution Study personnel, and because the locations sampled were not resurveyed, the 1973 data are lumped into the 1974-86 period.

If a location was sampled more than once within one of the 2 time periods, only 1 collection is used in the counts of number of stations sampled and number of stations at which a species was taken. Generally the more recent record within a time period is used.

As used in this report, a collection is defined as a sampling for which a date, collector, location, and species identification were known. The best available information on these topics was used. For example, some sampling dates consisted only of a year, some sample locations were unknown or unclear, and some fish were identified only to genus.

1900-72 Period

Collections from this period were made at 3,635 stations by a number of collectors on 1,169 streams and 523 lakes (Table 2, Append. Fig. D.1). Collections between 1900 and

1950 were made primarily by the following collectors: A. Cahn, E. P. Creaser, W. E. Dickman, N. Enting, C. W. Greene, J. L. Griffith, C. Hubbs, S. N. Jones, H. V. Ogden, P. Okkelberg, R. R. Pope, H. R. Rich, Schultz, L. C. Stuart, C. Tarzwell, C. L. Turner, and G. Wagner. With the exception of A. Cahn (1927) and Greene (1935), names were taken from original field notes. Most specimens from these collections were verified by Dr. Carl Hubbs or Dr. C. W. Greene and cited by Greene (1935). The collections made for the Upper Mississippi River Conservation Committee (Smith and Lopinot 1967) were also an important source of information. During the 1950s and 1960s, the 2 most notable non-DNR collectors were Dr. George Becker and Prof. Marlin Johnson. For the Madison area lakes, the work of McNaught (1963) was most useful.

The distribution of sampling within the 1900-72 period is given in Table 3 by decade for each basin. According to this summary, 68% of the stations were sampled between 1960 and 1972. Appendix Table B.1 provides another indicator of sampling distribution. In that table, the percent of all collections during 1900-72 made prior to 1950 is given for each species. The average for all species was 28%.

The amount of historical records entered into the computerized data base varied depending on the basin. For basins in which only scattered sampling was done in 1974-86, no special effort was made to obtain older records. However, for basins in which a current survey was completed, an effort was made to obtain historical records. Because time available for data entry was limited, not all early records were entered into the data base.

1974-86 Period

Collections from this period were made at 9,841 sampling stations on 2,678 streams and 900 lakes (Table 2, Append. Fig. D.2). Fish Distribution Study personnel collected 5,396 (55%) samples, other DNR personnel collected 4,174 (42%) samples, and non-DNR personnel collected 271 (3%) samples (Table 4, Append. Fig. D.3). Collectors for each fish species collected during 1974-86 are identified in Appendix Table B.2.

Several calculations were made to highlight differences between the 2 time periods. First, total occurrences were used to compare differences in sampling effort. This was defined as the sum of the number of stations at which species were collected. Second, percent occurrence was used to show differences in the magnitude of increased knowledge of the distribution for each species. It was defined as the percent change from the early to later periods in the number of stations at which each species was taken.

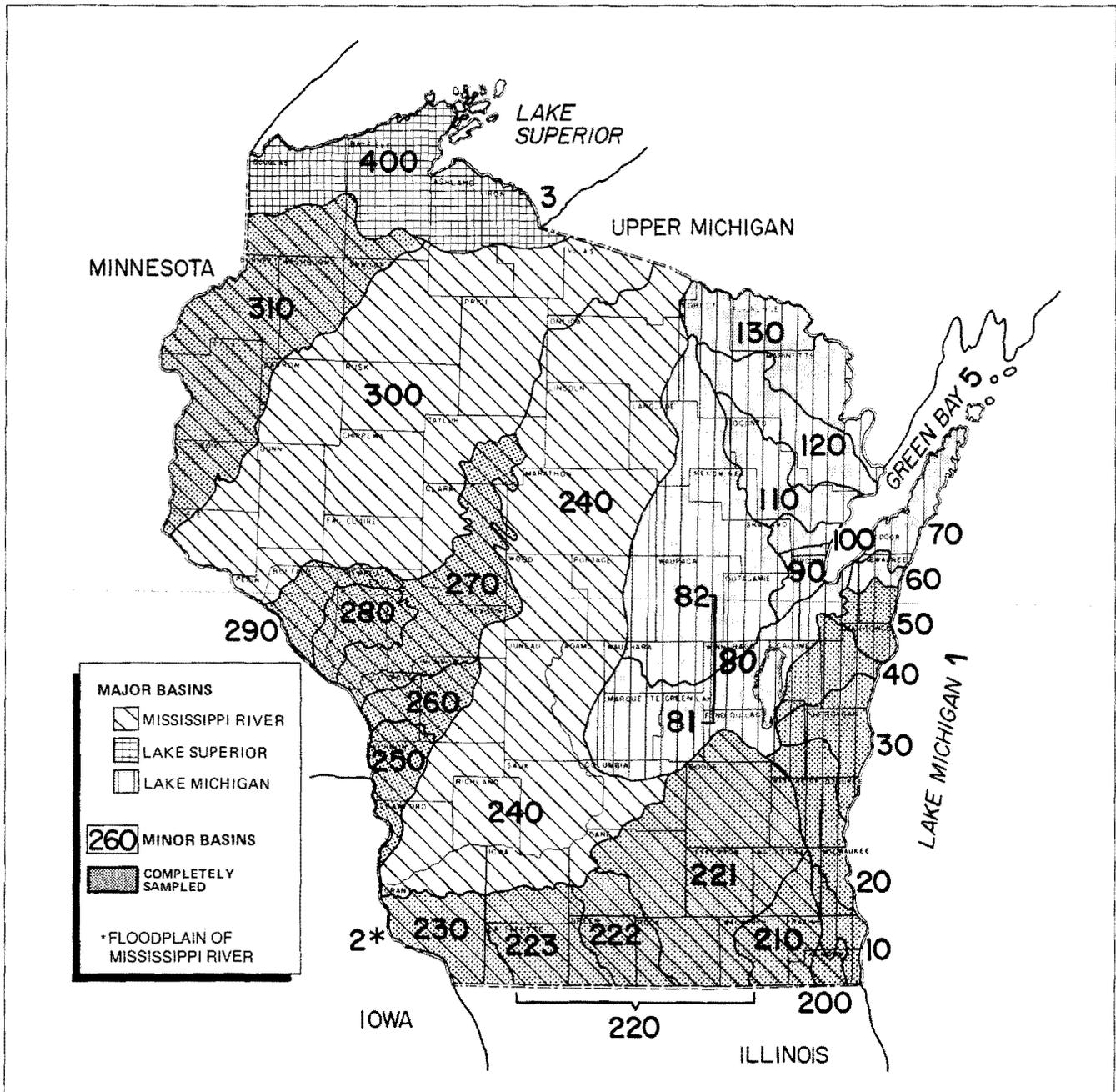


Figure 1. Major and minor river basins in Wisconsin showing those basins in which sampling has been completed. (Sampling has also been completed in one sub-basin of basin 300.)

Collection Methods and Gear (1974-86)

During the current survey of fish distribution by Fish Distribution Study personnel, the primary collection method used was electrofishing (Append. Fig. E.1). Fish management personnel used similar methods and gear, but they made greater use of AC electrofishing gear. Eight types of electrofishing gear were used: DC stream shocker (at 32% of the stations), gasoline- or battery-powered pulse DC backpack shocker (14%), DC longline shocker (11%), DC boom shocker (5%), AC stream shocker (5%), AC battery-powered backpack shocker (2%), DC minishocker (1%), and AC boom shocker (<1%). Selection of electrofishing gear type was dependent on the size of the body of water.

All generators (except the DC longline shocker) produced alternating current, which was converted, if desired, to DC. With the boom shocker, a choice of several pulse rates and frequencies was possible. The DC boom shocker occasionally used AC when the DC unit was inoperative. The DC minishocker was similar to the boom shocker except that it used the generator from the stream shocker in a smaller boat than the boom shocker. It also had only 1 boom and required 1 person seated in a chair in the bow of the boat dipping fish. The AC battery-powered backpack used a 12-volt, deep cycle battery and output alternating current at several voltages. For more information concerning the boom and stream shocking equipment, see Novotny and Priegel (1971, 1974).

In addition to electrofishing gear, small mesh seines were used by Fish Distribution Study personnel at 30% of the stations, primarily in lakes and large rivers. The seines were 1.2-m and 9.1-m bag seines with 4.8-mm delta mesh. At a few stations, seines were used in combination with electrofishing gear.

Sampling Effort (1974-86)

Sampling effort for the current survey of fish distribution was based on several criteria we established. First, for each basin surveyed, the number of lakes present was divided into 12 surface area categories from 0-50 acres to >5,001 acres. Similarly the number of streams present was divided into 10 length categories from 0-5 miles to >201 miles. For each size category, a percentage of water bodies to sample was determined. These size groups and percentages are given in Appendix Tables A.1-A.2. Secondly the number of lake stations per 100 acres to sample in each size category was determined, as was the number of stream stations per mile. These station numbers are also given in Appendix Tables A.1-A.2.

Once these decisions were made regarding sampling frequency, sampling locations were determined. Location establishment was based mainly on habitat diversity and secondarily on the distance between stations and on accessibility. The length of a sampling station averaged 80 m for all electrofishing gear except for the boom shocker and

minishocker. Boom shocker and minishocker stations averaged 2.7 km. Areas seined averaged 316 m².

Collections in completed basins were made on 31% of the streams and 8% of the lakes (Append. Tables A.1-A.2, respectively). While these percentages are relatively low, the streams that were sampled composed 73% of the total length of all streams. The sampled lakes composed 59% of the total surface area for all lakes in the basin. This was due to the fact that most streams and lakes not sampled were small. The average area of all lakes in the completed basins was 41 ha.

Collections between 1974 and 1979 composed 86% of the total for the 1974-86 time period, with 12% between 1980 and 1983. This shows that most sampling occurred in the initial 6 years of the study.

Fish Identification, Enumeration, and Status Listing

The following procedures were used in this study for fish identification and enumeration. During 1974-86, in order to reduce the volume of specimens taken back to the laboratory, larger fish were identified to species in the field and were usually returned to the water. Generally all others were preserved in 10% Formalin for later identification in the laboratory. Identification was made based on the unpublished keys of Dr. George Becker.¹ Questionable specimens were tentatively identified and sent to Dr. Becker at the University of Wisconsin-Stevens Point for verification. A subsample of the stonerollers collected at each station by the Bureau of Research was keyed to species; the remainder was recorded as stonerollers (*Campostoma* spp.). Fish Distribution Study personnel identified all fish collected by the Bureau of Research and some by the Bureau of Fisheries Management for the 1974-86 period. Identification of all other fish collected during this period was based on the collectors' identification. For the 1900-72 period, all species records were based upon the collectors' identification.

Because of the difficulty of correctly identifying certain species and because of variation in the taxonomic expertise of all collectors, collections were coded into 2 categories. One category was for collectors whose identification we accepted and the other was for those whose identification we were uncertain about. DNR collections not identified by Fish Distribution Study personnel were put into the uncertain category. Category determination was made once and was applied to all species taken by a given collector and not individually for each species. The category designation for all non-DNR collectors is shown at the end of Appendix Table B.1.

The common and scientific names of fish species cited in this report (Table 5) follow names established by the American Fisheries Society's Committee on Names of Fishes (Robins et al. 1980) except for rainbow trout (Kendall 1989). All hybrids and specimens not keyed to species are not included in this report.

¹These keys were later updated and published by Becker (1983) in his comprehensive work, *Fishes of Wisconsin*. However, this updating had no effect on the identifications made using the unpublished keys.

Table 1. Geographic area of inland basins in Wisconsin and geographic area of basins not completely sampled by Fish Distribution Study personnel, with percent of total area in parenthesis.*

Basin No. and Name	Area (km ²)	
	Total	Not Sampled
2 Mississippi River (floodplain)	unknown	unknown
10 Root River	679	0
20 Milwaukee River	2,340	0
30 Sheboygan River	1,769	0
40 Manitowoc River	1,427	0
50 Twin River	951	0
60 Kewaunee River	355	355 (100)
70 Door Peninsula drainage	377	377 (100)
80** Fox River	16,395	13,116 (80)
90 Suamico River	799	799 (100)
100 Pensaukee River	376	376 (100)
110 Oconto River	1,997	1,997 (100)
120 Peshtigo River	2,849	2,849 (100)
130 Menominee River	10,541	10,541 (100)
200 Des Plaines River	332	0
210 Fox River	2,440	0
220 ^a Greater Rock River	14,452	0
230 Grant & Platte rivers	2,525	0
240 Wisconsin River	31,080	24,291 (78)
250 Coon & Bad Axe rivers	1,582	0
260 La Crosse River	1,264	0
270 Black River	6,188	0
280 Trempealeau River	1,888	0
290 Buffalo River	1,665	0
300 Chippewa River	25,301	17,928 (71)
310 St. Croix River	11,417	0
400 Lake Superior drainage	<u>8,057</u>	<u>1,612 (20)</u>
Total	149,046	74,241 (50)

*Excludes the 3 basins that are part of Wisconsin's major basins but lie outside of its geographic area: 1 Lake Michigan (proper), 3 Lake Superior (proper), and 5 Green Bay (proper).

**Includes sub-basins 81 and 82.

^aIncludes sub-basins 221, 222, and 223.

At each station, the number of specimens for each species was counted up to 98 and recorded on Form 8100-46 (Append. Fig. C.1). However, at many stations there were more than 98 specimens taken for certain species. For these species, the number of specimens was recorded as 99. Therefore the numbers of specimens recorded in the tables in Appendix F are, for some species, substantially lower than the number actually captured. Furthermore there were as many as 495 stations (lake and stream stations combined) for a given species at which the number taken was unknown, further underestimating the total number of specimens. For these reasons, the numbers of specimens listed in Appendix F are rounded to 2 significant figures for each species.

Evaluation of each species' statewide population status followed designations of rare species by the DNR's Bureau of Endangered Resources. These designations consist of official lists of endangered and threatened species and an unofficial list of watch species. Endangered and threatened species are defined by law (Sec. 29.415(2) as amended

by Chaps. 110 and 355, Laws of 1979) and watch species are defined by the Bureau of Endangered Resources. These 3 definitions are as follows:

- (1) **Endangered:** Any species whose continued existence as a viable component of the state's wild animals . . . is determined by the department to be in jeopardy on the basis of scientific evidence.
- (2) **Threatened:** Any species of wild animals . . . which appears likely, within the foreseeable future, on the basis of scientific evidence to become endangered.
- (3) **Watch:** Any species for which a population problem is suspected but not known. These species will be under special observation to identify conditions that could cause further decline or any factors that could help to insure their survival in the state.

In order to assist readers in recognizing these uncommon species, photos or drawings of them are included in Appendix E, along with the habitat preference of each species.

Table 2. Number of streams and lakes sampled* and the number of stations sampled** in each basin for the 2 time periods. Numbers of Fish Distribution Study personnel collections are shown in parenthesis. Totals are broken down by completed and uncompleted basins.

Basin	Streams						Lakes					
	1900-72		1974-86				1900-72		1974-86			
	No. Streams	No. Stations	No. Streams	No. Stations	No. Streams	No. Stations	No. Lakes	No. Stations	No. Lakes	No. Stations	No. Lakes	No. Stations
2 ^a	15	54	27	(23)	195	(132)	8	14	18	(10)	56	(46)
10	12	31	29	(27)	78	(55)	1	1	8	(0)	8	(0)
20	15	66	64	(56)	285	(126)	16	16	48	(24)	65	(31)
30	15	27	54	(53)	207	(107)	16	16	21	(5)	21	(5)
40	8	17	31	(30)	119	(73)	9	9	8	(3)	8	(3)
50	6	12	23	(23)	49	(40)	4	4	1	(0)	1	(0)
60 ^a	2	7	0	(0)	0	(0)	0	0	0	(0)	0	(0)
70 ^a	9	13	2	(0)	2	(0)	4	4	1	(0)	1	(0)
81 ^a	49	86	37	(18)	101	(22)	17	59	10	(0)	39	(1)
82 ^a	92	189	238	(112)	636	(275)	39	69	29	(8)	45	(15)
90 ^a	6	8	7	(7)	18	(9)	0	0	0	(0)	0	(0)
100 ^a	1	1	4	(3)	29	(5)	0	0	0	(0)	0	(0)
110 ^a	11	15	24	(8)	67	(10)	8	8	25	(0)	26	(0)
120 ^a	19	30	79	(3)	298	(4)	10	10	18	(0)	22	(0)
130 ^a	98	233	78	(0)	294	(0)	25	29	34	(0)	35	(0)
200	4	7	17	(13)	48	(30)	5	5	12	(9)	12	(9)
210	27	75	65	(60)	173	(131)	35	51	51	(48)	174	(134)
221	57	158	171	(156)	521	(394)	25	50	73	(46)	337	(246)
222	28	58	66	(64)	174	(163)	5	5	6	(4)	7	(5)
223	35	60	116	(111)	230	(204)	3	3	3	(2)	8	(7)
230	49	96	99	(98)	194	(177)	0	0	0	(0)	0	(0)
240 ^a	184	405	329	(165)	993	(290)	69	93	87	(4)	94	(4)
250	26	86	69	(39)	226	(64)	1	1	0	(0)	0	(0)
260	21	78	63	(42)	177	(72)	2	2	2	(1)	9	(8)
270	72	261	147	(127)	414	(303)	13	13	11	(2)	16	(3)
280	30	120	122	(109)	382	(229)	0	0	3	(0)	3	(0)
290	24	99	91	(69)	218	(102)	2	2	4	(0)	4	(0)
300 ^a	88	207	292	(227)	747	(430)	48	58	154	(52)	352	(222)
310	117	315	192	(171)	622	(437)	144	145	221	(154)	578	(467)
400 ^a	<u>49</u>	<u>86</u>	<u>142</u>	<u>(130)</u>	<u>242</u>	<u>(193)</u>	<u>14</u>	<u>13</u>	<u>52</u>	<u>(34)</u>	<u>59</u>	<u>(36)</u>
Total	1,169	2,900	2,678	(1,944)	7,739	(4,077)	523	680	900	(406)	1,980	(1,242)
Basins not completed	623	1,334	1,259	(696)	3,622	(1,370)	242	357	428	(109)	729	(324)
Basins completed	546	1,566	1,419	(1,248)	4,117	(2,707)	281	323	472	(297)	1,251	(918)

*Includes all sampling or collections in each basin. Therefore, numbers are different than those in Appendix Tables A.1-A.4 which summarize only sampling by Fish Distribution Study personnel.

**Excludes 55 stations from the early period and 122 stations from the later period whose water type is either unknown or a mixture of stream and lake environments.

^aBasins not completely sampled by Fish Distribution Study personnel.

Table 3. Number of stations sampled in each basin by decade for the early period, 1900-72. Percent of total stations sampled is shown in parenthesis for each decade.*

Basin	1900-09	1910-19	1920-29	1930-39	1940-49	1950-59	1960-69	1970-72	Total
2	8	8	14	-	23	5	27	1	86
10	7	-	11	-	-	3	3	8	32
20	10	4	25	-	2	-	27	14	82
30	9	-	2	-	-	2	31	2	46
40	3	-	-	-	-	1	21	1	26
50	1	-	-	-	-	3	10	2	16
60	2	-	-	-	-	-	5	-	7
70	7	-	-	-	-	-	10	-	17
81	6	-	67	22	-	1	38	11	145
82	6	-	51	4	2	29	138	31	261
90	1	-	4	-	-	-	3	-	8
100	-	-	1	-	-	-	-	-	1
110	-	-	14	3	1	-	4	1	23
120	1	-	19	7	-	-	12	1	40
130	7	-	31	5	-	5	104	111	263
200	1	-	1	-	1	-	6	3	12
210	20	-	8	-	1	15	65	19	128
221	35	15	32	-	1	-	48	82	213
222	9	-	6	-	-	-	50	2	67
223	8	-	19	-	-	-	36	-	63
230	4	-	19	-	-	6	64	3	96
240	33	-	124	6	-	31	272	40	506
250	1	-	8	-	-	26	43	9	87
260	2	-	3	1	1	5	57	11	80
270	4	-	31	2	1	-	186	52	276
280	3	-	4	-	-	6	90	18	121
290	-	-	7	-	-	-	66	31	104
300	19	2	55	11	-	1	75	104	267
310	19	-	52	2	4	21	302	62	462
400	<u>31</u>	-	<u>12</u>	-	-	-	<u>38</u>	<u>19</u>	<u>100</u>
Total	257 (7)	29 (1)	620 (17)	63 (2)	37 (1)	160 (4)	1,831 (50)	638 (18)	3,635

*Includes the 55 stations from the early period whose water type is either unknown or a mixture of stream and lake environments; therefore numbers do not agree with those in Table 2.

Data Handling

Data collected at the sampling stations during the current survey of fish distribution were recorded in pencil on Form 8100-46 (Append. Fig. C.1) and included station and species information and ecological data. This form was made of polyethylene paper, which is virtually unaffected by salt and fresh water, and is resistant to tearing, discoloration, and rotting. After all fish were identified in the laboratory and exact location was determined, all information was coded and transferred onto Form 8100-58 (Append. Fig. C.2) for data entry into the Master Fish File. This latter form was also used for transcription and coding of historical records of fish distribution.

The data for each collection were entered into 2 computer files. Sample location data were entered into the Master Stream and Lake File, which used a system of

water mileages to assign a specific location to most streams and lakes in Wisconsin.² Specific stream and fish data for each collection were entered into the Master Fish File. Examples of pages from computer print-outs of these 2 computer files are shown in Appendix Figures C.3-C.5. A detailed explanation of the data storage system as exemplified in these figures is presented in Fago (1988), which is a revision of Fago (1984b).

In order to organize, store, and retrieve data from over 17,500 collections in this computerized data base dating from 1900, Cobol and Mark IV computer programs were developed through a cooperative effort with the DNR's Bureau of Information Management. Some of the programs were used to update the Master Fish File and others were used to help in the analysis of the data. These analyses permitted customized computer print-outs of specific portions of the total data base.

²Limits on time and funding prevented all of the state's water bodies from being incorporated into this system; as a result, small water bodies were excluded.

Table 4. Number of stations sampled in each basin by year for the late period, 1974-86. Numbers of Fish Distribution Study personnel collections are shown in parenthesis.*

Basin	1973**	1974	1975	1976	1977	1978	1979
2	-	13	4	83 (82)	7 (3)	19 (6)	105 (87)
10	-	2	24 (23)	17	1	7 (7)	25 (25)
20	45 (28)	6	43 (23)	35	33	87 (93)	17 (15)
30	-	24	8	61	13	44 (46)	26 (14)
40	-	10	2	-	27	2	56 (49)
50	-	4	1	1	-	-	6 (6)
60	-	-	-	-	-	-	-
70	-	2	1	-	-	-	-
81	-	12	8 (5)	7	48	47	4 (2)
82	-	111 (1)	37	114	80	31	277 (262)
90	-	-	19 (9)	-	-	-	-
100	-	-	28 (5)	1	-	-	-
110	-	12	14 (10)	29	18	12	5
120	-	116	50 (4)	23	30	24	28
130	-	61	145	45	9	44	22
200	-	10	1	4 (4)	-	1 (1)	33 (34)
210	-	7	19	9	20	250 (235)	29 (28)
221	-	185 (169)	389 (310)	167 (143)	49 (3)	24	23 (16)
222	-	156 (153)	6 (3)	6	1	-	8 (8)
223	-	10	4	213 (210)	-	-	8
230	-	1	3	8 (1)	-	174 (172)	7 (5)
240	-	78 (1)	149	163 (4)	211 (43)	96 (19)	294 (214)
250	-	67	47	43	10	-	4 (4)
260	-	79	3	14	8	4	-
270	-	13 (1)	32 (1)	42 (1)	262 (238)	57 (52)	23 (15)
280	-	4	13	45	22	25	277 (230)
290	-	14	40	31	10	12	16
300	-	58 (7)	248 (200)	336 (220)	64 (23)	83 (6)	251 (199)
310	-	13	27	129 (94)	294 (194)	172 (143)	277 (236)
400	-	<u>1</u>	<u>141 (120)</u>	<u>7</u>	<u>4</u>	<u>24 (3)</u>	<u>16</u>
Total	45 (28)	1,069 (332)	1,506 (713)	1,633 (759)	1,221 (504)	1,239 (783)	1,837 (1,449)

One type of analysis used a Cobol program to organize the data by species and to create a species listing that showed all stations for each species. This listing, based on the water mileage system developed for this study, was organized in 2 ways (Fig. 2):

- (1) The first method involved listing all stations on a main river until the first tributary was reached then changing direction to list stations on that tributary (Fig. 2a). When a tributary to the tributary was reached, direction changed again to list stations on that new tributary. At the end of each tributary, listing resumed at the previous confluence until the original river was reached again. At that point, listing on the original river resumed until the second tributary was reached then listing changed and the above sequence was repeated within the basin of the second tributary.
- (2) The second method involved listing all stations on the original river then returning to the first tributary and listing all stations on it (Fig. 2b). When a tributary to the tributary was reached, listing continued on the original tributary.

The program for both of these methods could be restricted to one or more of the following criteria: particular minor basins, a sub-basin or part of a sub-basin, a 7-digit water body identification code or range of codes, individual collectors, dates, township and range (by entire township or contiguous townships), counties, water types, and selected species. At each station, the stream name along with water type and water body identification code, number of fish taken, collector, gear, effort, date, township description, and county were listed. An example of the Cobol listing for one species is shown in Appendix Figure C.6. At the end of each species listing, the total number of stations, total number of specimens, average number of fish per station, and number of stations for each collector was computed. At the end of the print-out, a summary table was given that listed each species, the number of stations at which it was taken, percent of total stations possible, total number of species occurrences, totals for each collector, and totals for number of species and hybrids (Append. Fig. C.7).

Another type of data analysis used a Mark IV program to organize the data by stations and to create lists for each

Table 4. Continued.

Basin	1980	1981	1982	1983	1984	1985	1986	Total
2	33 (14)	8 -	2 (1)	- -	2 -	1 -	- -	277 (193)
10	- -	7 -	1 -	1 -	- -	1 -	- -	86 (55)
20	1 -	13 -	- -	1 -	49 -	19 -	4 -	353 (159)
30	47 (47)	2 -	5 (5)	- -	- -	- -	- -	230 (112)
40	25 (26)	- -	6 (2)	- -	- -	- -	- -	128 (77)
50	27 (24)	- -	- -	11 (10)	- -	- -	- -	50 (40)
60	- -	- -	- -	- -	- -	- -	- -	- -
70	- -	- -	- -	- -	- -	- -	- -	3 -
81	15 (15)	1 (1)	- -	- -	- -	4 -	- -	146 (23)
82	3 -	27 (26)	1 (1)	- -	- -	- -	- -	681 (290)
90	- -	- -	- -	- -	- -	- -	- -	19 (9)
100	- -	- -	- -	- -	- -	- -	- -	29 (5)
110	2 -	1 -	- -	- -	- -	- -	- -	93 (10)
120	49 -	- -	- -	- -	- -	- -	- -	320 (4)
130	3 -	- -	- -	- -	- -	- -	- -	329 -
200	11 -	- -	- -	- -	- -	- -	- -	60 (39)
210	27 (21)	5 -	1 -	- -	- -	- -	- -	367 (284)
221	8 -	18 -	- -	1 -	1 -	2 -	16 (16)	883 (657)
222	- -	- -	- -	- -	- -	- -	7 (7)	184 (171)
223	1 -	- -	1 -	- -	- -	- -	1 (1)	238 (211)
230	- -	1 -	2 -	- -	- -	- -	- -	196 (178)
240	95 (15)	4 -	2 -	- -	2 -	- -	- -	1,094 (296)
250	59 (63)	- -	- -	- -	- -	- -	- -	230 (67)
260	54 (56)	- -	25 (25)	- -	- -	- -	- -	187 (81)
270	4 -	1 -	- -	- -	- -	- -	- -	434 (308)
280	- -	- -	- -	- -	- -	- -	- -	386 (230)
290	72 (74)	- -	28 (29)	- -	- -	- -	- -	223 (103)
300	38 (1)	19 -	7 (1)	2 -	- -	3 -	- -	1,109 (657)
310	52 (27)	11 -	28 (26)	199 (188)	1 -	1 -	- -	1,204 (908)
400	<u>106 (106)</u>	<u>1 -</u>	<u>- -</u>	<u>1 -</u>	<u>- -</u>	<u>- -</u>	<u>- -</u>	<u>301 (229)</u>
Total	732 (489)	119 (27)	109 (90)	216 (198)	55 (-)	31 (-)	28 (24)	9,840 (5,396)

*Includes the 122 stations from the late period whose water type is either unknown or a mixture of stream and lake environments; therefore numbers do not agree with those in Table 2.

**The late period, 1947-86, also includes a single small survey from 1973, the year before the Fish Distribution Study began.

station of all of the information collected (such as the number of specimens of each species and the total number of species, hybrids, and unspecified categories). The program could be restricted to the same criteria cited above for the Cobol program, and the listing could be organized the same 2 ways (Fig. 2). However, only the Mark IV listing could be restricted to gear or to any of the 10 ecological variables recorded for each station. These variables consisted of stream width, stream depth, velocity, water temperature, conductivity, turbidity, pH, bottom type, aquatic vegetation type, and stream bank vegetation type. In addition, the Mark IV program could be organized in still different ways, including: (1) by county and then alphabetically by name of stream or lake, (2) by county and then by basin, or (3) by township, range, and section. Two examples of the Mark IV listing are shown in Appendix Figures C.4 and C.5. The first figure shows the 3-digit alphanumeric code for each fish species collected at that station. The second gives the common name of the species

instead of the 3-digit code. These print-outs in Appendix C illustrate only the most commonly used or requested summaries. Dozens of other combinations and print-outs are possible.

In addition to the programs used to create specialized print-outs for users, other programs were used to generate distribution maps for each species (Append. G). Programs were written in SAS to plot these maps using computers at the Hill Farms Regional Computing Center and a Zeta 8-pen plotter.

In designing these maps, we first digitized the state outline and basin boundaries using the Wisconsin Transverse Mercator coordinate system. We then converted the township descriptions of all collections to the same system so they could be mapped. However, since space did not permit all stations to be clearly shown, the computer program was changed to allow only 1 station per section of a township to be plotted for each species.

Table 5. List of family, common, and scientific names of all fish species cited in this report.

Computer No.	Common Name	Scientific Name
	Lampreys	Petromyzontidae
A02	Chestnut lamprey	<i>Ichthyomyzon castaneus</i>
A03	Northern brook lamprey	<i>Ichthyomyzon fossor</i>
A04	Silver lamprey	<i>Ichthyomyzon unicuspis</i>
A05	American brook lamprey	<i>Lampetra appendix</i>
A06	Sea lamprey	<i>Petromyzon marinus</i>
	Sturgeons	Acipenseridae
B01	Lake sturgeon	<i>Acipenser fulvescens</i>
B02	Shovelnose sturgeon	<i>Scaphirhynchus platorynchus</i>
	Paddlefishes	Polyodontidae
C01	Paddlefish	<i>Polyodon spathula</i>
	Gars	Lepisosteidae
D01	Longnose gar	<i>Lepisosteus osseus</i>
D02	Shortnose gar	<i>Lepisosteus platostomus</i>
	Bowfins	Amiidae
E01	Bowfin	<i>Amia calva</i>
	Freshwater eels	Anguillidae
F01	American eel	<i>Anguilla rostrata</i>
	Herrings	Clupeidae
G01	Alewife	<i>Alosa pseudoharengus</i>
G02	Gizzard shad	<i>Dorosoma cepedianum</i>
G03	Skipjack herring	<i>Alosa chrysochloris</i>
	Mooneyes	Hiodontidae
H01	Goldeye	<i>Hiodon alosoides</i>
H02	Mooneye	<i>Hiodon tergisus</i>
	Trouts	Salmonidae
I04	Cisco or lake herring	<i>Coregonus artedii</i>
I05	Lake whitefish	<i>Coregonus clupeaformis</i>
I12	Pink salmon	<i>Oncorhynchus gorbusha</i>
I14	Coho salmon	<i>Oncorhynchus kisutch</i>
I15	Kokanee (sockeye) salmon	<i>Oncorhynchus nerka</i>
I16	Chinook salmon	<i>Oncorhynchus tshawytscha</i>
I19	Rainbow trout	<i>Oncorhynchus mykiss</i> *
I21	Brown trout	<i>Salmo trutta</i>
I22	Brook trout	<i>Salvelinus fontinalis</i>
I23	Lake trout	<i>Salvelinus namaycush</i>
	Smelts	Osmeridae
J01	Rainbow smelt	<i>Osmerus mordax</i>
	Mudminnows	Umbridae
K01	Central mudminnow	<i>Umbra limi</i>
	Pikes	Esocidae
L01	Grass pickerel	<i>Esox americanus vermiculatus</i>
L02	Northern pike	<i>Esox lucius</i>
L03	Muskellunge	<i>Esox masquinongy</i>
	Carp and minnows	Cyprinidae
M06	Central stoneroller	<i>Campostoma anomalum</i>
M07	Largescale stoneroller	<i>Campostoma oligolepis</i>

Table 5. Continued.

Computer No.	Common Name	Scientific Name
	Carps and minnows (<i>continued</i>)	Cyprinidae
M08	Goldfish	<i>Carassius auratus</i>
M09	Redside dace	<i>Clinostomus elongatus</i>
M10	Lake chub	<i>Couesius plumbeus</i>
M11	Grass carp	<i>Ctenopharyngodon idella</i>
M12	Common carp	<i>Cyprinus carpio</i>
M14	Brassy minnow	<i>Hybognathus hankinsoni</i>
M15	Mississippi silvery minnow	<i>Hybognathus nuchalis</i>
M16	Speckled chub	<i>Hybopsis aestivalis</i>
M17	Silver chub	<i>Hybopsis storeriana</i>
M18	Gravel chub	<i>Hybopsis x-punctata</i>
M19	Hornyhead chub	<i>Nocomis biguttatus</i>
M20	Golden shiner	<i>Notemigonus crysoleucas</i>
M21	Pallid shiner	<i>Notropis amnis</i>
M22	Pugnose shiner	<i>Notropis anogenus</i>
M23	Emerald shiner	<i>Notropis atherinoides</i>
M24	River shiner	<i>Notropis blennius</i>
M25	Ghost shiner	<i>Notropis buchanani</i>
M27	Striped shiner	<i>Notropis chrysocephalus</i>
M28	Common shiner	<i>Notropis cornutus</i>
M29	Bigmouth shiner	<i>Notropis dorsalis</i>
M30	Pugnose minnow	<i>Notropis emiliae</i>
M31	Blackchin shiner	<i>Notropis heterodon</i>
M32	Blacknose shiner	<i>Notropis heterolepis</i>
M33	Spottail shiner	<i>Notropis hudsonius</i>
M34	Ozark minnow	<i>Notropis nubilus</i>
M35	Rosyface shiner	<i>Notropis rubellus</i>
M36	Spotfin shiner	<i>Notropis spilopterus</i>
M37	Sand shiner	<i>Notropis stramineus</i>
M38	Weed shiner	<i>Notropis texanus</i>
M39	Redfin shiner	<i>Notropis umbratilis</i>
M40	Mimic shiner	<i>Notropis volucellus</i>
M41	Suckermouth minnow	<i>Phenacobius mirabilis</i>
M42	Northern redbelly dace	<i>Phoxinus eos</i>
M43	Southern redbelly dace	<i>Phoxinus erythrogaster</i>
M44	Finescale dace	<i>Phoxinus neogaeus</i>
M45	Bluntnose minnow	<i>Pimephales notatus</i>
M46	Fathead minnow	<i>Pimephales promelas</i>
M47	Bullhead minnow	<i>Pimephales vigilax</i>
M48	Blacknose dace	<i>Rhinichthys atratulus</i>
M49	Longnose dace	<i>Rhinichthys cataractae</i>
M50	Creek chub	<i>Semotilus atromaculatus</i>
M51	Pearl dace	<i>Semotilus margarita</i>
M52	Red shiner	<i>Notropis lutrensis</i>
	Suckers	Catostomidae
N05	River carpsucker	<i>Carpionodes carpio</i>
N06	Quillback	<i>Carpionodes cyprinus</i>
N07	Highfin carpsucker	<i>Carpionodes velifer</i>
N08	Longnose sucker	<i>Catostomus catostomus</i>
N09	White sucker	<i>Catostomus commersoni</i>
N10	Blue sucker	<i>Cycleptus elongatus</i>
N11	Creek chubsucker	<i>Erimyzon oblongus</i>
N12	Lake chubsucker	<i>Erimyzon sucetta</i>
N13	Northern hog sucker	<i>Hypentelium nigricans</i>

Table 5. Continued.

Computer No.	Common Name	Scientific Name
	Suckers (<i>continued</i>)	Catostomidae
N14	Smallmouth buffalo	<i>Ictiobus bubalus</i>
N15	Bigmouth buffalo	<i>Ictiobus cyprinellus</i>
N16	Black buffalo	<i>Ictiobus niger</i>
N17	Spotted sucker	<i>Minytrema melanops</i>
N18	Silver redhorse	<i>Moxostoma anisurum</i>
N19	River redhorse	<i>Moxostoma carinatum</i>
N21	Golden redhorse	<i>Moxostoma erythrurum</i>
N22	Shorthead redhorse	<i>Moxostoma macrolepidotum</i>
N23	Greater redhorse	<i>Moxostoma valenciennesi</i>
	Bullhead catfishes	Ictaluridae
O05	Black bullhead	<i>Ictalurus melas</i>
O06	Yellow bullhead	<i>Ictalurus natalis</i>
O07	Brown bullhead	<i>Ictalurus nebulosus</i>
O08	Channel catfish	<i>Ictalurus punctatus</i>
O09	Slender madtom	<i>Noturus exilis</i>
O10	Stonecat	<i>Noturus flavus</i>
O11	Tadpole madtom	<i>Noturus gyrinus</i>
O12	Flathead catfish	<i>Pylodictis olivaris</i>
	Pirate perches	Aphredoderidae
P01	Pirate perch	<i>Aphredoderus sayanus</i>
	Trout-perches	Percopsidae
Q01	Trout-perch	<i>Percopsis omiscomaycus</i>
	Codfishes	Gadidae
R01	Burbot	<i>Lota lota</i>
	Killifishes	Cyprinodontidae
S01	Banded killifish	<i>Fundulus diaphanus</i>
S02	Blackstripe topminnow	<i>Fundulus notatus</i>
S03	Starhead topminnow	<i>Fundulus notti</i>
	Silversides	Atherinidae
T01	Brook silverside	<i>Labidesthes sicculus</i>
	Sticklebacks	Gasterosteidae
U01	Brook stickleback	<i>Culaea inconstans</i>
U02	Ninespine stickleback	<i>Pungitius pungitius</i>
	Temperate basses	Percichthyidae
V01	White bass	<i>Morone chrysops</i>
V02	Yellow bass	<i>Morone mississippiensis</i>
	Sunfishes	Centrarchidae
W04	Rock bass	<i>Ambloplites rupestris</i>
W05	Green sunfish	<i>Lepomis cyanellus</i>
W06	Pumpkinseed	<i>Lepomis gibbosus</i>
W07	Warmouth	<i>Lepomis gulosus</i>
W08	Orangespotted sunfish	<i>Lepomis humilis</i>
W09	Bluegill	<i>Lepomis macrochirus</i>
W10	Longear sunfish	<i>Lepomis megalotis</i>
W11	Smallmouth bass	<i>Micropterus dolomieu</i>
W12	Largemouth bass	<i>Micropterus salmoides</i>

Table 5. Continued.

Computer No.	Common Name	Scientific Name
	Sunfishes (<i>continued</i>)	Centrarchidae
W13	White crappie	<i>Pomoxis annularis</i>
W14	Black crappie	<i>Pomoxis nigromaculatus</i>
	Perches	Percidae
X03	Crystal darter	<i>Ammocrypta asprella</i>
X04	Western sand darter	<i>Ammocrypta clara</i>
X05	Mud darter	<i>Etheostoma asprigene</i>
X07	Rainbow darter	<i>Etheostoma caeruleum</i>
X08	Bluntnose darter	<i>Etheostoma chlorosomum</i>
X09	Iowa darter	<i>Etheostoma exile</i>
X10	Fantail darter	<i>Etheostoma flabellare</i>
X11	Least darter	<i>Etheostoma microperca</i>
X12	Johnny darter	<i>Etheostoma nigrum</i>
X14	Banded darter	<i>Etheostoma zonale</i>
X15	Yellow perch	<i>Perca flavescens</i>
X16	Logperch	<i>Percina caprodes</i>
X17	Gilt darter	<i>Percina evides</i>
X18	Blackside darter	<i>Percina maculata</i>
X19	Slenderhead darter	<i>Percina phoxocephala</i>
X20	River darter	<i>Percina shumardi</i>
X21	Sauger	<i>Stizostedion canadense</i>
X22	Walleye	<i>Stizostedion vitreum vitreum</i>
	Drums	Sciaenidae
Y01	Freshwater drum	<i>Aplodinotus grunniens</i>
	Sculpins	Cottidae
Z01	Mottled sculpin	<i>Cottus bairdi</i>
Z02	Slimy sculpin	<i>Cottus cognatus</i>

* Previously classified as *Salmo gairdneri*.



This unusually dark specimen of a channel catfish was taken from the lower Trempealeau River with a boom shocker.



This fine walleye was taken with a boom shocker in the lower Buffalo River.



This shovelnose sturgeon was taken in the Red Cedar River.



Muskellunge taken from the lower Black River.

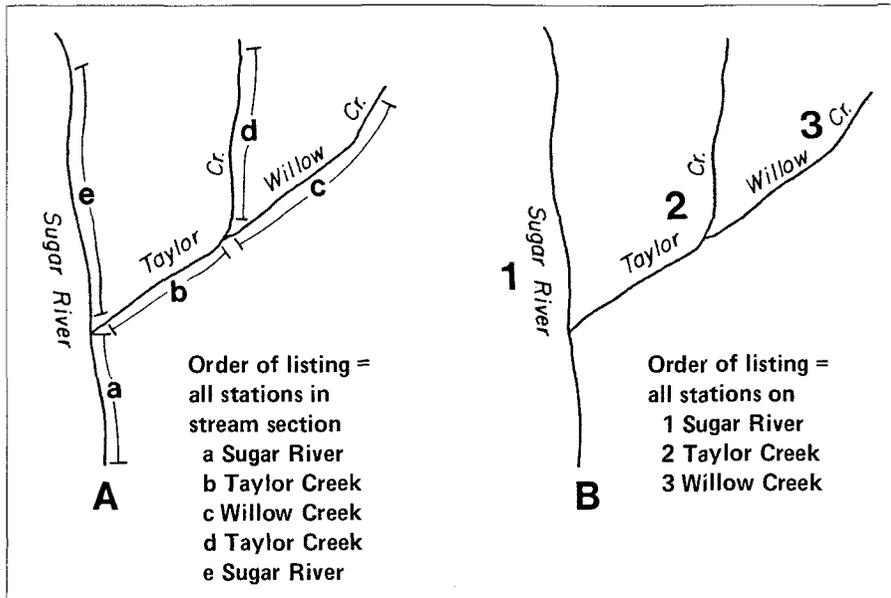
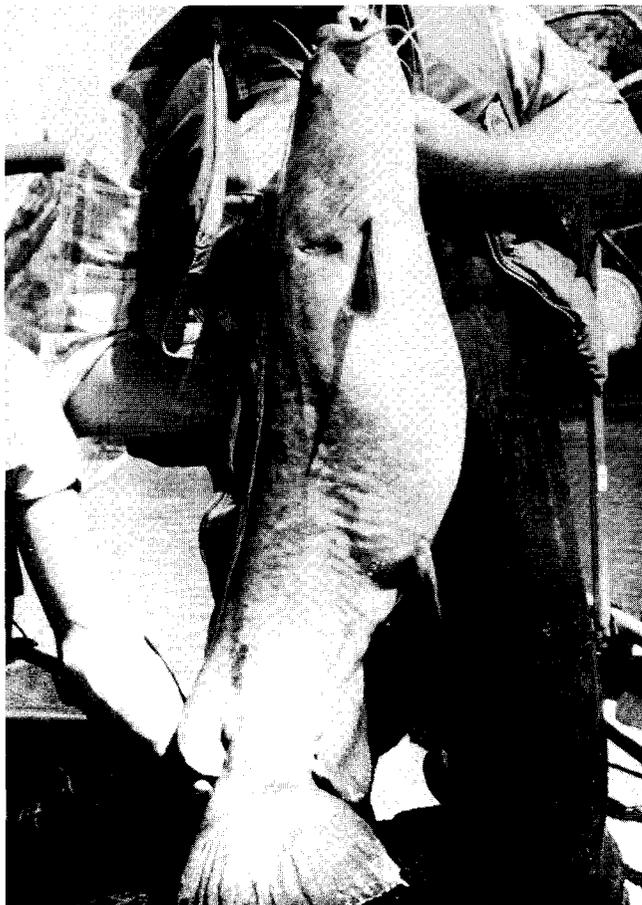


Figure 2. Two methods of organizing stations on computer print-outs.



This large flathead catfish was taken from the lower Buffalo River with a boom shocker.

Once this decision was made regarding station mapping, symbols were assigned to reflect the certainty of species identifications. Triangles were used for collections by collectors whose identification we accepted, and circles were used for collections by collectors whose identification we were uncertain about. Two maps were then created for each species, one summarizing distribution records for 1900-72 (labelled early maps) and the other summarizing distribution for 1974-86 (labelled late maps). Since the maps were computer generated, they show only station locations.

Map captions give actual numbers of collections for each species. These numbers are grouped in 2 ways. The first version divides the total into the number of collections represented by triangles and

the number represented by circles. The second version divides the total into the number of collections made by DNR personnel and the number made by others. For each of these 4 categories, the number of collections on each map is the first number shown, and the number of collections that were not mapped is given in parentheses.

To assist interpretation of these computer-generated maps, a separate base map was prepared showing the major streams and lakes in Wisconsin. This map was created by obtaining from the U. S. Geological Survey a Wisconsin base map at a scale of 1:2,000,000. This negative—identified as “from National Atlas, 1971”—was printed and a positive obtained. Corrections were then made to some streams and lakes to conform their positions to those on the 7.5-minute series of U. S. Geological Survey topographic maps. Names of some of the major rivers that were not originally on the map were also added. After all revisions were made, the map was reduced to the size of the computer-generated distribution maps. This base map was then printed as a clear acetate overlay, and 2 copies are bound in at the end of this report with a perforated edge for easy tear-out. This overlay was designed to be used with each map in Appendix G.

RESULTS AND DISCUSSION

Findings are presented followed by a discussion of some of the more interesting species including those on the Wisconsin lists of endangered, threatened, and watch species. Unless otherwise indicated, findings refer only to the 1974-86 period.

Species Found

Over 1.6 million specimens representing 141 species were collected (Table 6). These include all 8 of the endangered, all 6 of the threatened species, and 16 of the 21 watch species.³ Of the 141 species, 140 are known to have reproducing populations in the inland waters of Wisconsin. Distribution maps for these 140 species are presented in Appendix G. Distribution maps are also included for 1 nonreproducing species—the American eel. Although known to spawn in the Sargasso Sea, female American eels spend much of their life in Wisconsin. Thus their distribution was mapped, and records about this species are included in some tables in this report.

In addition to the 141 species for which detailed collection records and distribution maps are given, 2 other species were taken during the course of this study. These species—the grass carp and kokanee (sockeye) salmon were taken only incidentally. They are believed to not have reproducing populations in Wisconsin and therefore were excluded from all tables and maps in this report. Their presence is only considered in the total (143) number of species collected.

Stream vs. Lake Habitat

Of all stations sampled in the inland waters of Wisconsin, the majority could be classified as to whether they were found in stream or lake habitat. However, 55 stations from the early period and 122 from the later one could not be so classified. Their water type was unknown or was a mixture of stream and lake environments. Of the remainder, 80% were in a stream environment and 20% in a lake environment (81% and 19%, respectively, for the early period) (Table 2). Of the 141 species (includes American eel) collected in the inland waters of Wisconsin, 122 occurred in streams at least 50% of the time (Table 7); 75 of these 122 occurred in streams at least 90% of the time. Of the 19 species collected at least 50% of the time in a lake environment, only 3 were taken 90% or more of the time in a lake. These percentages are based on the total number of stations at which a particular species was taken. An example is the chestnut lamprey that was taken at a total of 136 stations of which 130 (96%) were in a stream environment and 6 (4%) were in a lake environment.

Common and Rare Species

If one looks only at the 7,739 stations on streams sampled during 1974-86 (Table 2), the 10 most common species (caught at the highest percentage of stream stations) were white sucker (66%), creek chub (54%), Johnny darter (43%), common shiner (35%), blacknose dace (35%), central mudminnow (35%), brook stickleback (34%), brook trout (26%), bluntnose minnow (27%), and fathead minnow (24%) (Append. Table F.1). The 10 most numerous species (most specimens caught) were white sucker (150,000), creek chub (100,000), common shiner (95,000), brook trout (66,000), blacknose dace (59,000), Johnny darter (53,000), bluntnose minnow (47,000), central mudminnow (38,000), brook stickleback (37,000), and mottled sculpin (36,000) (Append. Table F.1). The fathead minnow, the 10th most common species, was the 13th most numerous. Of the 28 rarest stream species, i.e., those caught at less than 0.5% of stream stations (Table 8), all but 4 (alewife, coho salmon, speckled chub, and slender madtom) were also represented by the smallest total number of specimens (Append. Table F.1).

If one looks only at the 1,980 stations on lakes (including reservoirs) sampled during 1974-86 (Table 2), the 10 most common species (caught at the highest percentage of lake stations) were bluegill (72%), yellow perch (68%), largemouth bass (62%), pumpkinseed (53%), bluntnose minnow (43%), black crappie (35%), northern pike (32%), white sucker (31%), Johnny darter (29%), and golden shiner (28%) (Append. Table F.2). The 10 most numerous species (most specimens caught) were bluegill (55,000), yellow perch (42,000), bluntnose minnow (38,000), largemouth bass (20,000), pumpkinseed (17,000), black crappie (15,000), white sucker (11,000), walleye (10,000), golden shiner (8,700), and black bullhead (7,900) (Append. Table F.2). The northern pike and Johnny darter, which were among the 10 most common species, were the 11th and 15th most numerous. Of the 39 rarest lake species, i.e., those caught at less than 0.5% of lake stations (Table 9), all but 4 (pallid shiner, redbfin shiner, smallmouth buffalo, and river darter) were also represented by the smallest total number of specimens (Append. Table F.2).

If one looks at all stations (9,841) sampled during 1974-86, the 10 most common species (caught at the highest percentage of all stations) were white sucker (58%), creek chub (43%), Johnny darter (40%), common shiner (31%), central mudminnow (30%), bluntnose minnow (30%), blacknose dace (28%), brook stickleback (27%), bluegill (25%), and yellow perch (23%) (Append. Table F.3). The 10 most numerous species (most specimens caught) were white sucker (170,000), common shiner (100,000), creek chub (100,000), bluntnose minnow (86,000), bluegill (73,000),

³Lists of the state's endangered and threatened species were based on a 1982 Wisconsin Administrative Code; the list of watch species was based on one being used by the Bureau of Endangered Resources in 1985. See the Foreword of this report for an explanation of subsequent changes in all 3 lists.

Table 6. Number of stations and percent of total stations at which each species was collected, basins* not collected from in the subsequent or previous period, and percent change in occurrence in the known number of stations at which each species was taken in the inland waters of Wisconsin, 1900-86.

Map No.	Species	1900-72				1974-86				Percent Change in Occurrence**
		No. Stn.	Percent Total	No. Basins	Basins not Found in 1974-86	No. Stn.	Percent Total	No. Basins	Basins not Found in 1900-72	
1	Chestnut lamprey	39	1	6	82 ^a (1) ^b	136	1	8	81,250,270 (3)	250
2	Northern brook lamprey	40	1	8	260,280 (2)	81	1	12	81,120,210,222,290,310 (6)	100
3	Silver lamprey	29	1	8	20,210,400 ^a (3)	58	1	13	130,230,250,260,270,280,290,300 (8)	100
4	American brook lamprey	46	1	9	400 ^a (1)	445	5	18	40,50,110,120,130,210,223,280,290,310 (10)	870
5	Sea lamprey	14	t ^c	2	60 ^a (1)	4	t	3	50,110 (2)	-71
6	Lake sturgeon (W) ^d	31	1	8	400 ^a (1)	34	t	8	110 (1)	10
7	Shovelnose sturgeon	38	1	3	-	42	t	3	-	11
8	Paddlefish (W)	9	t	3	-	14	t	3	-	56
9	Longnose gar	84	2	12	290,400 ^a (2)	151	2	13	223, 230,270 (3)	80
10	Shortnose gar	49	1	7	221,260,310 (3)	85	1	7	230,270,280 (3)	73
11	Bowfin	102	3	13	40,290,400 ^a (3)	222	2	16	100,130,230,250,270,280 (6)	120
12	American eel (W)	23	1	6	20,260 (2)	38	t	9	81,222,240,270,280 (5)	65
13	Alewife	5	t	4	70 ^a (1)	19	t	6	40,50,81 (3)	280
14	Gizzard shad	84	2	10	250,300 ^a (2)	162	2	12	10,50,81,82 (4)	93
15	Skipjack herring	3	t	2	310 (1)	2	t	1	-	-33
16	Goldeye (E)	11	t	2	310 (1)	16	t	4	230,240,300 (3)	45
17	Mooneye	65	2	8	250 (1)	141	1	10	230,270,280 (3)	120
18	Cisco or lake herring (W)	38	1	10	2 ^a ,81 ^a ,130 ^a (3)	31	t	7	-	-18
19	Lake whitefish	6	t	3	81 ^a ,82 ^a (2)	3	t	3	40,400 (2)	-50
20	Pink salmon	-	-	-	-	4	t	4	40,110,120,400 (4)	-
21	Coho salmon	5	t	2	240 ^a ,310 (2)	35	t	7	10,20,30,50,81,120,400 (7)	600
22	Chinook salmon	-	-	-	-	26	t	10	10,20,30,40,50,81,100,110,120,400 (10)	-
23	Rainbow trout	96	3	18	-	259	3	25	50,81,100,222,223,290,300 (7)	170
24	Brown trout	454	12	22	-	1,560	16	25	40,81,120 (3)	240
25	Brook trout	680	19	19	70 ^a ,230 (2)	2,110	21	22	20,40,50,222,223 (5)	210
26	Lake trout	7	t	5	130 ^a ,240 ^a ,300 ^a ,310,400 ^a (5)	1	t	1	210 (1)	-86
27	Rainbow smelt	13	t	1	-	10	t	5	10,50,300,310 (4)	-23
28	Central mudminnow	695	19	28	60 ^a ,70 ^a (2)	2,909	30	28	100,230 (2)	320
29	Grass pickerel	87	2	12	20,70 ^a ,81 ^a ,400 ^a (4)	130	1	10	30,230 (2)	49
30	Northern pike	696	19	27	70 ^a (1)	2,053	21	28	100,230 (2)	190

Table 6. Continued.

Map No.	Species	1900-72				1974-86				Percent Change in Occurrence**
		No. Stn.	Percent Total	No. Basins	Basins not Found in 1974-86	No. Stn.	Percent Total	No. Basins	Basins not Found in 1900-72	
31	Muskellunge	53	1	9	-	165	2	13	2,110,120,210 (4)	210
32	Central stoneroller	303	8	17	50,270 (2)	900	9	19	30,200,290,310 (4)	200
33	Largescale stoneroller	158	4	18	10,60 ^a ,70 ^a ,81 ^a ,222,280 (6)	385	4	15	200,230,400 (3)	140
34	Goldfish	3	t	2	-	57	1	9	20,30,40,50,210,222,223 (7)	1,800
35	Redside dace (W)	69	2	13	10,20,40,60 ^a ,310 (5)	174	2	8	-	150
36	Lake chub	18	1	4	70 ^a (1)	40	t	3	-	120
37	Common carp	461	13	26	60 ^a ,70 ^a (2)	1,291	13	27	100,110,130 (3)	180
38	Brassy minnow	233	6	21	10,40,260 (3)	836	9	22	100,110,120,280 (4)	260
39	Mississippi silvery minnow	112	3	11	210,222,250,290 (4)	77	1	7	-	-31
40	Speckled chub (T)	40	1	3	250 (1)	29	t	4	270,310 (2)	-28
41	Silver chub	53	1	8	280, 310 (2)	78	1	8	222,223 (2)	47
42	Gravel chub (E)	2	t	2	-	41	t	3	223 (1)	2,000
43	Hornyhead chub	551	15	28	10,60 ^a ,290 (3)	1,392	14	26	2 (1)	150
44	Golden shiner	451	12	27	70 ^a (1)	1,245	13	28	100,223 (2)	180
45	Pallid shiner (E)	32	1	6	222,240 ^a ,270,280,310 (5)	26	t	1	-	-19
46	Pugnose shiner (W)	21	1	7	2 ^a ,70 ^a (2)	58	1	8	20,300,400 (3)	180
47	Emerald shiner	325	9	24	60 ^a ,70 ^a ,90 ^a ,200,222 (5)	571	6	22	40,110,260 (3)	76
48	River shiner	124	3	14	40,50,222,290,310 (5)	221	2	12	20,221,223 (3)	78
49	Ghost shiner	8	t	1	2 ^a (1)	-	-	-	-	-100
50	Striped shiner (E)	25	1	4	-	15	t	4	-	-40
51	Common shiner	1,274	35	30	60 ^a ,290 (2)	3,019	31	28	-	140
52	Bigmouth shiner	365	10	18	400 ^a (1)	728	8	18	200 (1)	99
53	Pugnose minnow (W)	59	2	9	290 (1)	127	1	10	81,310 (2)	120
54	Blackchin shiner	82	2	17	250 (1)	290	3	17	90 (1)	250
55	Blacknose shiner	230	6	21	10,90 ^a ,222 (3)	658	7	22	40,50,100,250 (4)	190
56	Spottail shiner	226	6	23	10,60 ^a ,120 ^a (3)	370	4	20	-	64
57	Ozark minnow (T)	15	t	4	-	50	1	4	-	230
58	Rosyface shiner	189	5	23	30,60 ^a ,70 ^a ,81 ^a ,130 ^a (5)	341	3	18	-	80
59	Spotfin shiner	469	13	22	70 ^a ,400 ^a (2)	1,120	11	23	30,110,200 (3)	140
60	Sand shiner	252	7	22	290 (1)	598	6	25	10,30,50,200 (4)	140
61	Weed shiner (W)	95	3	15	81 ^a ,200,210,221,230 (5)	81	1	12	20,260 (2)	-15

Table 6. *Continued.*

Map No.	Species	1900-72				1974-86				Percent Change in Occurrence**
		No. Stn.	Percent Total	No. Basins	Basins not Found in 1974-86	No. Stn.	Percent Total	No. Basins	Basins not Found in 1900-72	
62	Redfin shiner (W)	71	2	15	10,50,81 ^a ,200,210,260,270,280 (8)	27	t	7	-	-62
63	Mimic shiner	150	4	19	70 ^a ,81 ^a ,110 ^a ,130 ^a ,222,223 (6)	377	4	16	30,40,230 (3)	150
64	Suckermouth minnow	127	3	12	300 ^a (1)	177	2	12	82 (1)	39
65	Northern redbelly dace	225	6	20	60 ^a ,70 ^a ,230 (3)	877	9	22	50,100,210,222,310 (5)	290
66	Southern redbelly dace	217	6	21	2 ^a ,60 ^a ,70 ^a ,260,290,400 ^a (6)	600	6	18	90,100,270 (3)	180
67	Finescale dace	63	2	7	81 ^a ,221 (2)	258	3	9	30,120,270,310 (4)	310
68	Bluntnose minnow	1,063	29	30	60 ^a (1)	2,955	30	29	-	180
69	Fathead minnow	470	13	28	60 ^a (1)	2,076	21	29	100,110 (2)	340
70	Bullhead minnow	134	4	11	221,223 (2)	302	3	15	20,82,210,260,300,310 (6)	130
71	Blacknose dace	938	26	29	60 ^a ,70 ^a (2)	2,714	28	27	-	190
72	Longnose dace	520	14	22	70 ^a ,81 ^a (2)	1,312	13	21	10 (1)	150
73	Creek chub	1,610	44	30	60 ^a (1)	4,263	43	29	-	160
74	Pearl dace	271	7	20	60 ^a ,70 ^a (2)	972	10	19	100 (1)	260
75	Red shiner (W)	2	t	1	230 (1)	-	-	-	-	-100
76	River carpsucker	63	2	5	-	76	1	8	20,230,270 (3)	21
77	Quillback	124	3	15	290 (1)	338	4	15	230 (1)	170
78	Highfin carpsucker	26	1	5	290 (1)	85	1	8	230,250,270,310 (4)	230
79	Longnose sucker	20	1	3	50,120 ^a (2)	26	t	2	130 (1)	30
80	White sucker	2,162	59	30	60 ^a (1)	5,740	58	29	-	170
81	Blue sucker (T)	37	1	5	260 (1)	54	1	5	270 (1)	46
82	Creek chubsucker	2	t	1	200 (1)	-	-	-	-	-100
83	Lake chubsucker (W)	50	1	8	2 ^a (1)	98	1	9	10,20 (2)	96
84	Northern hog sucker	389	11	23	10,20,50,90 ^a (4)	838	9	21	30,100 (2)	120
85	Smallmouth buffalo	49	1	7	221,290,310 (3)	82	1	4	-	67
86	Bigmouth buffalo	38	1	7	310 (1)	133	1	10	222,250,270,290 (4)	250
87	Black buffalo (T)	15	t	2	-	11	t	3	223 (1)	-27
88	Spotted sucker	61	2	11	260 (1)	151	2	11	250 (1)	150
89	Silver redhorse	114	3	15	250 (1)	410	4	20	40,50,81,130,210,260(6)	260
90	River redhorse (W)	2	t	2	-	76	1	10	20,82,210,221,222,240,270,300 (8)	3,700
91	Golden redhorse	173	5	20	10,260,290,400 ^a (4)	578	6	19	30,81,250 (3)	230
92	Shorthead redhorse	283	8	19	-	835	8	23	30,100,130,210 (4)	200

Table 6. Continued.

Map No.	Species	1900-72				1974-86				Percent Change in Occurrence**
		No. Stn.	Percent Total	No. Basins	Basins not Found in 1974-86	No. Stn.	Percent Total	No. Basins	Basins not Found in 1900-72	
93	Greater redhorse (W)	17	t	8	2 ^a ,81 ^a ,120 ^a (3)	106	1	10	40,50,100,110,221 (5)	520
94	Black bullhead	413	11	26	-	1,564	16	29	90,100,223 (3)	280
95	Yellow bullhead	243	7	23	70 ^a (1)	793	8	27	50,90,100,250,290 (5)	230
96	Brown bullhead	151	4	25	70 ^a ,90 ^a ,230,260,400 ^a (5)	388	4	21	280 (1)	160
97	Channel catfish	176	5	20	70 ^a ,200,250,400 ^a (4)	317	3	19	20,40,50 (3)	80
98	Slender madtom (E)	7	t	3	210 (1)	28	t	2	-	300
99	Stonecat	141	4	19	-	423	4	22	260,280,290 (3)	200
100	Tadpole madtom	178	5	23	10,70 ^a ,120 ^a ,222 (4)	350	4	22	50,90,260 (3)	97
101	Flathead catfish	53	1	11	81 ^a ,221 (2)	53	1	11	223,270 (2)	0
102	Pirate perch (W)	23	1	5	2 ^a ,82 ^a (2)	25	t	6	270,280,290 (3)	9
103	Trout-perch	67	2	11	10,70 ^a ,90 ^a ,280 (4)	112	1	10	30,40,50 (3)	67
104	Burbot	139	4	11	-	649	7	17	90,100,110,120,260, 290(6)	370
105	Banded killifish	69	2	13	50,60 ^a ,70 ^a ,130 ^a ,222,240 ^a (6)	204	2	9	30,400 (2)	200
106	Blackstripe topminnow	51	1	7	223 (1)	106	1	7	20 (1)	110
107	Starhead topminnow (E)	7	t	3	240 ^a (1)	9	t	3	270 (1)	30
108	Brook silverside	158	4	14	250, 290 (2)	364	4	14	230,260 (2)	130
109	Brook stickleback	719	20	28	2 ^a ,60 ^a ,70 ^a (3)	2,698	27	27	100,200 (2)	280
110	Ninespine stickleback	7	t	3	20,300 ^a ,400 ^a (3)	2	t	2	10,30 (2)	-71
111	White bass	179	5	15	10,250 (2)	280	3	16	50,230,270 (3)	56
112	Yellow bass	51	1	7	40,240 ^a ,250 (3)	73	1	6	200,210 (2)	43
113	Rock bass	519	14	28	70 ^a ,200 (2)	1,394	14	27	100 (1)	170
114	Green sunfish	304	8	24	-	1,240	13	27	90,120,260 (3)	310
115	Pumpkinseed	692	19	28	70 ^a (1)	1,982	20	28	100 (1)	190
116	Warmouth	60	2	13	230,290 (2)	123	1	17	20,82,110,120,222,400 (6)	110
117	Orangespotted sunfish	75	2	10	280,290 (2)	136	1	11	20,250,300 (3)	81
118	Bluegill	843	23	27	70 ^a (1)	2,492	25	26	-	200
119	Longear sunfish (T)	26	1	11	2 ^a ,10,70 ^a ,81 ^a ,200,221 (6)	27	t	7	100,120 (2)	4
120	Smallmouth bass	466	13	27	70 ^a ,200 (2)	1,044	11	26	50 (1)	120
121	Largemouth bass	738	20	28	70 ^a (1)	2,142	22	28	100 (1)	190
122	White crappie	130	4	16	223,250,260,290 (4)	238	2	16	30,200,222,230 (4)	83
123	Black crappie	561	15	25	-	1,276	13	26	223 (1)	130
124	Crystal darter (E)	6	t	3	240 ^a (1)	19	t	4	280,310 (2)	220
125	Western sand darter (W)	57	2	8	221 (1)	81	1	7	-	42

Table 6. Continued.

Map No.	Species	1900-72				1974-86				Percent Change in Occurrence**
		No. Stn.	Percent Total	No. Basins	Basins not Found in 1974-86	No. Stn.	Percent Total	No. Basins	Basins not Found in 1900-72	
126	Mud darter (W)	41	1	9	222,300 ^a ,310 (3)	80	1	7	270 (1)	95
127	Rainbow darter	120	3	10	82 ^a ,223 (2)	274	3	11	2,230,250 (3)	130
128	Bluntnose darter (E)	2	t	1	-		2	t	1-	0
129	Iowa darter	235	6	25	70 ^a ,90 ^a ,223 (3)	654	7	24	30,40 (2)	180
130	Fantail darter	467	13	21	70 ^a (1)	1,188	12	23	40,90,130 (3)	150
131	Least darter (W)	67	2	15	10,30,81 ^a ,120 ^a ,130 ^a ,240 ^a (6)	89	1	10	270 (1)	33
132	Johnny darter	1,495	41	29	70 ^a (1)	3,944	40	28	-	160
133	Banded darter	140	4	12	130 ^a ,250 (2)	305	3	16	90,100,110,260,280,290 (6)	120
134	Yellow perch	900	25	25	70 ^a (1)	2,273	23	28	100,222,230,250 (4)	150
135	Logperch	327	9	21	70 ^a (1)	865	9	23	40,110,260 (3)	160
136	Gilt darter (T)	5	t	2	-	44	t	4	2,300 (2)	780
137	Blackside darter	324	9	25	60 ^a ,70 ^a (2)	865	9	25	30,110 (2)	170
138	Slenderhead darter	55	2	11	81 ^a (1)	108	1	10	-	96
139	River darter	54	1	7	-	81	1	8	270 (1)	50
140	Sauger	88	2	9	82 ^a (1)	163	2	11	230,270,290 (3)	85
141	Walleye	359	10	22	-	904	9	25	40,120,230 (3)	150
142	Freshwater drum	154	4	12	250 (1)	246	3	12	270 (1)	60
143	Mottled sculpin	537	15	20	60 ^a ,70 ^a ,230 (3)	1,792	18	20	40,100,250 (3)	230
144	Slimy sculpin	<u>57</u>	2	8	60 ^a ,110 ^a (2)	<u>155</u>	2	8	50,260 (2)	170
No. species		142				141				
Total no. occurrences (sum of the number of stations for all species collected)		31,969				86,975				

*Total basins possible = 30 since basins 80 and 220 are subdivided into their sub-basins.

**Percent change in the number of stations over the earlier period; rounded to 2 significant figures.

^aBasins not completely sampled by Fish Distribution Study personnel.

^bTotal number of basins listed for a species.

^ct = less than 0.5%.

^dE = Endangered.

T = Threatened.

W = Watch.

Table 7. *Percent occurrence of fish species in lakes and streams, 1974-86.*

Species	Percent Occurrence		Species	Percent Occurrence	
	In Lakes	In Streams		In Lakes	In Streams
Northern brook lamprey	0	100	Northern redbelly dace	6	94
American brook lamprey	t*	100	Quillback	6	94
Sea lamprey	0	100	Golden redbhorse	6	94
Skipjack herring	0	100	Greater redbhorse	6	94
Pink salmon	0	100	Burbot	6	94
Coho salmon	0	100	Paddlefish	7	93
Chinook salmon	0	100	Striped shiner	7	93
Lake chub	0	100	River carpsucker	7	93
Gravel chub	0	100	Highfin carpsucker	7	93
Southern redbelly dace	0	100	Smallmouth buffalo	7	93
Longnose dace	t	100	Mooneye	8	92
Blue sucker	0	100	River shiner	8	92
Slender madtom	0	100	Silver redbhorse	8	92
Stonecat	t	100	Flathead catfish	8	92
Pirate perch	0	100	Mud darter	8	92
Ninespine stickleback	0	100	Sauger	8	92
Crystal darter	0	100	Common shiner	9	91
Bluntnose darter	0	100	Finescale dace	9	91
Gilt darter	0	100	Shorthead redbhorse	9	91
Brown trout	1	99	Rainbow darter	9	91
Central stoneroller	1	99	Rainbow trout	10	90
Redside dace	1	99	Silver chub	10	90
Bigmouth shiner	1	99	Fathead minnow	11	89
Suckermouth minnow	1	99	Bullhead minnow	11	89
Blacknose dace	1	99	White sucker	11	89
Northern hog sucker	1	99	River darter	12	88
Western sand darter	1	99	Spotfin shiner	13	87
Fantail darter	1	99	Gizzard shad	14	86
Banded darter	1	99	Blackstripe topminnow	15	85
Blackside darter	1	99	Johnny darter	15	85
Slimy sculpin	1	99	Shortnose gar	16	84
Creek chub	2	98	Channel catfish	17	83
Brook stickleback	2	98	Black buffalo	18	82
Brook trout	3	97	Spotted sucker	19	81
Largescale stoneroller	3	97	Trout-perch	19	81
Mississippi silver minnow	3	97	Orangespotted sunfish	20	80
Speckled chub	3	97	Common carp	21	79
Hornyhead chub	3	97	Emerald shiner	21	79
Pearl dace	3	97	Bigmouth buffalo	21	79
Slenderhead darter	3	97	Tadpole madtom	22	78
Mottled sculpin	3	97	Goldfish	23	77
Chestnut lamprey	4	96	Freshwater drum	23	77
Brassy minnow	4	96	Redfin shiner	24	76
Ozark minnow	4	96	Black bullhead	24	76
Rosyface shiner	4	96	Green sunfish	24	76
Longnose sucker	4	96	Pallid shiner	26	74
River redbhorse	4	96	Weed shiner	28	72
Silver lamprey	5	95	Logperch	28	72
Sand shiner	5	95	Pugnose minnow	29	71
Shovelnose sturgeon	6	94	Bluntnose minnow	29	71
American eel	6	94	Smallmouth bass	29	71
Alewife	6	94	Rainbow smelt	30	70
Goldeye	6	94	Northern pike	32	68
Central mudminnow	6	94	White bass	32	68

Table 7. Continued.

Species	Percent Occurrence	
	In Lakes	In Streams
Yellow bullhead	33	67
Rock bass	34	66
Longnose gar	37	63
Longear sunfish	37	63
White crappie	37	63
Grass pickerel	41	59
Bowfin	42	58
Walleye	42	58
Blacknose shiner	43	57
Spottail shiner	44	56
Golden shiner	45	55
Least darter	47	53
Lake sturgeon	48	52
Mimic shiner	48	52
Starhead topminnow	50	50
Lake chubsucker	51	49
Brook silverside	52	48
Pumpkinseed	54	46
Black crappie	56	44
Iowa darter	57	43
Largemouth bass	58	42
Bluegill	59	41
Yellow perch	60	40
Yellow bass	65	35
Muskellunge	67	33
Blackchin shiner	67	33
Brown bullhead	68	32
Warmouth	71	29
Pugnose shiner	86	14
Banded killifish	86	14
Cisco or lake herring	100	0
Lake whitefish	100	0
Lake trout	100	0

* t = less than 0.5%.



The sauger held by Ken Kahler (on left) and smallmouth bass held by Eric Polzin (on right) were taken in the lower Trempealeau River.

brook trout (68,000), blacknose dace (60,000), Johnny darter (59,000), yellow perch (52,000) and central mudminnow (39,000) (Append. Table F.3). The brook stickleback, the 8th most common species, was the 11th most numerous. Of the 31 rarest species, i.e., those caught at less than 0.5% of all the stations (Table 10), all but 5 (alewife, cisco or lake herring, lake chub, speckled chub, and gilt darter) were also represented by the smallest total number of specimens (Append. Table F.3).

Differences Between Time Periods

Only 2 species of fish (pink salmon and chinook salmon) collected during the 1974-86 period were not previously reported. However, both were introduced species.

Three species collected in the early period have not been reported since then. The red shiner and creek chubsucker are apparently no longer present in Wisconsin, since we have completed the sampling in the basins in which they had been previously found. The red shiner was only collected at 2 stations (very close to the Illinois border) less than 1/2 mile apart in 1969. It is, therefore, doubtful if a reproducing population ever existed in Wisconsin. Like the red shiner, previous records of the creek chubsucker came from only 2 stations; these stations were on 2 streams in the Des Plaines River basin. This species was last collected in 1928. A third species, the ghost shiner (last collected in 1949) has only been found in the Mississippi River, and since we have not completed the sampling of this basin, there is a slight chance it may still be present there.

If one looks at the total number of occurrences (sum of the number of stations at which species were captured) in the 1900-72 period as compared to the 1974-86 period, total occurrences increased from 31,969 to 86,975 (Table 6). Fish Distribution Study personnel accounted for 78% of the total occurrences in the later period. They also collected 138 out of the 141 total species found. (For a list of species taken by all non-DNR collectors, see Appendix Table B.2.)

One of the most important results of this study was the documentation of changes in the *known* distribution of species *within* the inland waters of Wisconsin in 1974-86 as compared to the previous period (Table 6). Such changes are not meant to imply that species have expanded, decreased, or remained unchanged in their range in Wisconsin. Instead changes simply indicate that we now know that species are present at more, less, or the same number of locations, respectively, as they were in the early period. In addition, changes allow a measurement to be made, in the case of increases, of the improvement in our knowledge of the distribution of the species in the inland waters of Wisconsin.

Distribution changes were measured by differences in several parameters: numbers of stations or locations, basins, and water bodies. In terms of stations, percentages were calculated to show the percent change in the number of stations at which each species was taken. Decreases were documented for 17 species, increases for 123 species, no changes for 2 species, and undetermined change for 2 other species (Table 6). The decreases ranged from 100%

for 3 species to 15% for one (weed shiner). The increases ranged from 4% for the longear sunfish to 3,700% for the river redhorse (average = 221%). However, conclusions from these changes should be made with caution since approximately 50% of the state (Fig. 1) has not been completely sampled. Thus the final increases may be greater, and the decreases may not be as high. With this in mind, the decreases for 5 species (cisco or lake herring, lake whitefish, lake trout, rainbow smelt, and ninespine stickleback) are probably due to not completing the sampling of basins in which they were previously found. For 1 species (red shiner), its decline should not be inferred since a reproducing population has not been documented. Distribution for 11 other species also decreased; reasons for these decreases are unknown.

A second parameter used to indicate distribution changes is the number of basins in which a species is found for the first time, the number of basins in which it is now absent, and the change in the total number of basins (Table 6). In the following discussion, the sub-basins 221, 222, 223, 81, and 82 are counted as basins, thus bringing the maximum number possible for a species to 30. One hundred and sixteen species were found for the first time in one or more basins. These 116 were reported from an average of 3 new basins per species, with ranges of 1-10 basins per species. One hundred and nineteen species were no longer found in one or more basins. Distribution of these 119 species decreased an average of 2 basins per species, with ranges of 1-8 basins per species.

The basins in which these 119 species were no longer found included both uncompleted and/or completed basins. Of the 119 species, 43 were no longer found just in uncompleted basins, and 42 were no longer found in a combination of both completed and uncompleted basins. Since sampling of 13 basins was not completed by the close of the recent survey, there is a good chance that the species found in these uncompleted basins in the 1900-72 period may still be found in them. The remaining 34 of the 119 species were no longer found only in 1 or more completed basins. For these species, their distribution may possibly have influenced the observed reduction in the number of basins in which the species were absent in 1974-86.

Both increases and decreases in the number of basins in which a species was found were observed. Sixty-five species had increases in the number of basins, and 51 species had decreases in the number of basins in which they were collected. For 26 species, no change was observed in the number of basins in which the species was caught. However, 5 species (paddlefish, longnose gar, striped shiner, Ozark minnow, and bluntnose darter) were only caught in the exact same basins. For individual species, changes can be seen by comparing the 1900-72 and 1974-86 species maps in Appendix G.

A third parameter used to measure distribution change between 1900-72 and 1974-86 was differences in the number of water bodies in which species were found. Although these differences were not computed for all species, they were calculated for those species on the Department's endangered, threatened, and watch lists. These differences will be discussed later in this report.

Table 8. List of species collected at less than 0.5 percent of the stream stations, 1974-86.

Sea lamprey	Pugnose shiner
Lake sturgeon	Striped shiner
Shovelnose sturgeon	Redfin shiner
Paddlefish	Longnose sucker
American eel	Black buffalo
Alewife	Slender madtom
Goldeye	Pirate perch
Pink salmon	Banded killifish
Coho salmon	Starhead topminnow
Chinook salmon	Ninespine stickleback
Rainbow smelt	Yellow bass
Speckled chub	Longear sunfish
Pallid shiner	Crystal darter
	Bluntnose darter

Table 9. List of species collected at less than 0.5 percent of the lake stations, 1974-86.

Chestnut lamprey	Ozark minnow
Silver lamprey	Redfin shiner
American brook lamprey	Suckermouth minnow
Shovelnose sturgeon	Longnose dace
Paddlefish	River carpsucker
American eel	Highfin carpsucker
Alewife	Longnose sucker
Skipjack herring	Smallmouth buffalo
Goldeye	Black buffalo
Lake whitefish	River redhorse
Lake trout	Greater redhorse
Rainbow smelt	Stonecat
Central stoneroller	Flathead catfish
Redside dace	Starhead topminnow
Mississippi silvery minnow	Western sand darter
Speckled chub	Mud darter
Silver chub	Banded darter
Pallid shiner	Slenderhead darter
Striped shiner	River darter
	Slimy sculpin

Table 10. List of species collected at less than 0.5 percent of the total stations, 1974-86.

Sea lamprey	Speckled chub
Lake sturgeon	Gravel chub
Shovelnose sturgeon	Pallid shiner
Paddlefish	Striped shiner
American eel	Redfin shiner
Alewife	Longnose sucker
Skipjack herring	Black buffalo
Goldeye	Slender madtom
Cisco or lake herring	Pirate perch
Lake whitefish	Starhead topminnow
Pink salmon	Ninespine stickleback
Coho salmon	Longear sunfish
Chinook salmon	Crystal darter
Lake trout	Bluntnose darter
Rainbow smelt	Gilt darter
Lake chub	

Many of the increases in number of stations and number of basins at which species were taken were due primarily, but perhaps not entirely, to more efficient gear and increased sampling effort. Since the early period, there has been a shift away from AC electrofishing and seining gear toward DC electrofishing gear, which is more effective for capturing many species (Table 11). Unfortunately, many collectors (18% of collections) in the early period did not record the gear used at each station. However, it is believed that most collectors probably used the same type of seine or net at these locations as they used at their other stations. If seines were in fact used at these locations, this would make the shift from seining in the early period to DC electrofishing gear in the later period even more pronounced. A further breakdown of the 1900-72 period into the 1900-59 and 1960-72 periods clearly shows the reliance on seines in the earliest period and a change to electrofishing (primarily AC) in the 1960-72 period (Table 12).

In addition to use of more effective gear, distribution increases may also be due in part to increased sampling effort in 1974-86. The increase in sampling effort can be seen in the fact that there were 1,509 more streams and 377 more lakes with at least 1 station sampled during the 1974-86 period compared to the 1900-72 period (Table 2). The total number of stations sampled in the 1974-86 period also increased (171%) compared to the total number of stations sampled in 1900-72 (Table 12).

Within the 1900-72 period, only 33% of the stations were sampled during 1900-59 which composed 82% of the years covered by the early period. This clearly shows the heavier sampling effort during the 1960-72 portion of the early period. Thus, if distribution in 1974-86 were compared to that in 1900-59, the changes would be much greater. These intra-period differences are also reflected in Appendix B.1, which cites for each species the percent of data collected during the 1900-50 portion of the 1900-72 period.

Species Richness

Six percent of the stations in completed basins sampled by Fish Distribution Study personnel had 20 or more species, and 1% of the stations had more than 25 species (Table 13). The average number of species per station was 9. It should be noted that the effort used at the stations has not been standardized. Furthermore, on some of the larger rivers, different sampling gear was used to sample the same section of the river, but the collections using each gear type were counted as if they were from separate stations. An example is a boom shocker and small mesh seine that were used on the same section of a river; results were recorded as separate stations.

When comparing the species caught per station, readers should keep in mind the total number of species caught in the basin. For completed basins, the total numbers of

species caught (in parentheses) are as follows: 10(45), 20(75), 30(70), 40(59), 50(62), 200(43), 210(85), 221(93), 222(73), 223(62), 230(74), 250(70), 260(64), 270(97), 280(83), 290(60), Red Cedar River basin(98), and 310(97). These numbers depend upon many factors including: size of basin, diversity of the aquatic habitat (such as size and number of rivers and lakes), climate, amount of pollution in the basin, and accessibility of upstream migration for fish from adjacent basins. For species that have only a few records in a particular basin, one should also consider the source of the data.

Endangered Species

All 8 endangered species (goldeye, gravel chub, pallid shiner, striped shiner, slender madtom, starhead topminnow, crystal darter, and bluntnose darter) were captured in both time periods.⁴ However, there were changes in not only the total number of stations for most species but also in the number of basins and the number of stations within a basin at which they were captured (Table 6 and Appendix G, which contains 2 maps [1900-72 and 1974-86] for each species). Our knowledge of the current distribution and status of these species can be better understood by looking at the number of water bodies from which they were collected, at the number of different locations on each water body, at the number of specimens taken at each location (Table 14), and at the species' distribution map for the later period (Append. G). Illustrations and habitat preferences of the 8 endangered species are given in Appendix Figure E.2.

For the goldeye, it had previously not been taken from 3 basins in which we collected it in 1974-86. However, the only basin (only completed basins are counted) in which we did not collect it was the St. Croix River basin (Table 6 and Append. G Map 16(E)). Its current distribution of 16 stations in 8 water bodies in 4 basins is shown in Table 17 and can be seen on Appendix G Map 16(L). Based on stations that had a known number of specimens, an average of 2.2 goldeyes/station were taken.

The gravel chub had previously been taken from only 1 station in each of the Rock and Sugar river basins. Its current known distribution is limited to 41 stations in these 2 basins and the Pecatonica River basin in which it was collected for the first time (Append. G Map 42(L)). It should be noted that 35 of those stations occurred in 10- and 13-mile stretches of 2 streams. An average of 6.2 gravel chubs/station were collected from 4 streams.

The pallid shiner had previously been taken at 32 stations in 6 basins (Append. G Map 45(E)). Its current distribution is restricted to only 9 water bodies in the Mississippi River basin and is shown in Appendix G Map 45(L). An average of 9.6 pallid shiners/station were taken.

The striped shiner was collected in the same 4 basins as in the early period, but there was a decrease of 40% in the number of stations at which it was present (Append. G

⁴The list of species designated as endangered in Wisconsin was based on a 1982 Wisconsin Administrative Code. See the Foreword of this report for an explanation of subsequent changes in this official list.

Table 11. Gear type used in each basin in 1900-72 and 1974-86, reported as the percent of stations sampled (all collectors) for each time period, with the average percent for all basins.*

Basin	Electrofishing				Seine**		Electrofishing & Seine		Unknown		Miscellaneous ^a	
	DC		AC		1900-72	1974-86	1900-72	1974-86	1900-72	1974-86	1900-72	1974-86
	1900-72	1974-86	1900-72	1974-86								
2	-	22	-	3	35	62	2	8	62	3	1	1
10	16	78	-	3	63	19	-	-	22	-	-	-
20	1	64	11	1	54	33	1	t ^b	33	1	-	-
30	20	50	17	t	50	49	2	-	11	-	-	t
40	27	55	35	-	27	43	-	2	12	-	-	1
50	25	98	19	-	50	2	6	-	-	-	-	-
60	-	-	-	-	86	-	-	-	-	-	14	-
70	-	-	-	-	94	100	-	-	6	-	-	-
81	3	34	-	3	86	61	-	-	8	-	3	3
82	2	88	t	2	42	9	1	t	50	t	5	t
90	-	84	-	5	25	11	-	-	75	-	-	-
100	-	93	-	3	-	3	-	-	100	-	-	-
110	4	78	4	2	61	16	-	-	30	1	-	2
120	-	89	2	5	80	5	2	-	13	1	3	t
130	44	88	8	4	26	6	1	t	21	-	t	1
200	-	45	17	2	58	50	-	3	17	-	8	-
210	6	42	4	2	62	55	2	t	24	1	2	-
221	10	52	1	t	64	45	1	t	22	t	2	2
222	9	87	-	-	82	12	6	-	3	-	-	1
223	2	92	-	-	76	8	-	-	22	-	-	-
230	17	98	11	-	39	2	-	-	33	-	-	-
240	6	84	2	3	64	12	3	t	25	t	1	1
250	59	85	11	-	29	1	1	-	-	14	-	-
260	39	84	46	8	11	7	-	-	4	-	-	-
270	12	88	70	1	14	10	t	t	4	t	-	t
280	32	91	58	t	7	8	-	1	3	-	-	-
290	52	99	33	t	13	-	-	1	2	-	-	-
300	21	54	29	14	39	30	2	1	9	1	1	t
310	1	12	69	36	24	49	1	2	5	t	1	1
400	4	57	-	20	51	20	30	1	11	2	4	-
Avg. % ^c	14	64	22	8	43	26	2	1	18	1	1	1

* The total number of stations from which these percentages were calculated excludes 148 stations for which more than 1 type of gear was used. All figures were rounded to the nearest percent.

** Includes any kind of nets.

^a Includes stations at which fish were found dead or taken by gear such as hook and line, dip net, minnow traps, etc.

^b t = less than 0.5%.

^c Based on the number of stations used for each basin.

Table 12. Comparison of gear type within 4 time periods between 1900 and 1986, reported as the number and percent (in parenthesis) of stations sampled for each time period.

Years	Total Stations	Electrofishing		Seine	Electrofishing & Seine	Unknown	Misc.
		DC	AC				
1900-59	1,215	43 (4)	39 (3)	770(63)	15(1)	333(27)	15(1)
1960-72	2,568	470(18)	805(31)	859(33)	65(3)	339(13)	30(1)
1900-72*	3,635	499(14)	818(22)	1,557(43)	76(2)	643(18)	42(1)
1974-86	9,841	6,294(64)	782 (8)	2,551(26)	71(1)	88 (1)	55(1)

* Numbers are not the same as in Tables 3, 4, and 11 because the 148 stations at which more than one gear type was used are included in this summary table.

Table 13. Quantities of species taken per station by Fish Distribution Study personnel in each completed basin in 1974-86, reported as the percent of number of stations in each category* for each basin, with an average percent for all basins and the average number of species per station for each basin.

No. Species/ Station	Basin																		Avg. %
	10	20	30	40	50	200	210	221	222	223	230	250	260	270	280	290	300**	310	
0	-	2	3	2	2	2	2	t	1	2	-	-	1	2	4	1	2	1.7	
1	4	4	3	2	5	4	4	5	8	-	1	1	7	3	5	8	2	3	3.6
2	9	2	3	9	-	4	3	6	7	2	1	4	9	3	11	13	3	5	5.0
3	11	4	7	6	10	7	2	5	4	3	1	3	5	3	9	7	5	7	5.0
4	5	8	7	8	2	2	5	6	3	3	3	3	9	4	11	10	5	9	6.4
5	13	6	4	12	10	5	9	7	7	3	3	6	14	4	12	14	8	11	8.2
6	9	7	8	8	5	7	7	9	5	5	2	9	11	5	9	7	6	8	7.2
7	7	9	3	5	-	11	6	8	9	6	2	6	7	9	7	4	9	9	7.6
8	2	7	5	9	2	9	8	8	6	7	4	9	12	4	6	11	8	9	7.5
9	11	7	10	4	2	18	6	6	7	11	7	7	9	6	5	4	8	7	7.1
10	4	5	8	5	12	2	6	6	8	8	8	7	2	8	5	4	7	6	6.3
11	2	4	4	5	2	2	7	6	3	12	9	12	5	4	3	4	6	6	5.8
12	5	5	5	5	2	5	6	4	3	9	10	4	2	4	3	-	5	5	4.8
13	5	2	10	1	10	5	6	3	6	6	8	10	1	4	1	4	4	3	4.2
14	4	3	8	6	2	5	6	3	2	2	9	6	1	4	4	2	4	2	3.7
15	2	4	3	1	5	5	5	2	4	3	7	-	1	4	2	2	4	2	3.0
16	4	3	3	4	5	-	2	2	3	3	6	4	-	4	2	1	3	2	2.6
17	4	4	1	-	5	-	2	2	2	2	6	3	-	2	t ^a	-	2	1	1.7
18	-	2	1	2	2	2	2	2	2	t	4	1	1	4	1	-	1	1	1.7
19	-	3	1	2	2	-	-	1	4	2	1	1	1	2	1	-	2	1	1.3
20	-	4	1	-	5	2	1	2	1	3	2	-	-	3	-	-	1	t	1.3
21	-	3	2	-	-	-	1	1	1	1	1	1	1	2	-	2	1	t	0.9
22	-	1	-	1	-	-	1	1	1	3	1	-	-	3	t	-	1	1	1.0
23	-	-	-	1	-	-	1	1	-	1	-	-	-	2	-	-	1	1	0.6
24	-	-	-	-	-	-	t	t	1	1	1	-	-	2	-	-	1	t	0.4
25	-	1	-	-	-	-	-	-	1	1	1	-	-	3	-	-	1	t	0.5
26	-	-	-	-	-	2	-	2	-	-	-	-	-	t	-	-	1	t	0.2
27	-	-	-	-	-	-	1	t	1	-	-	-	-	1	t	-	t	t	0.2
28	-	-	-	-	2	-	-	-	1	-	-	-	-	1	-	-	-	-	0.1
29	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	0.1
30	-	-	-	-	-	-	-	t	-	-	-	-	-	1	-	-	t	-	0.1
31	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	T ^b
32	-	-	-	-	-	-	t	-	-	-	-	-	-	-	-	-	-	-	T
33	-	-	-	-	-	-	-	t	-	-	-	-	-	-	-	-	-	-	T
34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	t	-	-	-	-	-	-	-	-	-	-	-	T
41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	T
Avg. no. species	7	10	9	8	10	9	10	9	9	11	12	10	7	12	7	6	10	8	9

* The number of species at a station. All figures were rounded to the nearest percent.

** Includes the Red Cedar River sub-basin only.

^a t = less than 0.5%.

^b T = less than 0.05%.

Maps 50(E) and 50(L)). An average of 6.1 striped shiners/station were now taken at 15 stations in 9 water bodies.

The slender madtom was collected at only 3 of the 7 stations in 2 basins in which it was found in the early period. It was not collected in the Fox River basin (basin 210), the only other basin in which it had been previously reported. The fish is known to occur at 28 stations in 16 water bodies with an average of 9.9 fish/station (Append. G Maps 98(E) and 98(L)). This is an increase of 300% in the number of stations where it was found.

The starhead topminnow had not previously been reported from the Black River basin (Append. G Maps 107(E) and 107(L)). The rest of its distribution has remained about the same as the early period. An average of 6.1 starhead topminnows were taken from 9 stations in 7 water bodies.

The crystal darter was collected in 2 basins (Trempealeau and St. Croix river basins) not previously reported but not from the Wisconsin River basin (Append. G Maps 124(E) and 124(L)). The one station in the Wisconsin River at which it had been taken in 1962 was sampled in the later period, but no specimens were taken. An average of 6.2 crystal darters/station were taken from 19 stations in only 5 rivers.

The bluntnose darter, the rarest of the endangered species, had been reported in 1949 from a total of 2 stations somewhere in Pools 8 and 9 in the Mississippi River. In the later period 1 specimen was caught at each of 2 stations in Pool 11 (Append. G Maps 128(E) and 128(L)).

Threatened Species

All 6 threatened species (speckled chub, Ozark minnow, blue sucker, black buffalo, longear sunfish, and gilt darter) were also captured in both time periods.⁵ Like the endangered species, the changes in the known distribution were substantial for most threatened species (Table 6), and our knowledge of their current distribution and status can be better understood by looking at the number of water bodies from which they were collected, at the number of different locations on each water body, at the number of specimens taken at each location (Table 15), and at the species' distribution map for the later period (Append. G). Illustrations and habitat preferences of the 6 threatened species are given in Appendix Figure E.3.

The speckled chub was taken at 28% fewer stations and not at all in the Coon & Bad Axe river basin (Append. G Maps 40(E) and 40(L)). An average of 15.3 speckled chubs/station were taken at 29 stations in 8 water bodies.

The Ozark minnow was taken at 50 stations (230% increase over the early period) from 28 water bodies in the same 4 basins as previously reported (Append. G Maps 57(E) and 57(L)). An average of 12.1 Ozark minnows/station were taken.

The blue sucker was taken at 54 stations (46% increase over the early period) from 9 water bodies in 5 basins (Append. G Maps 81(E) and 81(L)). It was taken for the first time in the Black River basin but was not taken in the La Crosse River basin. An average of 9.1 blue suckers/station were taken.

The black buffalo was taken at 11 stations (27% decrease over the early period) from 5 water bodies in 3 basins (Append. G Maps 87(E) and 87(L)). It was taken for the first time in the Pecatonica River basin. An average of only 1.5 black buffalos/station were taken.

The longear sunfish was only caught at 27 stations (1 more than in the early period). However, it was caught for the first time in the Pensaukee and Peshtigo river basins but not taken again in 3 completed basins (Root, Des Plaines, and Rock river basins) in which it was taken in the early period (Append. G Maps 119(E) and 119(L)). An average of 10.1 longear sunfish/station from 17 water bodies were taken.

The gilt darter was taken at 44 stations (780% increase) from 9 rivers in 4 basins. It was taken for the first time in the Mississippi and Chippewa river basins (Append. G Maps 136(E) and 136(L)). The St. Croix and Black rivers seem to be the only strongholds for this species in the state. An average of 9.0 gilt darters/station were taken.

Watch Species

Of the 21 watch fish species, 4 occur primarily in the Great Lakes and are therefore excluded from the geographical area covered by this summary report.⁶ One species—the red shiner—was found only in 1900-72. Five others—the paddlefish, pugnose shiner, redfin shiner, river redhorse, and greater redhorse—are currently being proposed for addition to the Department's official list of threatened species. These 5 species along with 2 other watch species—the mud darter and pirate perch—will be discussed. The remaining 9 watch species—the lake sturgeon, cisco or lake herring, American eel, redbreast dace, pugnose minnow, weed shiner, lake chubsucker, western sand darter, and least darter—should be looked at closely in the future to determine if they too should be added to the threatened list. For the watch species being discussed, the changes in the known distribution were substantial for most (Table 6), and our knowledge of their current distribution and status can be better understood by looking at the number of water bodies from which they were collected, at the number of different locations on each water body, at the number of specimens taken at each location (Table 16), and at the species' distribution map for the later period (Append. G). Illustrations and habitat preferences of 14 of the watch species are given in Appendix Figure E.4.

⁵The list of species designated as threatened in Wisconsin was based on a 1982 Wisconsin Administrative Code. See the Foreword of this report for an explanation of subsequent changes in this official list.

⁶The list of species considered watch in Wisconsin was based on one being used by the Bureau of Endangered Resources in 1985. See the Foreword of this report for an explanation of subsequent changes in this unofficial list.

The paddlefish was reported from 14 stations from 4 water bodies in 3 basins with an average of 9.9 fish/station (Append. G Maps 8(E) and 8(L)). The only stronghold for the paddlefish was at the Prairie du Sac dam on the Wisconsin River where 94% of the fish were taken.

The pugnose shiner was taken at 58 stations (180% increase) from 42 water bodies in 8 basins (basins 20, 300, and 400 for the first time) with an average of 5.8 fish/station (Append. G Maps 46(E) and 46(L)).

The redbfin shiner was taken from only 7 basins; this represents a decrease of 7 completed basins from the early period (Append. G Maps 62(E) and 62(L)). The number of stations has dropped 62% (now only 28 stations). If 6 of the 28 stations are excluded, the average number of redbfin shiners/station is only 4.

The river redhorse had previously been taken from only 2 stations in 2 basins. It was taken in the later period at 76 stations (3,700% increase) from 14 water bodies in 10 basins (for the first time in 8 basins) with an average of 6.6 fish/station (Append. G Maps 90(E) and 90(L)).

The greater redhorse was taken at 106 stations (520% increase) from 37 water bodies in 10 basins with an average of 4.1 fish/station (Append. G Maps 93(E) and 93(L)).

The pirate perch was taken at 25 stations (9% increase) from 18 water bodies in 6 basins with an average of 3.4 fish/station (Append. G Maps 102(E) and 102(L)).

The mud darter was taken at 80 stations (95% increase) from 36 water bodies in 7 basins with an average of 5.4 fish/station (Append. G Maps 126(E) and 126(L)). It was taken for the first time in the Black River basin but not from 2 completed basins (Sugar and St. Croix river basins) in which it was previously captured.

Table 14. *Specific records for endangered species collected in the inland waters of Wisconsin during 1974-86.**

Species	Basin	Water Body	No. Stations	No. Fish	Avg. No. Fish/Station**
Goldeye	2	Mississippi R.	4	19	2.2
		Raft Channel	1	1	
		Running Slough	2	2	
		Big L. & Sloughs	1	4	
	230	Grant R.	1	1	
	240	Wisconsin R.	4	4	
	300	Kickapoo R.	2	3	
		Chippewa R.	<u>1</u>	<u>1</u>	
		Total	16	35	
	Gravel chub	221	Rock R.	2	
Turtle Cr. ^a			20	125	
222		Sugar R. ^b	15	106	
223		Pecatonica R.	<u>4</u>	<u>6</u>	
		Total	41	254	
Pallid shiner	2	Mississippi R.	9	21	9.6
		McCartney L.	1	6	
		Cassville Slough	3	68	
		State Line Slough	3	52	
		Ferry L.	1	29	
		Catfish Slough	2	38	
		Glen L.	2	23	
		Ambrough Slough	3	10	
		L. Winneshiek	<u>2</u>	<u>2</u>	
			Total	26	
Striped shiner	20	Milwaukee R.	6	63	
		Pigeon Cr.	1	16	

Table 14. *Continued.*

Species	Basin	Water Body	No. Stations	No. Fish	Avg. No. Fish/Station**
Striped shiner (continued)	20	Cedar Cr.	2	2	
		Stony Cr.	1	1	
		Mink Cr.	1	1	
		E. Br. Milwaukee R.	1	5	
	30	Otter Cr.	1	2	
	210	Wind L.	1	1	
	221	Rubicon R.	<u>1</u>	<u>1</u>	
		Total	15	92	6.1
Slender madtom	221	Rock R.	2	2	
		Little Turtle Cr.	1	2	
		Darien Cr.	1	1	
		Bark R.	7	112	
		Oconomowoc R.	4	85	
		Mason Cr.	1	12	
	223	Pecatonica R.	1	3	
		Dodge Br.	1	1	
		Unnamed Cr.	1	1	
		Otter Cr.	1	5	
		Wood Br.	2	9	
		Bonner Br.	2	22	
		Cottage Inn Br.	1	16	
		Mineral Point Br.	1	4	
		Pedler Cr.	1	1	
		Livingston Br.	<u>1</u>	<u>1</u>	
		Total	28	277	9.9
Starhead topminnow	210	Fox R.	1	1	
		Mukwonago R.	2	20	
		Lower Phantom L.	2	24	
		Upper Phantom L.	1	4	
		L. Beulah	1	3	
	222	Unnamed Ditch	1	2	
	270	Black R.	<u>1</u>	<u>1</u>	
		Total	9	55	
Crystal darter	2	Mississippi R.	2	4	
	280	Trempealeau R.	1	1	
	300	Chippewa R.	9	98	
		Red Cedar R.	5	13	
	310	St. Croix R.	<u>2</u>	<u>2</u>	
		Total	19	118	6.2
Bluntnose darter	2	Mississippi R.	<u>2</u>	<u>2</u>	
		Total	2	2	1.0

*Endangered status is based on those species designated by the Department as endangered at the time this final report was written [Wis. Admin. Code NR 27.03(2)(e), Nov. 1982].

**Does not include stations at which the number of specimens was not recorded.

^aAll stations were in a 10-mile stretch of the creek.

^bAll stations were in a 13-mile stretch of the river.

Table 15. *Specific records for threatened species collected in the inland waters of Wisconsin during 1974-86.**

Species	Basin	Water Body	No. Stations	No. Fish	Avg. No. Fish/Station**	
Speckled chub	2	Mississippi R.	6	98		
		Cassville Slough	1	1		
		L. Winneshiek	1	1		
		Unnamed Slough	1	2		
	240	Wisconsin R.	14	309		
		Kickapoo R.	3	29		
	270	Black R.	1	1		
	310	St. Croix R.	<u>2</u>	<u>3</u>		
		Total	29	444	15.3	
	Ozark minnow	221	Turtle Cr.	3	7	
Unnamed Cr.			1	4		
Spring Brook			1	12		
Little Turtle Cr.			4	148		
Darien Cr.			3	12		
Ladd Cr.			1	87		
W. Br. Ladd Cr.			1	1		
Unnamed Cr.			1	2		
223			E. Br. Richland Cr.	2	15	
			Apple R.	1	58	
230			Unnamed Cr.	1	1	
			Unnamed Cr.	1	1	
			Pats Cr.	3	10	
			Platte R.	7	59	
			Little Platte R.	3	45	
			McAdam Br.	1	21	
		Blockhouse Cr.	2	17		
		Rountree Br.	1	2		
		Unnamed Cr.	1	4		
		Willow Br.	1	11		
		Austin Br.	1	2		
		Unnamed Cr.	1	6		
		Leggett Cr.	1	6		
		Unnamed Cr.	1	6		
		300	Red Cedar Cr.	1	4	
			Vermillion R.	2	44	
			Brill R.	2	12	
Long L.			<u>2</u>	<u>6</u>		
Total			50	603	12.1	
Blue sucker		2	Mississippi R.	4	5	
			Winneshiek Slough	1	1	
			Battle Slough	1	1	
		240	Wisconsin R.	20	279	
	Kickapoo R.		2	2		

Table 15. *Continued.*

Species	Basin	Water Body	No. Stations	No. Fish	Avg. No. Fish/Station**	
Blue sucker (<i>continued</i>)	270	Black R.	1	1		
	300	Chippewa R.	18	182		
		Red Cedar R.	6	21		
	310	St. Croix R.	<u>1</u>	<u>1</u>		
		Total	54	493	9.1	
Black buffalo	2	Mississippi R.	1	1		
	223	Pecatonica R.	2	3		
	240	Wisconsin R.	3	3		
		Kickapoo R.	3	4		
		L. Wisconsin	<u>2</u>	<u>6</u>		
		Total	11	17	1.5	
Longear sunfish	20	Milwaukee R.	5	23		
		E. Br. Milwaukee R.	2	11		
		Mauthe L.	1	1		
		W. Br. Milwaukee R.	2	11		
	82	Unnamed Cr.	1	3		
	90	Little Suamico R.	1	2		
	100	Pensaukee R.	1	6		
	120	Leigh Fl.	1	1		
	210	Fox R.	2	2		
		White R.	1	3		
		Mukwonago R.	2	86		
		300	Bass L.	1	14	
			L. Winter	1	2	
			Beverly L.	1	99	
			Lac Courte Oreilles	3	5	
			Grindstone L.	1	3	
	Whitefish L.	<u>1</u>	<u>2</u>			
	Total	27	274	10.1		
Gilt darter	2	Mississippi R.	1	1		
	270	Black R.	6	79		
	300	Chippewa R.	2	16		
	310	St. Croix R.	27	281		
		Apple R.	1	1		
		Wood R.	1	1		
		Yellow R.	2	14		
		Namekagon R.	3	3		
		Moose R.	<u>1</u>	<u>2</u>		
			Total	44	398	9.0

*Threatened status is based on those species designated by the Department as threatened at the time this final report was written [Wis. Admin. Code NR 27.03(3)(e), Nov. 1982].

**Does not include stations at which the number of specimens was not recorded.

Table 16. *Specific records for selected watch species collected in the inland waters of Wisconsin during 1974-86.**

Species	Basin	Water Body	No. Stations	No. Fish	Avg. No. Fish/Station**
Paddlefish	2	L. Pepin	1	1	
	240	Wisconsin R.	6	130	
		Unnamed Ditch	1	2	
	300	Chippewa R.	<u>6</u>	<u>6</u>	
		Total	14	139	9.9
Pugnose shiner	20	Forest L.	1	4	
		Big Cedar L.	1	1	
		Lucas L.	1	3	
		Silver L.	1	5	
		Crooked L.	1	14	
		Mauthe L.	1	3	
	81	Tittle L.	1	1	
	82	Fox R.	1	1	
		Willow Cr.	1	2	
	210	Mynyard L.	1	2	
		S. Br. Little Wolf R.	2	7	
		Elizabeth L.	1	1	
		L. Mary	1	1	
		Benedict L.	1	27	
		Cross L.	1	53	
		Silver L.	1	1	
		Waubeesee L.	1	2	
		L. Kec-Nong-Ga-Mong	1	1	
		Mukwonago R.	1	1	
		Upper Phantom L.	1	5	
		L. Beulah	1	1	
		Lulu L.	1	4	
		221	L. Ripley	4	4
	Lower Nemahbin L.		2	14	
	Rock L.		1	2	
	Oconomowoc L.		2	2	
	Okauchee L.		1	1	
	Pike L.		3	11	
	300		Bear L.	1	1
	310	Kekegama L.	1	12	
		Long L.	6	75	
		Red Cedar L.	1	3	
		Manitowish L.	1	1	
		Upper Clam L.	1	1	
		Yellow R.	2	3	
		Falk L.	1	1	
Burlingame L.		1	9		
Twentysix L.		1	2		
Yellow L.		2	3		
400	Big Sand L.	2	27		
	McKenzie Cr.	1	3		
	L. Delta	<u>1</u>	<u>21</u>		
		Total	58	336	5.8

Table 16. *Continued.*

Species	Basin	Water Body	No. Stations	No. Fish	Avg. No. Fish/Station**
Redfin shiner	20	Cedar Cr.	3	16	
		Cedarburg Pond	1	12	
		N. Br. Milwaukee R.	1	1	
		Wallace Cr.	1	1	
	82	Willow Cr.	1	13	
		Pine R.	1	5	
		Austin Cr.	1	1	
	90	Tibbet Cr.	1	71	
		221	Rock R.	1	1
	Bass Cr.		2	27	
	Crawfish R.		2	3	
	Mud Cr.		1	6	
	222	Danville Millpond	1	4	
		Sugar R.	1	5	
		Sylvester Cr.	1	1	
		Sugar R.-E. Channel	1	1	
		Decatur L.	1	1	
		Ross Crossing Cr.	1	1	
	240	Hemlock Cr.	1	6	
	300	Tainter L.	1	1	
Yellow R.		1	5		
Barron Fl. #1		1	60		
Barron Fl. #3		<u>1</u>	<u>11</u>		
Total			27	253	9.4
River redhorse	20	E. Br. Milwaukee R.	1	2	
	82	Wolf R.	2	3	
	2	Mississippi R.	4	4	
		Moseman Slough	1	3	
	210	Fox R.	6	106	
		White R.	1	2	
	221	Rock R.	4	16	
	222	Sugar R.	2	2	
	240	Wisconsin R.	1	1	
	270	Black R.	11	22	
	300	Chippewa R.	8	21	
	310	St. Croix R.	33	313	
		Apple R.	1	3	
Yellow R.		<u>1</u>	<u>1</u>		
Total		76	499	6.6	
Greater redhorse	20	Milwaukee R.	14	40	
		Pigeon R.	1	10	
		Cedar Cr.	1	9	
		N. Br. Milwaukee R.	3	7	
		E. Br. Milwaukee R.	1	1	
	40	W. Br. Milwaukee R.	1	2	
		Manitowoc R.	5	88	
		Branch R.	4	5	
		S. Br. Manitowoc R.	1	1	

Table 16. *Continued.*

Species	Basin	Water Body	No. Stations	No. Fish	Avg. No. Fish/Station**	
Greater redhorse (<i>continued</i>)	50	E. Twin R.	4	25		
		W. Twin R.	6	52		
		Neshota R.	1	4		
	82	L. Poygan	1	1		
		Unnamed Ditch	1	3		
		Pensaukee R.	5	22		
	110	Little R.	1	1		
	221	Rock R.	1	1		
		Turtle Cr.	2	9		
		Bark R.	1	1		
	240	Wisconsin R.	1	3		
		Wyona L.	1	2		
	300	Chippewa R.	2	2		
		Red Cedar R.	3	7		
		Brill R.	1	3		
		Island L.	1	1		
		Swift Cr.	1	1		
		Whitefish L.	1	1		
		310	St. Croix R.	26	68	
			Yellow R.	4	22	
	Loon Cr.		1	2		
	Chases Brook		1	1		
	Namekagon R.		4	27		
	Dogtown Cr.		1	1		
	McKenzie Cr.		1	1		
	Trego L.		1	1		
	Spring Cr.		1	8		
	Moose R.		1	1		
	Total			106	434	4.1
	Pirate perch	200	Des Plaines R.	1	1	
			Jerome Cr.	3	29	
			Unnamed Ditch	1	1	
			Kilbourn Road Ditch	4	7	
Salem Br.			1	1		
240		Wisconsin R.	1	3		
		Bush Cr.	1	1		
		Millville Cr.	1	3		
		Morrey Cr.	1	1		
		Blue Mounds Cr.	1	1		
		Dunlap Cr.	1	1		
		Swamp Cr.	1	1		
		Rocky Run	2	3		
250		Unnamed Cr.	1	5		
		Mormon Cr.	1	1		
270		Black R.	2	20		
280		Trempealeau R.	1	- ^a		
290	Waumandee Cr.	1	2			
Total		25	81	3.4		
Mud darter	2	Mississippi R.	26	98		
		Sand Cut	1	2		
		Cassville Slough	3	27		
		State Line Slough	1	2		
		Garnet L.	1	3		
		Ambrough Slough	2	3		
		L. Winneshiek	2	3		

Table 16. *Continued.*

Species	Basin	Water Body	No. Stations	No. Fish	Avg. No. Fish/Station**	
Mud darter (continued)	2	Thief Slough	1	1		
		Unnamed Slough	1	7		
		Fountain City Bay	1	17		
		Indian Point Slough	2	6		
		Probst L.	1	4		
		Moseman Slough	1	1		
	230	Platte R.	1	2		
		Sandy Cr.	1	14		
	240	Millville Cr.	1	1		
		Mill Cr.	1	1		
		Blue Mounds Cr.	1	3		
	250	Du Charme Cr.	1	1		
		Unnamed Cr.	1	1		
		Copper Cr.	1	6		
		Buck Cr.	1	4		
		Sugar Cr.	1	7		
		Rush Cr.	1	37		
		Bad Axe R.	1	3		
		Unnamed Cr.	1	6		
		Unnamed Cr.	1	33		
		Mormon Cr.	1	25		
		Pammel Cr.	1	4		
		270	Black R.	6	29	
			Fleming Cr.	1	1	
			Sand Cr.	1	6	
	280	Trempealeau R.	6	11		
	290	Waumandee Cr.	1	44		
		Buffalo R.	5	11		
		Deer Cr.	<u>1</u>	<u>6</u>		
		Total	80	430	5.4	

*Watch status is based on those species considered by the Department as watch at the time this final report was written (Bur. Endanger. Resour., pers. comm., 1985).

**Does not include stations at which the number of specimens was not recorded.

^aUnknown number taken. This station is not used in the average number of fish per station.

RECOMMENDATIONS

Continuing Use of Fish Distribution Data

Regardless of whether or not the survey of the state is completed, the computerized data base created by this research study exists as a resource for use by any interested person. Information can be obtained by users electronically through direct access to the computerized files. Users can also contact the Bureau of Research and request specialized print-outs of portions of the data base. Information obtained by both methods has assisted past users in activities such as preparing environmental impact assessments, forming master plans, and planning or conducting future research studies.

Use in Future Research Studies

This series of reports on fish distribution does not deal generally with the ecological data collected since 1974. These data include specific site information such as water temperature, turbidity, bottom type, aquatic vegetation type, etc. Accessing and analyzing these ecological data could provide useful baseline information for future fisheries or limnological research projects. Study data on fish distribution provide a similar baseline for other investigations.

Protection of Endangered and Threatened Species and Their Habitat

The aquatic environment of the inland waters in Wisconsin in which the endangered and threatened fish species are found should be protected. Any manipulations of this habitat should consider the presence of these valuable species.

Updating Present Records

DNR research and fisheries management personnel should in the course of routine surveys preserve at least 1 specimen of each endangered, threatened, and watch species they observe (except paddlefish, lake sturgeon, and American eel) and notify the Bureau of Research. This notification should include collection date; names of the species caught, collector, and water body; and water body identification code and location (township description). Such collections will permit continuing reassessment of the endangered and threatened species lists as required by law and of the watch list as well.

Completion of This Survey

Completion of a statewide survey has not been achieved due to funding reduction; only 50% of the inland geographic area of the state has been covered (Fig. 1). When additional funds become available for investigations of endangered, threatened, and/or nongame species, completion of the survey should be considered.

In order to guide completion of the survey, a detailed sampling plan has been prepared (Append. A). This plan is based on the premise that the level of sampling effort used to date in completed basins should also be used in the uncompleted basins. Given this premise, the uncompleted basins contain about 1,934 streams (26% of the total in these basins) to sample with about 4,071 stations (Append. Table A.3). There are also about 654 lakes (6% of total) to be sampled with about 3,606 stations (Append. Table A.4). These tables itemize the streams and lakes by length or acreage groups and for each group cite the total number of water bodies, percent to be sampled, number of water bodies that should be sampled, number of water bodies already completed, number of water bodies remaining to be sampled, number of stations per mile or per 100 acres,

number of stations that should be sampled, number of stations on these water bodies already sampled, and number of stations remaining to be sampled. Furthermore the same type of information on streams (Append. Tables A.5-A.16) and on lakes (Append. Tables A.17-A.30) is presented for each uncompleted basin.

An example illustrates how these tables are to be read. Appendix Table A.3 summarizes recommended effort for sampling streams in the uncompleted basins of the state: basins 2, 60-130, 240 (above mile 92), 300 (excluding the Red Cedar River sub-basin), and 400. In these basins, there are 606 streams that are 6-10 miles long. We recommend that these streams be sampled at the same rate (91%) as those streams of the same length in the completed basins. Thus 551 of the 6- to 10-mile streams should be sampled, of which sampling has been completed on 79 streams, leaving 472 streams yet to sample. In terms of stations on these streams, we recommend that the number of stations per mile be the same (0.2) as that for stations on streams of the same length in the completed basins. To determine the total number of stations that should be sampled, this rate of 0.2/mile was multiplied by the length of each of the 472 streams yet to sample. The results were rounded and added, arriving at a total of 715 stations. Of these, 32 stations were already sampled (i.e., sampling of some stations on a stream had been completed but other stations on the same stream had not been). The difference is 683 stations to be sampled on streams in the 6- to 10-mile length group. These same types of calculations were done for other length groups of streams (Append. Tables A.3, A.5-A.18) and surface area groups of lakes (Append. Tables A.4, A.19-A.30).

Using the knowledge from how many streams and lake stations were sampled per week in the completed basins, we estimate it will take about 7 years for a 3-person crew to sample the streams and 5 years for the same-sized crew to sample the lakes. Whether sampling intensity greater than, less than, or equal to this is used will have to be decided when and if the research study is resumed.

In addition to completion of the statewide field survey, nonfield updating of the data base is another activity that could be funded. This updating would involve a systematic effort to obtain fish survey reports after 1950 on all uncompleted basins and after 1980 from all other basins. Data in these reports would then be entered into the computerized file. At best this activity would be a long-term one involving both ongoing updating as well as the initial effort to do this work.

Appendix A. Sampling Effort for Completed and Projected Surveys of the State

Appendix Table A.1. Sampling effort used by Fish Distribution Study personnel in sampling streams in all basins already completed (10-50, 200-223, 230, 250-290, 300*, and 310).

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total	3,639	379	99	62	41	28	20	4	2	0	4,274
% sampled	20	91	100	98	100	97	100	100	100	-	31
No. sampled	730	345	99	61	41	29	20	4	2	-	1,331
Stations											
No. sampled	796	585	240	207	202	227	314	119	205	-	2,895
No. per mile**	- ^a	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.6	-	

* Includes streams in Red Cedar River sub-basin only.

** Based on average number of stations per stream length.

^a Needed at least one station per stream.

Appendix Table A.2. Sampling effort used by Fish Distribution Study personnel in sampling lakes in all basins already completed (10-50, 200-223, 230, 250-290, 300*, and 310).

Parameters	Surface Area Groups (acres)												Total
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	
Lakes													
Total no.	3,581	284	193	69	33	15	38	18	8	6	9	4	4,258
% sampled	1	21	31	68	64	80	89	88	87	100	75	75	8
No. sampled	41	66	79	48	22	13	35	16	7	6	7	3	343
Stations													
No. sampled	123	198	237	144	87	52	206	129	74	44	102	45	1,441
No. per 100 acres**	3	3	3	3	1.2	0.89	0.82	0.69	0.60	0.33	0.49	0.21	

* Includes only the Red Cedar River sub-basin.

** For lakes less than 300 acres, the number of stations given is the number per lake.

Appendix Table A.3. Streams by length groups, previous sampling, and sampling effort recommended for all basins not completed (2, 60-130, 240, 300, 400).^{*} Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	6,469	606	158	84	83	53	27	4	2	3	7,489
% to be sampled	20	91	100	98	100	97	100	100	100	100	30
No. that <u>should</u> be sampled**	1,294	551	158	84	83	53	27	4	2	3	2,259
No. completed	219 ^a	79	16	5	2	3	1	0	0	0	325 ^a
No. to be sampled	1,077	472	142	79	81	50	26	4	2	3	1,936
Stations											
No. per mile	^b	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.6	0.6	
No. that <u>should</u> be sampled	1,077	715	362	279	399	388	333	150	224	469	4,396
No. <u>already</u> sampled ^c	2	32	20	24	20	44	49	1	26	107	325
No. to be sampled	1,075	683	342	255	379	344	284	149	198	362	4,071

^{*} Excludes streams in the Red Cedar River basin and Wisconsin River basin below mile 92 because sampling of them has been completed.

^{**} Based on data from individual basins (Tables A.5-A.17) not the percentages to be sampled listed in this table.

^a Total includes 2 more streams sampled in basin 2 than needed.

^b Each stream must have at least 1 station.

^c Includes only stations on streams not completed.

Appendix Table A.4. Lakes by area groups, previous sampling, and sampling effort recommended for all basins not completed (2, 60-130, 240, 300, 400).^{*} Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)												Total
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	
Lakes													
Total no.	8,913	541	327	161	76	51	99	40	10	8	14	19	10,259
% to be sampled	1	21	31	68	64	80	89	88	87	100	100	100	7
No. that <u>should</u> be sampled**	93	113	104	110	50	42	90	35	9	8	14	19	687
No. completed	13	8	9	0	0	0	0	0	0	0	0	1	31
No. to be sampled	80	105	95	110	50	42	90	35	9	8	14	18	656
Stations													
No. per 100 acres ^a	3	3	3	3	1	1	1	1	17	20	20	25	
No. that <u>should</u> be sampled	240	318	285	330	193	172	639	428	153	160	280	450	3,648
No. <u>already</u> sampled ^b	3	3	5	5	5	4	6	1	0	0	2	14 ^c	48 ^c
No. to be sampled	237	315	280	325	188	168	633	427	153	160	278	442	3,606

^{*} Excludes lakes in the Red Cedar River sub-basin and Wisconsin River basin below mile 92 because sampling of them has been completed. Also excludes Lake Winnebago (137,000 acres).

^{**} Based on data from individual basins (Tables A.18-A.30) not percentages to be sampled listed in this table.

^a For lakes less than 300 acres and greater than 1,500 acres, the number of stations given is the number per lake.

^b Includes only stations on lakes not completed.

^c Total includes 6 more stations sampled in basin 2 than needed.

Appendix Table A.5. Streams by length groups, previous sampling, and sampling effort recommended for the Mississippi River basin (2). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	69	7	1	0	1	1	0	0	0	1	80
% to be sampled	20	91	100	-	100	97	-	-	-	100	
No. that <u>should</u> be sampled	14	6	1	-	1	1	-	-	-	1	24
No. completed	16 ^a	2	0	-	0	0	-	-	-	0	18 ^a
No. to be sampled	0	4	1	-	1	1	-	-	-	1	8
Stations											
No. per mile	.*	0.2	0.2	-	0.2	0.2	-	-	-	0.6	
No. that <u>should</u> be sampled	0	6	3	-	5	9	-	-	-	139	162
No. <u>already</u> sampled**	0	0	0	-	0	0	-	-	-	83	83
No. to be sampled	0	6	3	-	5	9	-	-	-	56	79

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

^a Total includes 2 more streams sampled than needed.

Appendix Table A.6. Streams by length groups, previous sampling, and sampling effort recommended for the Kewaunee River basin (60). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	11	3	1	0	1	0	0	0	0	0	16
% to be sampled	20	91	100	-	100	-	-	-	-	-	
No. that <u>should</u> be sampled	2	3	1	-	1	-	-	-	-	-	7
No. completed	0	0	0	-	0	-	-	-	-	-	0
No. to be sampled	2	3	1	-	1	-	-	-	-	-	7
Stations											
No. per mile	.*	0.2	0.2	-	0.2	-	-	-	-	-	
No. that <u>should</u> be sampled	2	5	3	-	6	-	-	-	-	-	16
No. <u>already</u> sampled**	0	0	0	-	0	-	-	-	-	-	0
No. to be sampled	2	5	3	-	6	-	-	-	-	-	16

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

Appendix Table A.7. Streams by length groups, previous sampling, and sampling effort recommended for the Door Peninsula drainage basin (70). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	41	9	2	1	0	0	1	0	0	0	54
% to be sampled	20	91	100	98	-	-	100	-	-	-	
No. that <u>should</u> be sampled	8	8	2	1	-	-	1	-	-	-	20
No. completed	0	0	0	0	-	-	0	-	-	-	0
No. to be sampled	8	8	2	1	-	-	1	-	-	-	20
Stations											
No. per mile	*	0.2	0.2	0.2	-	-	0.2	-	-	-	
No. that <u>should</u> be sampled	8	13	6	3	-	-	14	-	-	-	44
No. <u>already</u> sampled**	0	0	0	0	-	-	0	-	-	-	0
No. to be sampled	8	13	6	3	-	-	14	-	-	-	44

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

Appendix Table A.8. Streams by length groups, previous sampling, and sampling effort recommended for the Fox River basin (81). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	340	36	17	5	4	5	0	0	1	0	408
% to be sampled	20	91	100	98	100	97	-	-	100	-	
No. that <u>should</u> be sampled	68	33	17	5	4	5	-	-	1	-	133
No. completed	6	1	1	0	0	0	-	-	0	-	8
No. to be sampled	62	32	16	5	4	5	-	-	1	-	125
Stations											
No. per mile	*	0.2	0.2	0.2	0.2	0.2	-	-	0.6	-	
No. that <u>should</u> be sampled	62	48	42	19	19	39	-	-	118	-	347
No. <u>already</u> sampled**	0	1	4	0	0	4	-	-	2	-	11
No. to be sampled	62	47	38	19	19	35	-	-	116	-	336

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

Appendix Table A.9. Streams by length groups, previous sampling, and sampling effort recommended for the Wolf River basin (82). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	775	58	18	8	11	7	4	0	0	1	882
% to be sampled	20	91	100	98	100	97	100	-	-	100	
No. that <u>should</u> be sampled	155	53	18	8	11	7	4	-	-	1	257
No. completed	65	24	5	2	1	3	1	-	-	0	101
No. to be sampled	90	29	13	6	10	4	3	-	-	1	156
Stations											
No. per mile	-*	0.2	0.2	0.2	0.2	0.2	0.2	-	-	0.6	
No. that <u>should</u> be sampled	90	44	34	21	49	31	38	-	-	133	440
No. <u>already</u> sampled**	0	2	0	5	6	0	16	-	-	24	53
No. to be sampled	90	42	34	16	43	31	22	-	-	109	387

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

Appendix Table A.10. Streams by length groups, previous sampling, and sampling effort recommended for the Suamico River basin (90). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	11	6	0	1	1	1	0	0	0	0	20
% to be sampled	20	91	-	98	100	97	-	-	-	-	
No. that <u>should</u> be sampled	2	5	-	1	1	1	-	-	-	-	10
No. completed	1	2	-	0	0	0	-	-	-	-	3
No. to be sampled	1	3	-	1	1	1	-	-	-	-	7
Stations											
No. per mile	-*	0.2	-	0.2	0.2	0.2	-	-	-	-	
No. that <u>should</u> be sampled	1	5	-	3	4	8	-	-	-	-	21
No. <u>already</u> sampled**	0	1	-	0	2	1	-	-	-	-	4
No. to be sampled	1	4	-	3	2	7	-	-	-	-	17

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

Appendix Table A.11. Streams by length groups, previous sampling, and sampling effort recommended for the Pensaukee River basin (100). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	34	1	0	1	0	1	0	0	0	0	37
% to be sampled	20	91	-	98	-	97	-	-	-	-	
No. that <u>should</u> be sampled	7	1	-	1	-	1	-	-	-	-	10
No. completed	2	0	-	0	-	0	-	-	-	-	2
No. to be sampled	5	1	-	1	-	1	-	-	-	-	8
Stations											
No. per mile	*	0.2	-	0.2	-	0.2	-	-	-	-	
No. that <u>should</u> be sampled	5	1	-	4	-	9	-	-	-	-	19
No. <u>already</u> sampled**	2	0	-	0	-	3	-	-	-	-	5
No. to be sampled	3	1	-	4	-	6	-	-	-	-	14

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

Appendix Table A.12. Streams by length groups, previous sampling, and sampling effort recommended for the Oconto River basin (110). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	288	15	4	1	4	0	3	0	0	0	315
% to be sampled	20	91	100	98	100	-	100	-	-	-	
No. that <u>should</u> be sampled	58	14	4	1	4	-	3	-	-	-	84
No. completed	5	2	1	0	0	-	0	-	-	-	8
No. to be sampled	53	12	3	1	4	-	3	-	-	-	76
Stations											
No. per mile	*	0.2	0.2	0.2	0.2	-	0.2	-	-	-	
No. that <u>should</u> be sampled	53	17	8	3	21	-	36	-	-	-	138
No. <u>already</u> sampled**	0	0	0	0	0	-	0	-	-	-	0
No. to be sampled	53	17	8	3	21	-	36	-	-	-	138

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

Appendix Table A.13. Streams by length groups, previous sampling, and sampling effort recommended for the Peshtigo River basin (120). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	313	27	5	5	3	1	0	1	0	0	355
% to be sampled	20	91	100	98	100	97	-	100	-	-	
No. that <u>should</u> be sampled	63	25	5	5	3	1	-	1	-	-	103
No. completed	0	2	0	0	0	0	-	0	-	-	2
No. to be sampled	63	23	5	5	3	1	-	1	-	-	101
Stations											
No. per mile	*	0.2	0.2	0.2	0.2	0.2	-	0.3	-	-	
No. that <u>should</u> be sampled	63	35	13	18	13	7	-	41	-	-	190
No. <u>already</u> sampled**	0	0	1	0	0	0	-	0	-	-	1
No. to be sampled	63	35	12	18	13	7	-	41	-	-	189

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

Appendix Table A.14. Streams by length groups, previous sampling, and sampling effort recommended for the Menominee River basin (130). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	482	29	9	5	2	4	2	1	0	0	534
% to be sampled	20	91	100	98	100	97	100	100	-	-	
No. that <u>should</u> be sampled	96	26	9	5	2	4	2	1	-	-	145
No. completed	0	0	0	0	0	0	0	0	-	-	0
No. to be sampled	96	26	9	5	2	4	2	1	-	-	145
Stations											
No. per mile	*	0.2	0.2	0.2	0.2	0.2	0.2	0.3	-	-	
No. that <u>should</u> be sampled	96	40	21	17	11	28	27	36	-	-	276
No. <u>already</u> sampled**	0	0	0	0	0	0	0	0	-	-	0
No. to be sampled	96	40	21	17	11	28	27	36	-	-	276

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

Appendix Table A.15. Streams by length groups, previous sampling, and sampling effort recommended for the Wisconsin River basin (240).^{*} Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	1,720	196	37	25	25	8	7	1	0	1	2,020
% to be sampled	20	91	100	98	100	97	100	100	-	100	
No. that <u>should</u> be sampled	344	178	37	25	25	8	7	1	-	1	626
No. completed	0	0	0	0	0	0	0	0	-	0	0
No. to be sampled	344	178	37	25	25	8	7	1	-	1	626
Stations											
No. per mile	-**	0.2	0.2	0.2	0.2	0.2	0.2	0.3	-	0.6	
No. that <u>should</u> be sampled	344	271	92	87	122	65	90	36	-	197	1,304
No. <u>already</u> sampled ^a	0	2	0	2	0	0	0	1	-	0	5
No. to be sampled	344	269	92	85	122	65	90	35	-	197	1,299

^{*} Excludes streams below mile 92 in the Wisconsin River basin because sampling of them is completed.

^{**} Each stream must have at least 1 station.

^a Includes only stations on streams not completed.

Appendix Table A.16. Streams by length groups, previous sampling, and sampling effort recommended for the Chippewa River basin (300).^{*} Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	1,617	146	48	24	22	16	7	1	1	0	1,882
% to be sampled	20	91	100	98	100	97	100	100	100	-	
No. that <u>should</u> be sampled	323	133	48	24	22	16	7	1	1	-	575
No. completed	80	19	6	1	0	0	0	0	0	-	106
No. to be sampled	243	114	42	23	22	16	7	1	1	-	469
Stations											
No. per mile	-**	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.6	-	
No. that <u>should</u> be sampled	243	171	107	83	109	122	88	37	106	-	1,066
No. <u>already</u> sampled ^a	0	10	4	8	12	15	18	0	24	-	91
No. to be sampled	243	161	103	75	97	107	70	37	82	-	975

^{*} Excludes streams in the Red Cedar River basin because sampling of them is completed.

^{**} Each stream must have at least 1 station.

^a Includes only stations on streams not completed.

Appendix Table A.17. Streams by length groups, previous sampling, and sampling effort recommended for the Lake Superior drainage basin (400). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Length Groups (miles)										Total
	0-5	6-10	11-15	16-20	21-30	31-50	51-100	101-150	151-200	>201	
Streams											
Total no.	768	73	16	8	9	9	3	0	0	0	886
% to be sampled	20	91	100	98	100	97	100	-	-	-	
No. that <u>should</u> be sampled	154	66	16	8	9	9	3	-	-	-	265
No. completed	44	27	3	2	1	0	0	-	-	-	77
No. to be sampled	110	39	13	6	8	9	3	-	-	-	188
Stations											
No. per mile	*	0.2	0.2	0.2	0.2	0.2	0.2	-	-	-	
No. that <u>should</u> be sampled	110	59	33	21	40	70	40	-	-	-	373
No. <u>already</u> sampled**	0	16	11	9	0	21	15	-	-	-	72
No. to be sampled	110	43	22	12	40	49	25	-	-	-	301

* Each stream must have at least 1 station.

** Includes only stations on streams not completed.

Appendix Table A.18. Lakes by area groups, previous sampling, and sampling effort recommended for the Mississippi River basin (2). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)												Total
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	
Lakes													
Total no.	72	11	6	1	3	0	1	0	0	1	0	3	98
% to be sampled	1	21	31	68	64	80	89	-	-	100	-	100	
No. that <u>should</u> be sampled	1	2	2	1	2	0	1	-	-	1	-	3	13
No. completed	0	0	0	0	0	0	0	-	-	0	-	1	1
No. to be sampled	1	2	2	1	2	0	1	-	-	1	-	2	12
Stations													
No. per 100 acres*	3	3	3	3	1	1	1	-	-	20	-	25	
No. that <u>should</u> be sampled	3	6	6	3	8	0	9	-	-	20	-	50	105
No. <u>already</u> sampled**	3	3	3	0	2	0	2	-	-	0	-	6 ^a	19 ^a
No. to be sampled	0	3	3	3	6	0	7	-	-	20	-	50	92

* For lakes less than 300 acres and greater than 1,500 acres, the number of stations given is the number per lake.

** Includes only stations on lakes not completed.

^a Total includes 6 more stations sampled than needed.

Appendix Table A.19. Lakes by area groups, previous sampling, and sampling effort recommended for the Kewaunee River basin (60). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)												Total
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	
Lakes													
Total no.	3	0	0	0	0	0	0	0	0	0	0	0	3
% to be sampled	1	-	-	-	-	-	-	-	-	-	-	-	-
No. that <u>should</u> be sampled	1	-	-	-	-	-	-	-	-	-	-	-	1
No. completed	0	-	-	-	-	-	-	-	-	-	-	-	0
No. to be sampled	1	-	-	-	-	-	-	-	-	-	-	-	1
Stations													
No. per 100 acres*	3	-	-	-	-	-	-	-	-	-	-	-	-
No. that <u>should</u> be sampled	3	-	-	-	-	-	-	-	-	-	-	-	3
No. <u>already</u> sampled**	0	-	-	-	-	-	-	-	-	-	-	-	0
No. to be sampled	3	-	-	-	-	-	-	-	-	-	-	-	3

* For lakes less than 300 acres, the number of stations given is the number per lake.

** Includes only stations on lakes not completed.

Appendix Table A.20. Lakes by area groups, previous sampling, and sampling effort recommended for the Door Peninsula drainage basin (70). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)												Total
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	
Lakes													
Total no.	24	4	1	1	1	0	1	1	0	0	0	0	33
% to be sampled	1	21	31	68	64	-	89	88	-	-	-	-	-
No. that <u>should</u> be sampled	1	1	1	1	1	-	1	1	-	-	-	-	7
No. completed	0	0	0	0	0	-	0	0	-	-	-	-	0
No. to be sampled	1	1	1	1	1	-	1	1	-	-	-	-	7
Stations													
No. per 100 acres*	3	3	3	3	1	-	1	1	-	-	-	-	-
No. that <u>should</u> be sampled	3	3	3	3	3	-	9	11	-	-	-	-	35
No. <u>already</u> sampled**	0	0	0	0	0	-	0	0	-	-	-	-	0
No. to be sampled	3	3	3	3	3	-	9	11	-	-	-	-	35

* For lakes less than 300 acres, the number of stations given is the number per lake.

** Includes only stations on lakes not completed.

Appendix Table A.21. Lakes by area groups, previous sampling, and sampling effort recommended for the Fox River basin (81).*
Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)												Total
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	
Lakes													
Total no.	262	24	5	7	2	2	3	2	0	1	2	4	314
% to be sampled	1	21	31	68	64	80	89	88	-	100	100	100	
No. that <u>should</u> be sampled	3	5	2	5	1	2	3	2	-	1	2	4	30
No. completed	0	0	0	0	0	0	0	0	-	0	0	0	0
No. to be sampled	3	5	2	5	1	2	3	2	-	1	2	4	30
Stations													
No. per 100 acres**	3	3	3	3	1	1	1	1	-	20	20	25	
No. that <u>should</u> be sampled	9	18	6	15	3	8	24	28	-	20	40	100	271
No. <u>already</u> sampled ^a	0	0	0	0	0	0	0	0	-	0	0	1	1
No. to be sampled	9	18	6	15	3	8	24	28	-	20	40	99	270

* Does not include Lake Winnebago (137,000 acres).

** For lakes less than 300 acres and greater than 1,500 acres, the number of stations given is the number per lake.

^a Includes only stations on lakes not completed.

Appendix Table A.22. Lakes by area groups, previous sampling, and sampling effort recommended for the Wolf River basin (82).
Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)												Total
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	
Lakes													
Total no.	1,060	66	27	13	4	2	3	6	1	1	1	2	1,186
% to be sampled	1	21	31	68	64	80	89	88	87	100	100	100	
No. that <u>should</u> be sampled	11	14	8	9	3	2	3	5	1	1	1	2	60
No. completed	5	1	0	0	0	0	0	0	0	0	0	0	6
No. to be sampled	6	13	8	9	3	2	3	5	1	1	1	2	54
Stations													
No. per 100 acres*	3	3	3	3	1	1	1	1	17	20	20	25	
No. that <u>should</u> be sampled	18	39	24	27	9	10	21	60	17	20	20	50	315
No. <u>already</u> sampled**	0	0	0	0	0	0	0	0	0	0	1	6	7
No. to be sampled	18	39	24	27	9	10	21	60	17	20	19	44	308

* For lakes less than 300 acres and greater than 1,500 acres, the number of stations given is the number per lake.

** Includes only stations on lakes not completed.

Appendix Table A.23. Lakes by area groups, previous sampling, and sampling effort recommended for the Suamico River basin (90). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)											Total	
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000		>5,001
Lakes													
Total no.	17	0	0	0	0	0	0	0	0	0	0	0	17
% to be sampled	1	-	-	-	-	-	-	-	-	-	-	-	-
No. that <u>should</u> be sampled	1	-	-	-	-	-	-	-	-	-	-	-	1
No. completed	0	-	-	-	-	-	-	-	-	-	-	-	0
No. to be sampled	1	-	-	-	-	-	-	-	-	-	-	-	1
Stations													
No. per 100 acres*	3	-	-	-	-	-	-	-	-	-	-	-	-
No. that <u>should</u> be sampled	3	-	-	-	-	-	-	-	-	-	-	-	3
No. <u>already</u> sampled**	0	-	-	-	-	-	-	-	-	-	-	-	0
No. to be sampled	3	-	-	-	-	-	-	-	-	-	-	-	3

* For lakes less than 300 acres, the number of stations given is the number per lake.

** Includes only stations on lakes not completed.

Appendix Table A.24. Lakes by area groups, previous sampling, and sampling effort recommended for the Pensaukee River basin (100). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)											Total	
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000		>5,001
Lakes													
Total no.	8	0	1	0	0	0	0	0	0	0	0	0	9
% to be sampled	1	-	31	-	-	-	-	-	-	-	-	-	-
No. that <u>should</u> be sampled	1	-	1	-	-	-	-	-	-	-	-	-	2
No. completed	0	-	0	-	-	-	-	-	-	-	-	-	0
No. to be sampled	1	-	1	-	-	-	-	-	-	-	-	-	2
Stations													
No. per 100 acres*	3	-	3	-	-	-	-	-	-	-	-	-	-
No. that <u>should</u> be sampled	3	-	3	-	-	-	-	-	-	-	-	-	6
No. <u>already</u> sampled**	0	-	0	-	-	-	-	-	-	-	-	-	0
No. to be sampled	3	-	3	-	-	-	-	-	-	-	-	-	6

* For lakes less than 300 acres, the number of stations given is the number per lake.

** Includes only stations on lakes not completed.

Appendix Table A.25. Lakes by area groups, previous sampling, and sampling effort recommended for the Oconto River basin (110). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)												
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	Total
Lakes													
Total no.	413	20	12	5	3	5	0	0	0	0	0	0	458
% to be sampled	1	21	31	68	64	80	-	-	-	-	-	-	
No. that <u>should</u> be sampled	4	4	4	3	2	4	-	-	-	-	-	-	21
No. completed	0	0	0	0	0	0	-	-	-	-	-	-	0
No. to be sampled	4	4	4	3	2	4	-	-	-	-	-	-	21
Stations													
No. per 100 acres*	3	3	3	3	1	1	-	-	-	-	-	-	
No. that <u>should</u> be sampled	12	12	12	9	8	16	-	-	-	-	-	-	69
No. <u>already</u> sampled**	0	0	0	0	0	0	-	-	-	-	-	-	0
No. to be sampled	12	12	12	9	8	16	-	-	-	-	-	-	69

* For lakes less than 300 acres, the number of stations given is the number per lake.

** Includes only stations on lakes not completed.

Appendix Table A.26. Lakes by area groups, previous sampling, and sampling effort recommended for the Peshtigo River basin (120). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)												
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	Total
Lakes													
Total no.	414	16	8	5	1	2	2	2	0	1	0	0	451
% to be sampled	1	21	31	68	64	80	59	88	-	100	-	-	
No. that <u>should</u> be sampled	4	3	3	3	1	2	2	2	-	1	-	-	21
No. completed	0	0	0	0	0	0	0	0	-	0	-	-	0
No. to be sampled	4	3	3	3	1	2	2	2	-	1	-	-	21
Stations													
No. per 100 acres*	3	3	3	3	1	1	1	1	-	20	-	-	
No. that <u>should</u> be sampled	12	9	9	9	3	10	16	26	-	20	-	-	114
No. <u>already</u> sampled**	0	0	0	0	0	0	0	0	-	0	-	-	0
No. to be sampled	12	9	9	9	3	10	16	26	-	20	-	-	114

* For lakes less than 300 acres and greater than 1,500 acres, the number of stations given is the number per lake.

** Includes only stations on lakes not completed.

Appendix Table A.27. Lakes by area groups, previous sampling, and sampling effort recommended for the Menominee River basin (130). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)												Total
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	
Lakes													
Total no.	700	31	13	6	1	2	5	1	0	0	0	0	759
% to be sampled	1	21	31	68	64	80	89	88	-	-	-	-	
No. that <u>should</u> be sampled	7	7	4	4	1	2	5	1	-	-	-	-	31
No. completed	0	0	0	0	0	0	0	0	-	-	-	-	0
No. to be sampled	7	7	4	4	1	2	5	1	-	-	-	-	31
Stations													
No. per 100 acres*	3	3	3	3	1	1	1	1	-	-	-	-	
No. that <u>should</u> be sampled	21	21	12	12	3	8	35	13	-	-	-	-	125
No. <u>already</u> sampled**	0	0	0	0	0	0	0	0	-	-	-	-	0
No. to be sampled	21	21	12	12	3	8	35	13	-	-	-	-	125

* For lakes less than 300 acres, the number of stations given is the number per lake.

** Includes only stations on lakes not completed.

Appendix Table A.28. Lakes by area groups, previous sampling, and sampling effort recommended for the Wisconsin River basin (240). * Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)												Total
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000	>5,001	
Lakes													
Total no.	2,729	164	122	63	30	19	41	13	7	4	4	6	3,202
% to be sampled	1	21	31	68	64	80	89	88	87	100	100	100	
No. that <u>should</u> be sampled	27	34	38	43	19	15	37	11	6	4	4	6	244
No. completed	0	0	0	0	0	0	0	0	0	0	0	0	0
No. to be sampled	27	34	38	43	19	15	37	11	6	4	4	6	244
Stations													
No. per 100 acres**	3	3	3	3	1	1	1	1	17	20	20	25	
No. that <u>should</u> be sampled	81	102	114	129	76	60	259	132	102	80	80	150	1,365
No. <u>already</u> sampled ^a	0	0	1	0	0	0	0	0	0	0	0	0	1
No. to be sampled	81	102	113	129	76	60	259	132	102	80	80	150	1,364

* Excludes lakes below mile 92 on the Wisconsin River because sampling of them has been completed.

** For lakes less than 300 acres and greater than 1,500 acres, the number of stations given is the number per lake.

^a Includes only stations on lakes not completed.

Appendix Table A.29. Lakes by area groups, previous sampling, and sampling effort recommended for the Chippewa River basin (300).* Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)											Total	
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000		>5,001
Lakes													
Total no.	2,209	147	106	45	22	14	36	13	2	0	6	4	2,604
% to be sampled	1	21	31	68	64	80	89	88	87	-	100	100	
No. that <u>should</u> be sampled	22	31	33	31	14	11	32	11	2	-	6	4	197
No. completed	1	0	1	0	0	0	0	0	0	-	0	0	2
No. to be sampled	21	31	32	31	14	11	32	11	2	-	6	4	195
Stations													
No. per 100 acres**	3	3	3	3	1	1	1	1	17	-	20	25	
No. that <u>should</u> be sampled	63	93	96	93	56	44	224	132	34	-	120	100	1,055
No. <u>already</u> sampled ^a	0	0	1	0	0	0	3	0	0	-	1	1	6
No. to be sampled	63	93	95	93	56	44	221	132	34	-	119	99	1,049

* Excludes lakes in the Red Cedar River basin because sampling of them has been completed.

** For lakes less than 300 acres and greater than 1,500 acres, the number of stations given is the number per lake.

^a Includes only stations on lakes not completed.

Appendix Table A.30. Lakes by area groups, previous sampling, and recommended sampling effort recommended for the Lake Superior drainage basin (400). Sampling frequency follows that used by the Fish Distribution Study for completed basins.

Parameters	Surface Area Groups (acres)											Total	
	0-50	51-100	101-200	201-300	301-400	401-500	501-1,000	1,001-1,500	1,501-2,000	2,001-2,500	2,501-5,000		>5,001
Lakes													
Total no.	1,002	58	26	15	9	5	7	2	0	0	1	0	1,125
% to be sampled	1	21	31	68	64	80	89	88	-	-	100	-	
No. that <u>should</u> be sampled	10	12	8	10	6	4	6	2	-	-	1	-	59
No. completed	7	7	8	0	0	0	0	0	-	-	0	-	22
No. to be sampled	3	5	0	10	6	4	6	2	-	-	1	-	37
Stations													
No. per 100 acres*	3	3	3	3	1	1	1	1	-	-	20	-	
No. that <u>should</u> be sampled	9	15	0	30	24	16	42	26	-	-	20	-	182
No. <u>already</u> sampled**	0	0	0	5	3	4	1	1	-	-	0	-	14
No. to be sampled	9	15	0	25	21	12	41	25	-	-	20	-	168

* For lakes less than 300 acres and greater than 1,500 acres, the number of stations given is the number per lake.

** Includes only stations on lakes not completed.

Appendix B. Listings of Species and Collectors

Appendix Table B.1. *Non-DNR collections used in this report for the 1900-72 period. This list includes: (1) the alphanumeric code and common name of each fish species collected; (2) in brackets, the percent of stations or records—from both DNR and non-DNR collectors—reported for the 1900-50 portion of the 1900-72 period; (3) codes identifying sources of non-DNR collections (according to a key given at the end of this table); and (4) in parenthesis, the number of stations for each collector category.*

Fish Code	Fish Names and Sources	Fish Code	Fish Names and Sources
A02	Chestnut lamprey [18] 1(4), 18(3)	I22	Brook trout [13] 1(83), 3(91), 6(2), 11(5), 22(23)
A03	Northern brook lamprey [3] 1(1), 2(1), 3(20), 22(6)	I23	Lake trout [100] 1(7)
A04	Silver lamprey [41] 1(7), 3(2), 11(1), 18(6), 20(1), 22(11)	J01	Rainbow smelt [0] 11(1), 22(12)
A05	American brook lamprey [15] 1(7), 3(20), 6(4)	K01	Central mudminnow [27] 1(181), 2(1), 3(161), 5(6), 6(49), 7(3), 11(6), 18(3), 22(13)
A06	Sea lamprey [0] 3(1), 22(13)	L01	Grass pickerel [36] 1(29), 2(1), 3(13), 4(1), 5(5), 6(14), 11(1), 18(2)
B01	Lake sturgeon [26] 1(4), 2(1), 11(1), 18(4), 22(1), 26(2)	L02	Northern pike [20] 1(123), 2(1), 3(127), 4(1), 5(1), 6(33), 11(6), 18(19), 22(12)
B02	Shovelnose sturgeon [24] 1(5), 3(2), 18(5)	L03	Muskellunge [17] 1(8), 2(1), 3(4), 6(1), 11(2), 22(3)
C01	Paddlefish [89] 1(4), 18(4)	M06	Central stoneroller [28] 1(81), 3(121), 5(2), 6(1), 18(3)
D01	Longnose gar [31] 1(16), 3(19), 6(4), 18(15), 22(1)	M07	Largescale stoneroller [73] 1(115), 3(41), 6(1)
D02	Shortnose gar [41] 1(9), 2(1), 3(6), 11(2), 18(16), 20(1)	M09	Redside dace [48] 1(33), 3(7), 6(4), 11(1)
E01	Bowfin [23] 1(12), 3(5), 6(5), 11(1), 18(16), 22(1)	M10	Lake chub [11] 1(2), 3(1), 6(2), 11(1), 22(12)
F01	American eel [52] 1(5), 18(8), 20(1), 26(1)	M12	Common carp [20] 1(81), 3(100), 4(1), 5(6), 6(32), 7(2), 11(5), 18(20), 22(2)
G01	Alewife [20] 1(1), 3(2), 7(1)	M14	Brassy minnow [20] 1(42), 2(2), 3(103), 5(2), 6(45), 18(4), 22(3)
G02	Gizzard shad [30] 1(15), 3(20), 6(11), 11(9), 18(21), 20(2)	M15	Mississippi silvery minnow [48] 1(44), 3(31), 6(15), 11(9), 18(10)
G03	Skipjack herring [100] 1(3)	M16	Speckled chub [35] 1(8), 3(18), 6(5), 11(1), 18(6)
H01	Goldeye [55] 1(2), 18(7), 20(2)	M17	Silver chub [49] 1(17), 3(12), 11(1), 18(9), 20(2)
H02	Mooneye [28] 1(8), 3(3), 6(1), 11(2), 18(15), 20(2)	M18	Gravel chub [50] 1(1), 3(1)
I04	Cisco or lake herring [82] 1(29), 18(1), 22(1), 26(2)	M19	Hornyhead chub [29] 1(161), 2(1), 3(210), 4(1), 5(11), 6(68), 11(6), 22(10)
I05	Lake whitefish [100] 1(6)	M20	Golden shiner [31] 1(131), 2(2), 3(119), 4(1), 5(3), 6(41), 7(4), 11(1), 18(9), 22(15)
I19	Rainbow trout [18] 1(17), 3(16), 6(1), 11(3), 22(18)		
I21	Brown trout [3] 1(15), 3(70), 6(12), 11(1), 22(18)		

Appendix Table B.1. *Continued.*

Fish Code	Fish Names and Sources	Fish Code	Fish Names and Sources
M21	Pallid shiner [81] 1(18), 3(3), 8(10)	M42	Northern redbelly dace [25] 1(57), 3(114), 5(2), 6(7), 11(3), 22(3)
M22	Pugnose shiner [67] 1(13), 3(3), 6(1), 11(2), 18(1)	M43	Southern redbelly dace [36] 1(77), 3(48), 5(5), 6(70), 11(3), 18(1)
M23	Emerald shiner [24] 1(69), 2(3), 3(107), 4(1), 5(2), 6(58), 11(18), 18(17), 20(1), 22(4)	M44	Finescale dace [27] 1(17), 3(4), 6(2), 22(2)
M24	River shiner [44] 1(43), 3(37), 6(8), 11(6), 18(16), 22(1)	M45	Bluntnose minnow [37] 1(387), 2(3), 3(326), 5(16), 6(157), 11(8), 18(9), 22(3)
M25	Ghost shiner [100] 18(8)	M46	Fathead minnow [30] 1(134), 3(150), 4(1), 5(8), 6(93), 7(3), 11(2), 18(6), 22(8)
M27	Striped shiner [44] 1(11), 3(8), 6(6)	M47	Bullhead minnow [31] 1(32), 2(1), 3(45), 6(29), 11(12), 18(14)
M28	Common shiner [30] 1(381), 2(5), 3(365), 4(1), 5(25), 6(142), 11(18), 18(3), 22(16)	M48	Blacknose dace [27] 1(250), 3(190), 5(9), 6(81), 11(11), 22(12)
M29	Bigmouth shiner [25] 1(81), 3(113), 5(19), 6(76), 11(3), 18(10), 26(1)	M49	Longnose dace [21] 1(110), 3(102), 6(43), 11(7), 22(12)
M30	Pugnose minnow [34] 1(10), 2(1), 3(16), 5(1), 6(16), 18(11)	M50	Creek chub [26] 1(414), 3(316), 5(22), 6(168), 7(6), 11(15), 18(2), 22(18)
M31	Blackchin shiner [51] 1(41), 2(1), 3(24), 4(1), 5(2), 6(5)	M51	Pearl dace [39] 1(107), 3(109), 5(1), 6(5), 11(1), 22(3)
M32	Blacknose shiner [51] 1(117), 3(88), 4(1), 5(2), 6(7), 22(8)	M52	Red shiner [0] 3(2)
M33	Spottail shiner [34] 1(68), 3(68), 6(21), 11(8), 18(13), 20(2), 22(13)	N05	River carpsucker [25] 1(6), 3(19), 6(3), 18(13)
M34	Ozark minnow [47] 1(7), 3(4), 6(2), 11(2)	N06	Quillback [19] 1(15), 3(33), 6(19), 11(1), 18(14), 20(1)
M35	Rosyface shiner [40] 1(73), 3(74), 5(2), 6(20), 11(4), 18(2)	N07	Highfin carpsucker [31] 1(5), 3(6), 6(3), 18(4)
M36	Spotfin shiner [34] 1(150), 3(158), 5(3), 6(88), 11(13), 18(11), 20(1)	N08	Longnose sucker [30] 1(6), 6(1), 11(1), 22(12)
M37	Sand shiner [32] 1(71), 3(102), 5(1), 6(44), 11(1), 18(9), 20(1), 22(8)	N09	White sucker [26] 1(542), 2(3), 3(409), 4(1), 5(27), 6(169), 7(3), 11(19), 18(12), 20(1), 22(29)
M38	Weed shiner [74] 1(60), 3(17), 6(5), 11(3), 18(9), 22(1)	N10	Blue sucker [16] 1(1), 3(2), 18(6)
M39	Redfin shiner [62] 1(44), 3(12), 6(12)	N11	Creek chubsucker [100] 1(2)
M40	Mimic shiner [72] 1(98), 2(5), 3(27), 6(4), 18(9), 20(1), 22(3)	N12	Lake chubsucker [22] 1(11), 3(4), 4(1), 5(2), 6(8)
M41	Suckermouth minnow [34] 1(39), 3(41), 6(29), 11(3), 18(4)		

Appendix Table B.1. Continued.

Fish Code	Fish Names and Sources	Fish Code	Fish Names and Sources
N13	Northern hog sucker [31] 1(116), 3(103), 5(5), 6(28), 11(3), 18(3)	S02	Blackstripe topminnow [29] 1(15), 3(18), 5(2), 6(15)
N14	Smallmouth buffalo [25] 1(2), 3(7), 6(1), 11(9), 18(14), 20(1)	S03	Starhead topminnow [29] 1(2), 4(1), 6(4)
N15	Bigmouth buffalo [45] 1(7), 3(8), 6(1), 18(14)	T01	Brook silverside [66] 1(43), 3(55), 5(1), 6(28), 11(3), 18(12)
N16	Black buffalo [73] 1(3), 18(11)	U01	Brook stickleback [30] 1(214), 2(1), 3(130), 5(12), 6(91), 11(6), 18(2), 22(14)
N17	Spotted sucker [34] 1(12), 3(10), 6(6), 11(1), 18(18), 20(1)	U02	Ninespine stickleback [43] 1(3), 2(1), 22(3)
N18	Silver redhorse [34] 1(30), 3(29), 6(5), 11(2), 18(13), 20(1), 22(4)	V01	White bass [26] 1(35), 3(52), 6(15), 11(5), 18(22), 20(2)
N19	River redhorse [50] 1(1), 20(1)	V02	Yellow bass [16] 1(3), 3(31), 6(3), 18(9)
N21	Golden redhorse [32] 1(48), 3(59), 5(1), 6(12), 11(2), 18(12)	W04	Rock bass [33] 1(160), 2(5), 3(99), 4(1), 5(5), 6(26), 11(3), 18(14), 20(1), 22(11)
N22	Shorthead redhorse [25] 1(61), 3(81), 6(14), 11(5), 18(19), 20(1), 22(6)	W05	Green sunfish [17] 1(46), 3(82), 4(1), 5(10), 6(52), 7(5), 11(3), 18(7)
N23	Greater redhorse [71] 1(10), 3(1), 18(1)	W06	Pumpkinseed [23] 1(144), 2(1), 3(190), 4(1), 5(4), 6(48), 7(2), 11(3), 18(14), 22(9)
O05	Black bullhead [23] 1(83), 3(128), 5(4), 6(43), 7(1), 11(4), 18(13), 20(1), 22(10)	W07	Warmouth [17] 1(4), 3(5), 4(1), 5(1), 6(9), 18(7)
O06	Yellow bullhead [27] 1(55), 2(1), 3(66), 4(1), 5(3), 6(28), 11(2), 18(15), 22(3)	W08	Orangespotted sunfish [27] 1(10), 3(38), 4(1), 5(2), 6(12), 18(11)
O07	Brown bullhead [28] 1(33), 3(18), 6(1), 7(1), 11(1), 18(9), 22(3)	W09	Bluegill [20] 1(151), 2(1), 3(207), 4(1), 5(6), 6(80), 7(3), 11(10), 18(23), 22(14)
O08	Channel catfish [23] 1(28), 3(32), 6(7), 11(1), 18(18), 20(1), 22(1)	W10	Longear sunfish [69] 1(18), 3(3), 4(1), 6(2), 11(1)
O09	Slender madtom [71] 1(5), 2(1), 6(1)	W11	Smallmouth bass [26] 1(111), 2(3), 3(114), 5(2), 6(34), 11(14), 18(13), 20(1), 22(5)
O10	Stonecat [18] 1(21), 3(49), 5(7), 6(10), 7(1), 11(2), 18(5), 22(9)	W12	Largemouth bass [29] 1(204), 2(4), 3(155), 4(1), 5(3), 6(52), 7(1), 11(8), 18(19), 22(14)
O11	Tadpole madtom [37] 1(57), 3(68), 6(30), 11(1), 18(9), 22(4)	W13	White crappie [37] 1(38), 3(32), 6(13), 11(1), 18(18)
O12	Flathead catfish [34] 1(8), 3(1), 18(15), 20(1)	W14	Black crappie [22] 1(112), 2(1), 3(137), 4(1), 5(2), 6(51), 11(9), 18(20), 20(1), 22(6)
P01	Pirate perch [43] 1(5), 2(1), 3(5), 6(3), 11(3), 18(5)	X03	Crystal darter [30] 1(1), 18(1)
Q01	Trout-perch [42] 1(21), 2(5), 3(8), 6(5), 18(7), 20(2), 22(11)	X04	Western sand darter [30] 1(9), 3(27), 6(5), 11(4), 18(9), 20(1)
R01	Burbot [27] 1(33), 3(14), 6(1), 18(2), 22(9)	X05	Mud darter [68] 1(20), 3(4), 6(6), 11(2), 18(8)
S01	Banded killifish [48] 1(32), 3(21), 4(1), 5(1), 6(12), 20(1)	X07	Rainbow darter [38] 1(45), 3(41), 4(1), 5(6), 6(13), 11(2)

Appendix Table B.1. Continued.

Fish Code	Fish Names and Sources	Fish Code	Fish Names and Sources
X08	Bluntnose darter [100] 18(2)	X17	Gilt darter [80] 1(4)
X09	Iowa darter [52] 1(119), 2(3), 3(65), 6(16), 11(3), 18(3), 22(4)	X18	Blackside darter [42] 1(131), 3(111), 4(1), 5(1), 6(27), 7(1), 11(2), 18(4)
X10	Fantail darter [36] 1(164), 2(1), 3(94), 4(1), 5(6), 6(99), 11(9), 18(2)	X19	Slenderhead darter [40] 1(17), 3(28), 6(1), 11(2), 18(5)
X11	Least darter [60] 1(40), 3(10), 5(3), 6(14)	X20	River darter [48] 1(16), 3(20), 6(3), 18(11), 20(1), 22(1)
X12	Johnny darter [35] 1(514), 2(5), 3(356), 4(1), 5(24), 6(174), 7(1), 11(26), 18(15), 20(1), 22(15)	X21	Sauger [24] 1(10), 3(9), 6(4), 11(5), 18(23), 20(2)
X14	Banded darter [25] 1(35), 3(67), 5(9), 6(25), 11(3)	X22	Walleye [16] 1(46), 2(2), 3(60), 5(1), 6(17), 11(2), 18(20), 22(9)
X15	Yellow perch [32] 1(274), 2(6), 3(213), 4(1), 6(43), 11(5), 18(17), 20(1), 22(23)	Y01	Freshwater drum [27] 1(32), 3(33), 6(6), 11(1), 18(20), 20(1)
X16	Logperch [37] 1(108), 2(2), 3(96), 4(1), 5(3), 6(22), 11(6), 18(15), 20(1), 22(14)	Z01	Mottled sculpin [30] 1(163), 2(5), 3(171), 6(43), 11(5), 22(17)
		Z02	Slimy sculpin [0] 1(8), 3(1), 6(14), 11(1), 22(5)

Key to Collectors' Code

1. Early Wisconsin fish collections (1900-44).*
2. University of Wisconsin-Madison students (1946-82).**
3. University of Wisconsin-Stevens Point, Dr. George Becker, Dr. Daniel Coble, and students (1952-78).*
4. University of Wisconsin-Milwaukee, Dr. Carroll Norden and students (1972).*
5. University of Wisconsin-Whitewater, Dr. George Seeburger and students (1968-71).**
6. University of Wisconsin-Waukesha, Prof. Marlin Johnson and students (1964-72).*
7. University of Wisconsin-Parkside students (1971).**
8. University of Wisconsin-Eau Claire, Dr. David Crowe (1974).**
9. Beloit College, Dr. John Lutz and students (1976-77).**
10. University of Wisconsin-La Crosse, Prof. John Held and students (1975-80).**
11. Milwaukee Public Museum, Milwaukee (1969-75).*
12. ENCAP, Inc., Dr. Greenfield, DeKalb University, DeKalb, IL (1980).**
13. Dairyland Power Cooperative, La Crosse (1974-81).**
14. Northern States Power Company, Minneapolis (1974).**
15. N.U.S. Corporation, Pittsburg, PA (1974).**
16. Bio Test, Inc., Chicago, IL (1974).**
17. Dames and Moore, Park Ridge, IL (1974).**
18. Upper Mississippi River Conservation Committee, La Crosse (1947-66).**
19. Commercial fishermen—fish identified by Fish Distribution Study or by Dr. George Becker (1976-84).*
20. University of Minnesota, St. Paul, Dr. James Underhill and students (1967).*
21. Iowa Cooperative Fish Research Unit, Ames, IA (1980).**
22. U.S. Fish and Wildlife Service, Minneapolis (1958-80).**
23. Miscellaneous collectors (1981).**
24. U.S. Army Corps of Engineers, Omaha, NE (1980-81).**
25. Commercial fishermen (1974-84).**
26. Unknown collector—e.g., sport fishermen (1964-85).**

* Collector's fish identification is accepted.

** Collector's fish identification is uncertain.

Appendix Table B.2. *Non-DNR collections used in this report for the 1974-86 period. The list includes: (1) the alphanumeric code and common name of each fish species collected; (2) codes identifying sources of non-DNR collections (according to a key given at the end of Appendix Table B.1.) and (3) in parentheses, the number of stations for each collector category.*

Fish Code	Fish Names and Sources	Fish Code	Fish Names and Sources
A02	Chestnut lamprey 13(2)	L02	Northern pike 2(6), 3(20), 10(5), 11(1), 12(7), 13(11), 16(7), 17(6), 22(1), 23(2), 24(3), 25(5), 26(1)
A03	Northern brook lamprey 2(1), 3(1)	L03	Muskellunge 3(2), 13(1), 25(1)
A04	Silver lamprey 3(1), 10(5), 13(4), 24(1)	M06	Central stoneroller 3(8), 9(4), 23(1)
A05	American brook lamprey 2(1), 3(2), 15(2)	M07	Largescale stoneroller 3(12)
B01	Lake sturgeon 13(1), 19(2), 25(9), 26(3)	M09	Redside dace 3(1)
B02	Shovelnose sturgeon 10(2), 13(6), 25(8)	M10	Lake chub 3(1)
C01	Paddlefish 25(1)	M12	Common carp 2(7), 3(13), 8(1), 9(1), 10(7), 12(8), 13(14), 15(3), 16(8), 17(10), 19(2), 24(5), 25(17), 26(1)
D01	Longnose gar 2(3), 10(2), 13(7), 16(1), 17(1), 24(1)	M14	Brassy minnow 2(1), 3(9)
D02	Shortnose gar 3(2), 10(3), 13(5), 16(3), 24(4), 25(1)	M15	Mississippi silvery minnow 10(1), 13(1), 15(2)
E01	Bowfin 2(3), 10(4), 12(3), 13(7), 16(2), 24(1), 25(12)	M17	Silver chub 10(5), 13(7), 24(1)
F01	American eel 10(2), 13(2), 19(1), 24(1), 25(9), 26(7)	M18	Gravel chub 9(1)
G01	Alewife 25(1)	M19	Hornyhead chub 2(4), 3(19), 9(1), 11(5)
G02	Gizzard shad 3(3), 10(7), 13(14), 16(2), 24(4), 25(1)	M20	Golden shiner 3(22), 8(1), 10(4), 11(1), 12(10), 13(8), 16(9), 17(2), 24(3)
G03	Skipjack herring 19(1), 25(1)	M21	Pallid shiner 13(1)
H01	Goldeye 10(5), 16(1), 24(1)	M22	Pugnose shiner 3(1)
H02	Mooneye 3(1), 10(8), 13(11), 15(1), 16(2), 24(2), 25(1)	M23	Emerald shiner 3(10), 10(6), 13(12), 15(3), 24(2)
I04	Cisco or lake herring 2(1), 25(2)	M24	River shiner 10(2), 13(12), 15(2), 24(1)
I14	Coho salmon 25(1)	M28	Common shiner 2(1), 3(57), 9(2), 10(1), 11(5), 12(5), 23(1), 24(1)
I19	Rainbow trout 3(5), 25(1), 26(2)	M29	Bigmouth shiner 3(16), 9(3), 12(1)
I21	Brown trout 2(2), 3(6), 13(2), 22(1), 25(1), 26(1)	M30	Pugnose minnow 10(3), 13(10)
I22	Brook trout 3(3), 15(1), 22(4), 23(1), 25(1), 26(1)	M31	Blackchin shiner 3(2), 11(1), 12(3)
K01	Central mudminnow 2(3), 3(14), 10(1), 11(6), 12(9), 15(2), 16(4), 22(4)	M32	Blacknose shiner 3(8), 16(1)
L01	Grass pickerel 11(2)		

Appendix Table B.2. Continued.

Fish Code	Fish Names and Sources	Fish Code	Fish Names and Sources
M33	Spottail shiner 3(2), 10(6), 13(13), 24(1)	N10	Blue sucker 10(1), 13(3), 14(1), 21(2), 25(1)
M35	Rosyface shiner 3(13), 9(1)	N12	Lake chubsucker 1(2), 12(1)
M36	Spotfin shiner 2(1), 3(7), 9(3), 10(4), 12(6), 13(13), 15(1), 16(3), 24(1)	N13	Northern hog sucker 3(12), 9(1), 24(1)
M37	Sand shiner 2(1), 3(5), 9(3), 10(2), 11(3), 12(6), 13(10), 15(3), 24(1)	N14	Smallmouth buffalo 10(2), 13(10), 16(1), 19(1), 24(2)
M38	Weed shiner 10(2), 13(4)	N15	Bigmouth buffalo 10(1), 13(5), 16(1), 17(3), 19(2), 24(1), 25(1)
M39	Redfin shiner 3(1)	N16	Black buffalo 9(1), 26(1)
M40	Mimic shiner 2(1), 3(3), 11(1), 15(1), 24(1)	N17	Spotted sucker 10(4), 13(11), 15(1), 16(1), 24(4)
M41	Suckermouth minnow 3(2), 13(1)	N18	Silver redhorse 3(9), 10(6), 13(14), 15(4), 17(1), 19(1), 24(3), 25(1)
M42	Northern redbelly dace 3(8), 22(2)	N19	River redhorse 3(2), 14(1), 24(1)
M43	Southern redbelly dace 3(1), 9(1), 11(2)	N21	Golden redhorse 3(6), 10(3), 13(10), 15(1), 24(3)
M44	Finescale dace 3(2)	N22	Shorthead redhorse 3(11), 10(7), 13(19), 15(3), 16(2), 17(2), 24(3), 25(2)
M45	Bluntnose minnow 2(1), 3(44), 9(3), 10(1), 11(7), 12(5), 13(4), 16(4)	N23	Greater redhorse 1(1), 14(1)
M46	Fathead minnow 2(5), 3(17), 11(5), 12(9), 13(1), 15(1), 22(1)	O05	Black bullhead 2(8), 3(25), 8(1), 10(1), 11(4), 12(11), 13(5), 15(1), 16(7), 17(4), 24(2), 25(1), 26(2)
M47	Bullhead minnow 10(6), 11(1), 13(10), 24(1)	O06	Yellow bullhead 2(3), 3(18), 10(2), 11(3), 12(5), 13(6), 16(3), 25(2), 26(1)
M48	Blacknose dace 3(9), 9(1), 11(8), 16(1), 22(1)	O07	Brown bullhead 2(6), 3(1), 11(1), 17(1), 25(1)
M49	Longnose dace 3(4)	O08	Channel catfish 2(2), 10(7), 13(10), 15(1), 16(1), 17(2), 19(1), 24(2), 25(6), 26(1)
M50	Creek chub 2(2), 3(21), 9(2), 11(12), 12(2), 13(1), 15(2), 16(1)	O10	Stonecat 9(1), 10(1), 11(3), 13(1)
M51	Pearl dace 3(1), 22(1)	O11	Tadpole madtom 3(7), 10(4), 11(2), 12(8), 13(9), 15(1), 16(2), 23(1)
N05	River carpsucker 10(4), 13(9), 24(1)	O12	Flathead catfish 10(6), 13(7), 16(1), 19(1), 24(1)
N06	Quillback 3(2), 10(4), 13(10), 15(3), 19(1), 24(3), 25(1)	P01	Pirate perch 6(4)
N07	Highfin carpsucker 10(1), 13(4)	Q01	Trout-perch 3(6), 10(2), 13(9), 24(1)
N09	White sucker 2(8), 3(53), 9(2), 10(5), 11(13), 12(4), 13(6), 15(4), 16(3), 17(3), 22(1), 23(1), 24(2), 25(1)		

Appendix Table B.2. Continued.

Fish Code	Fish Names and Sources	Fish Code	Fish Names and Sources
R01	Burbot 2(1), 3(4), 13(5), 15(2), 25(1), 26(1)	X03	Crystal darter 3(1), 10(1), 13(1), 14(1)
S01	Banded killifish 1(1)	X04	Western sand darter 10(1), 13(4), 24(1)
S02	Blackstripe topminnow 2(6), 16(2)	X05	Mud darter 10(7), 13(7)
T01	Brook silverside 9(1), 10(2), 11(2), 13(12), 16(1), 24(1)	X07	Rainbow darter 3(3), 9(2), 15(1)
U01	Brook stickleback 2(3), 3(11), 9(1), 11(3), 12(6), 15(2), 16(2), 22(4), 23(1)	X09	Iowa darter 3(3), 12(7)
V01	White bass 2(5), 3(8), 10(7), 13(16), 17(3), 19(1), 24(4), 25(1), 26(1)	X10	Fantail darter 2(1), 3(6), 11(4)
V02	Yellow bass 2(2), 13(1), 16(5)	X11	Least darter 3(1)
W04	Rock bass 2(3), 3(13), 10(7), 11(3), 13(17), 16(3), 24(3), 25(1), 26(1)	X12	Johnny darter 2(2), 3(42), 9(3), 10(5), 11(7), 12(5), 13(6), 15(2), 16(3), 24(2)
W05	Green sunfish 2(6), 3(5), 8(1), 9(1), 10(2), 11(4), 12(11), 13(6), 16(9), 17(1), 24(2), 25(1)	X14	Banded darter 2(1), 3(1), 9(2)
W06	Pumpkinseed 2(5), 3(17), 10(3), 11(5), 12(8), 13(11), 16(5), 22(1), 23(1), 24(5), 25(1)	X15	Yellow perch 2(4), 3(22), 10(6), 11(6), 12(1), 13(17), 17(1), 23(2), 24(5), 25(2)
W07	Warmouth 3(1), 11(1), 12(2)	X16	Loggerhead 3(14), 10(6), 11(2), 13(13), 23(1), 24(3)
W08	Orangespotted sunfish 10(1), 11(2), 13(3), 24(1)	X17	Gilt darter 3(5), 10(1)
W09	Bluegill 2(4), 3(9), 8(1), 9(1), 10(7), 11(4), 12(10), 13(15), 15(1), 16(8), 17(4), 23(2), 24(5), 25(2)	X18	Blackside darter 3(9), 11(2), 12(3), 15(1)
W11	Smallmouth bass 3(6), 9(4), 10(7), 11(1), 13(8), 15(1), 16(2), 23(1), 24(3), 25(2), 26(1)	X20	River darter 10(3), 13(6), 24(1)
W12	Largemouth bass 2(5), 3(7), 8(1), 10(5), 11(3), 12(2), 13(13), 16(4), 22(1), 23(2), 24(4), 25(3), 26(1)	X21	Sauger 10(6), 13(13), 16(2), 24(3), 25(2)
W13	White crappie 3(1), 10(3), 11(2), 12(4), 13(10), 16(2), 17(6), 24(3), 25(2), 26(1)	X22	Walleye 2(3), 3(16), 10(7), 13(16), 15(1), 17(5), 19(1), 24(3), 25(6), 26(1)
W14	Black crappie 2(2), 3(22), 10(7), 11(4), 12(11), 13(12), 16(8), 17(3), 23(1), 24(4), 25(3)	Y01	Freshwater drum 2(3), 3(3), 10(7), 13(17), 16(3), 19(1), 24(3), 25(13)
		Z01	Mottled sculpin 2(2), 3(3), 11(3), 22(1)
		Z02	Slimy sculpin 2(1), 23(1)

- 1 ADD
- 2 CHANGE
- 3 DELETE

F
OR
S

SEQUENCE _____ MAJOR BASIN _____ MINOR BASIN _____

CC1 MB MILES _____

ORDER MILEAGES 1) _____ 2) _____ 3) _____
 4) _____ 5) _____ 6) _____
 7) _____ 8) _____ 9) _____
 10) _____ 11) _____

STATION MILEAGE _____

REPORT LOCATION

NAME _____

DAM OR JAR CODE _____ WATERTYPE _____ 64th _____ LANDLOCKED SEQUENCE NUMBER _____

STREAM OR LAKE LOCATION TOWNSHIP _____ RANGE _____ SEC. _____ 1/16 _____ 1/4 _____ COUNTY _____

STATION LOCATION TOWNSHIP _____ RANGE _____ SEC. _____ 1/16 _____ 1/4 _____ COUNTY _____

SOURCE OF DATA _____ GEAR _____ EFFORT _____ DATE MO / DAY / YR _____ HOUR _____

WIDTH _____ L _____ M _____ U _____ DEPTH _____ L _____ M _____ U _____

VELOCITY _____ TEMPERATURE _____ CONDUCTIVITY _____ TURBIDITY _____

F BOTTOM TYPES _____

I AQUATIC VEG. _____

S STRM. BANK VEG. _____

WB-1-C _____

FISH SPECIES

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 1) _____ 2) _____ 3) _____ 4) _____
 5) _____ 6) _____ 7) _____ 8) _____
 9) _____ 10) _____ 11) _____ 12) _____
 13) _____ 14) _____ 15) _____ 16) _____

MORE DATA ON BACK: YES

FISH SPECIES (CONTINUED)

17) _____ 18) _____ 19) _____ 20) _____
 21) _____ 22) _____ 23) _____ 24) _____
 25) _____ 26) _____ 27) _____ 28) _____
 29) _____ 30) _____ 31) _____ 32) _____
 33) _____ 34) _____ 35) _____ 36) _____
 37) _____ 38) _____ 39) _____ 40) _____
 41) _____ 42) _____ 43) _____ 44) _____

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Appendix Figure C.2. Example of the data form (8100-58) for coding fish and stream information collected in the field for computer entry. (Front and back are shown.)

MAY 13, 1988

STREAM & LAKE FILE - MASTER

MAJ	MIN	MB.MI.	1	2	3	4	5	6	7	ACRES	STREAM OR LAKE NAME	-C	TSTWN	RINGSECS43	QTQTCO	
872600	2	222								17	GOOSE POND	0	6N	8E	13	NENE13
872700	2	222								33	L HARRIETT	0	5N	9E	9	NWNW13
872800	2	222								10	MORSE POND	0	6N	8E	3	SESW13
872900	2	222								12	MORTENSON POND	0	5N	9E	26	NWSW13
873000	2	222									SUGAR R - OXBOW	0	1N	10E	27	NWSW54
873100	2	222								1	UN L	0	1N	10E	21	A NWSW54
873200	2	222								1	UN L	0	2N	3E	1	NWSW33
873300	2	222								4	UN L	0	4N	10E	4	SENE54
873400	2	222								1	UN L	0	4N	10E	13	NWNW54
873500	2	222								1	UN L	0	4N	10E	16	NENE54
873600	2	222								6	UN L	0	4N	10E	16	SENE54
873700	2	222								6	UN L	0	11N	10E	26	SWNE11
873800	2	222								1	UN SPRING	0	3N	10E	31	SWSW54
873900	2	222								8	VERONA GRAVEL PIT #12 (EAST	0	6N	8E	22	SENE13
874000	2	222	1434.8R	156.9L	.7R					11	RACCOON CR	2	46N	1E	22	80
874100	2	222	1434.8R	156.9L	.7R	6.9R				7	E FK RACCOON CR	2	46N	1E	8	80
874200	2	222	1434.8R	156.9L	.7R	6.9R	1.4				E FK RACCOON CR -WI-IL BD	6	1N	12E	31	SESW54
874300	2	222	1434.8R	156.9L	.7R	6.9R	2.7R			4	UN CR (CHAMBERLIN SPRINGS)	2	1N	12E	31	SWNE54
874400	2	222	1434.8R	156.9L	.7R	9.5					RACCOON CR -WI-IL BD	6	1N	11E	35	SESE54
874500	2	222	1434.8R	156.9L	.7R	10.9L					UN CR	2	1N	11E	35	SWNW54
874600	2	222	1434.8R	156.9L	.7R	10.9L	.1			1	UN SPRING	1	1N	11E	35	SWNW54
874700	2	222	1434.8R	156.9L	.7R	11.4					DAM-RACCOON CR -MILLPOND	1	1N	11E	34	NENE54
874800	2	222	1434.8R	156.9L	.7R	11.7R				3	UN CR	2	1N	11E	27	SWSE54
874900	2	222	1434.8R	156.9L	.7R	11.7R	.3R			3	UN CR	2	1N	11E	27	NWSE54
875000	2	222	1434.8R	156.9L	.7R	14.0L				2	UN CR	2	1N	11E	20	NWNW54
875100	2	222	1434.8R	156.9L	.7R	14.0L	1.8L				UN CR	2	1N	11E	20	NWNW54
875200	2	222	1434.8R	156.9L	.7R	14.0L	1.8L	.1		1	UN L	1	1N	11E	20	NWNW54
875300	2	222	1434.8R	156.9L	9.2R					79	SUGAR R	2	28N	11E	11	80
875400	2	222	1434.8R	156.9L	9.2R	10.7					SUGAR R -WI-IL BD	6	1N	10E	36	SESW54
875500	2	222	1434.8R	156.9L	9.2R	10.7L				9	GREEN DRAINAGE SYSTEM	2	1N	10E	36	SESW54
875600	2	222	1434.8R	156.9L	9.2R	10.7L	6.4R			1	UN CR	2	1N	9E	25	SENE54
875700	2	222	1434.8R	156.9L	9.2R	11.1R				3	UN DITCH	2	1N	10E	36	NWSW54
875800	2	222	1434.8R	156.9L	9.2R	11.1R	.7R			1	UN DITCH	2	1N	10E	36	NENW54
875900	2	222	1434.8R	156.9L	9.2R	11.7R				2	UN DITCH	2	1N	10E	35	SENE54
876000	2	222	1434.8R	156.9L	9.2R	16.0L				6	UN DITCH	2	1N	10E	28	NESW54
876100	2	222	1434.8R	156.9L	9.2R	18.8L					SUGAR R -W CHANNEL	2	1N	10E	20	SWNE54
876200	2	222	1434.8R	156.9L	9.2R	18.8L	.5L			1	UN DITCH	2	1N	10E	20	SWNW54
876300	2	222	1434.8R	156.9L	9.2R	19.8R				13	TAYLOR CR	2	1N	10E	18	SESE54
876400	2	222	1434.8R	156.9L	9.2R	19.8R	1.8R			10	WILLOW CR (NORTH)	2	1N	10E	7	NESW54
876500	2	222	1434.8R	156.9L	9.2R	19.8R	1.8R	6.7R		4	UN CR	2	1N	10E	11	SWNE54
876600	2	222	1434.8R	156.9L	9.2R	19.8R	1.8R	8.1R		1	UN CR	2	1N	10E	1	NWNW54
876700	2	222	1434.8R	156.9L	9.2R	19.8R	5.7R			7	SWAN CR	2	2N	10E	30	NESE54
876800	2	222	1434.8R	156.9L	9.2R	21.1					SUGAR R -CO BD	6	1N	9E	13	NESE23
876900	2	222	1434.8R	156.9L	9.2R	21.7L				1	UN CR	2	1N	9E	13	SENE23
877000	2	222	1434.8R	156.9L	9.2R	22.4L				10	SPRING CR	2	1N	9E	12	SESW23
877100	2	222	1434.8R	156.9L	9.2R	22.4L	5.8L			2	OAKLEY BR	2	1N	9E	19	SESE23
877200	2	222	1434.8R	156.9L	9.2R	22.9L				5	OK CR	2	1N	9E	12	NESW23
877300	2	222	1434.8R	156.9L	9.2R	22.9L	1.4R			2	UN CR	2	1N	9E	10	SENE23
877400	2	222	1434.8R	156.9L	9.2R	26.6L				14	SYLVESTER CR	2	1N	9E	3	NENE23
877500	2	222	1434.8R	156.9L	9.2R	26.6L	1.5L			8	JUDA BR	2	2N	9E	34	NWNW23
877600	2	222	1434.8R	156.9L	9.2R	26.6L	1.5L	3.1L		4	RILEY SCHOOL BR	2	2N	9E	31	SWSW23
877700	2	222	1434.8R	156.9L	9.2R	26.6L	1.5L	4.4R		3	N FK JUDA BR	2	1N	8E	1	SWNW23
877800	2	222	1434.8R	156.9L	9.2R	26.6L	1.5L	5.1R		2	UN CR	2	1N	8E	2	SENE23
877900	2	222	1434.8R	156.9L	9.2R	26.6L	5.6R			1	UN CR	2	2N	8E	24	NESE23

65

Appendix Figure C.3. Example of a page from the Master Stream and Lake File showing water mileages of stream tributaries. (Listing method A—Figure 2—is used here.)

MAY 13, 1988

FISH MASTER FILE (MARK IV) WITH COMMON NAMES

PAGE 1

-----ORDER MILEAGES-----
 BASIN MBM 1 2/7 3/8 4/9 5/10 6/11 MILE ----STREAM OR LAKE NAME---- SD G EF ---DATE-- TWRNRGSECQTQTCO
 JAR WT

STATION LOCATION

2 222	0 0	1N	10E	27 NW	SW 54		+	SUGAR R -OXBOW 0873000	46 5	8/ 0/63	1N10E27NWSW54
SP=04 HV=00 UNSP=00 FISH GOLDEN SHINER + BLACK BULLHEAD + BLACKSTRIPE TOPMINNOW + ORANGESPOTTED SUNFISH +											
2 222	1434.8R	156.9L	.7R	6.9R		2.3	E FK RACCOON CR 0874100	61 5	12/12/65	1N12E31NWSW54	
SP=13 HV=00 UNSP=02 FISH SHINERS + STONEROLLERS + BRASSY MINNOW + COMMON SHINER + BIGMOUTH SHINER + SUCKERMOUTH MINNOW + SOUTHERN REDBELLY DACE + BLUNTNOSE MINNOW + CREEK CHUB + WHITE SUCKER + BROOK STICKLEBACK + FANTAIL DARTER + JOHNNY DARTER + BANDED DARTER + BLACKSIDE DARTER +											
2 222	1434.8R	156.9L	.7R	6.9R		2.4	E FK RACCOON CR 0874100	11 2 06	5/15/74	1N12E31SWNE54	
SP=15 HV=01 UNSP=01 FISH AMERICAN BROOK LAMPREY 4 BROWN TROUT 10 NORTHERN PIKE 6 NORTHERN PIKE X GRASS PICKEREL 1 STONEROLLERS 6 COMMON CARP 1 COMMON SHINER 1 BIGMOUTH SHINER 1 BLUNTNOSE MINNOW 13 CREEK CHUB 4 WHITE SUCKER 28 GREEN SUNFISH 3 BLUEGILL 1 FANTAIL DARTER 13 JOHNNY DARTER 31 BANDED DARTER 2 MOTTLED SCULPIN 6											
2 222	1434.8R	156.9L	.7R	6.9R	2.7R	1.5	UN CR (CHAMBERLIN SPRINGS) 0874300	71 5	10/ 5/77	1N12E29SWNW54	
SP=08 HV=00 UNSP=00 FISH CENTRAL STONEROLLER 1 BIGMOUTH SHINER 27 SOUTHERN REDBELLY DACE 10 BLACKNOSE DACE 29 CREEK CHUB 99 WHITE SUCKER 3 BROOK STICKLEBACK 5 JOHNNY DARTER 11											
2 222	1434.8R	156.9L	.7R	6.9R	2.7R	3.8	UN CR 0874300	11 3 06	5/15/74	1N12E21NWNW54	
SP=07 HV=00 UNSP=01 FISH STONEROLLERS 99 SOUTHERN REDBELLY DACE 19 FATHEAD MINNOW 4 BLACKNOSE DACE 75 CREEK CHUB 53 WHITE SUCKER 30 BROOK STICKLEBACK 8 JOHNNY DARTER 2											
2 222	1434.8R	156.9L	.7R	6.9R		3.2	E FK RACCOON CR 0874100	11 2 05	11/ 5/75	1N12E31NENW54	
SP=17 HV=00 UNSP=01 FISH AMERICAN BROOK LAMPREY 2 CENTRAL MUDMINNOW 6 GRASS PICKEREL 2 (006 030 0 40) STONEROLLERS 33 COMMON SHINER 2 BLUNTNOSE MINNOW 11 FATHEAD (1 49 3 0001) MINNOW 3 BLACKNOSE DACE 20 CREEK CHUB 16 WHITE SUCKER 47 GREEN (ET F1 G2 H5 I2) SUNFISH 10 BLUEGILL 6 (D3 FT K4 M2 O1) RAINBOW DARTER 1 FANTAIL DARTER 30 JOHNNY DARTER 25 BANDED DARTER 2 BLACKSIDE DARTER 10 MOTTLED SCULPIN 27											
2 222	1434.8R	156.9L	.7R	6.9R		3.3	E FK RACCOON CR 0874100	61 5	6/10/65	1N12E31NENW54	
SP=07 HV=00 UNSP=01 FISH STONEROLLERS + COMMON SHINER + REDFIN SHINER + SOUTHERN REDBELLY DACE + BLUNTNOSE MINNOW + CREEK CHUB + WHITE SUCKER + FANTAIL DARTER +											

Appendix Figure C.5. Example of a page from the Master Fish File showing the common name for the fish species collected at each station. (Listing method A—Figure 2—is used here.)

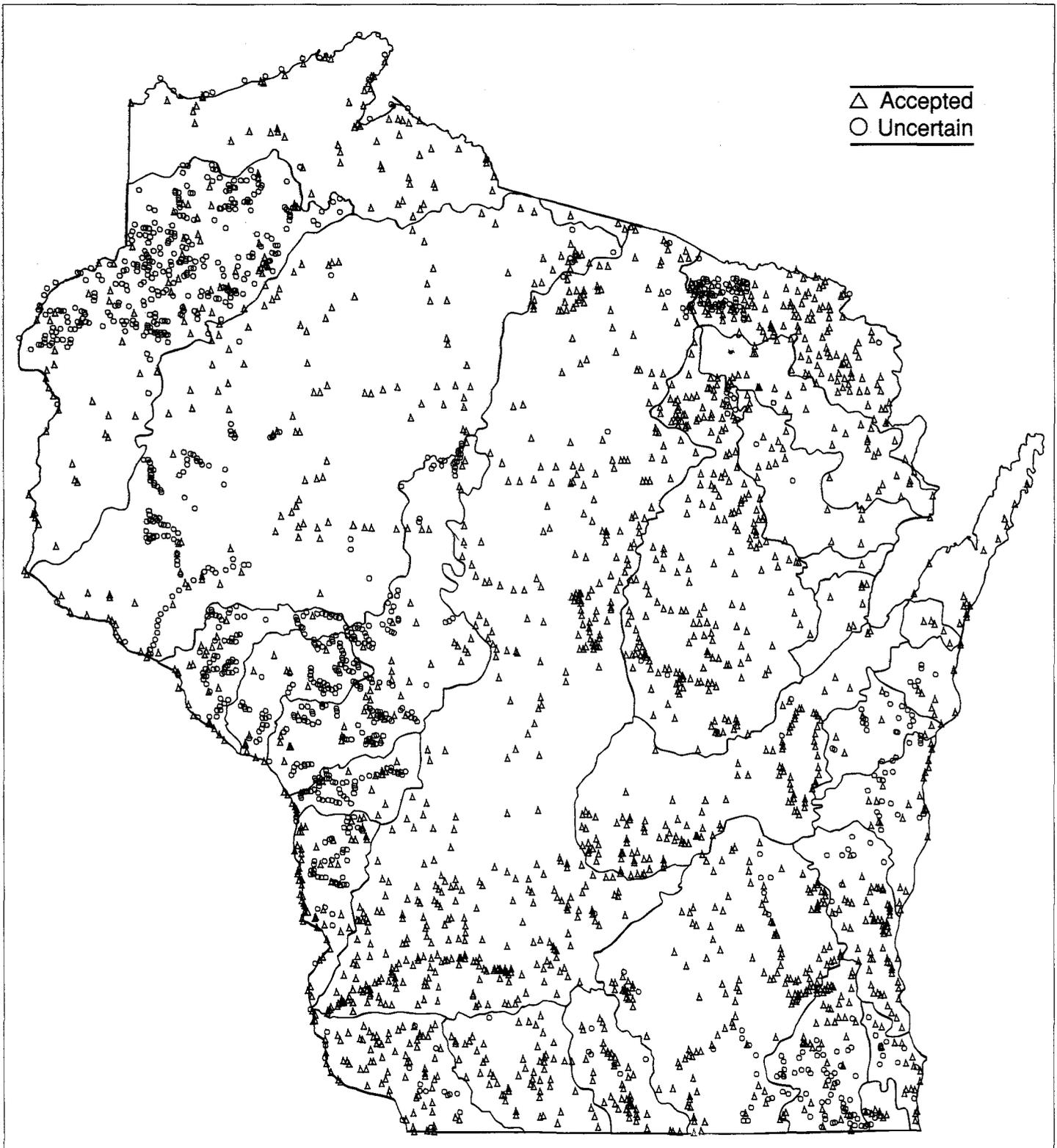
	NUMBER OF STATIONS	PERCENT OF TOTAL STATIONS	DATE RUN 10/10/88
I21 BROWN TROUT	1	2.56	
K01 CENTRAL MUDMINNOW	4	10.26	
M05 STONEROLLERS	13	33.33	
M06 CENTRAL STONEROLLER	19	48.72	
M07 LARGESCALE STONEROLLER	4	10.26	
M12 COMMON CARP	5	12.82	
M14 BRASSY MINNOW	5	12.82	
M19 HORNYHEAD CHUB	21	53.85	
M23 EMERALD SHINER	1	2.56	
M28 COMMON SHINER	28	71.79	
M29 BIGMOUTH SHINER	5	12.82	
M35 ROSYFACE SHINER	17	43.59	
M36 SPOTFIN SHINER	16	41.03	
M37 SAND SHINER	14	35.90	
M41 SUCKERMOUTH MINNOW	8	20.51	
M43 SOUTHERN REDBELLY DACE	18	46.15	
M45 BLUNTNOSE MINNOW	29	74.36	
M46 FATHEAD MINNOW	6	15.38	
M48 BLACKNOSE DACE	2	5.13	
M50 CREEK CHUB	27	69.23	
M76 COMMON SHINER X ROSYFACE SHINER	1	2.56	
N02 SUCKERS	1	2.56	
N04 REDHORSES	1	2.56	
N06 QUILLBACK	1	2.56	
N09 WHITE SUCKER	29	74.36	
N13 NORTHERN HOG SUCKER	10	25.64	
N15 BIGMOUTH BUFFALO	3	7.69	
N18 SILVER REDHORSE	9	23.08	
N21 GOLDEN REDHORSE	8	20.51	
N22 SHORTHEAD REDHORSE	13	33.33	
O08 CHANNEL CATFISH	1	2.56	
O10 STONECAT	5	12.82	
S02 BLACKSTRIFE TOPMINNOW	1	2.56	
U01 BROOK STICKLEBACK	12	30.77	
W04 ROCK BASS	5	12.82	
W05 GREEN SUNFISH	6	15.38	
W08 ORANGESPOTTED SUNFISH	5	12.82	
W09 BLUEGILL	10	25.64	
W11 SMALLMOUTH BASS	14	35.90	
W12 LARGEMOUTH BASS	6	15.38	
X07 RAINBOW DARTER	2	5.13	
X10 FANTAIL DARTER	13	33.33	
X12 JOHNNY DARTER	31	79.49	
X14 BANDED DARTER	5	12.82	
X15 YELLOW PERCH	3	7.69	
X18 BLACKSIDE DARTER	7	17.95	
X19 SLENDERHEAD DARTER	4	10.26	
X22 WALLEYE	1	2.56	
Z01 MOTTLED SCULPIN	7	17.95	

TOTAL NUMBER OF SPECIES OCCURRENCES		441
# STATIONS/SD:	SD-11-36 = 0	SD-40 = 0
	SD-45-47= 283	SD-50= 0
	SD-55,56= 0	SD-60,61= 158
	SD-66= 0	SD-72= 0
	SD-75= 0	SD-76= 0
	SD-77= 0	SD-78= 0
	SD-79= 0	SD-80= 0
	SD-81= 0	SD-83= 0
	SD-86= 0	SD-88= 0
	SD-89= 0	SD-90= 0
	SD-93= 0	SD-97= 0
	SD-98= 0	SD-99= 0
	SD-65= 0	SD-70= 0
	SD-71= 0	SD-87= 0
	SD-94= 0	SD-01= 0

TOTAL NUMBER OF SPECIES OCCURRENCES		441
TOTAL NUMBER OF STATIONS		
(WITH MILE RULE)		39
(WITHOUT MILE RULE)		42
TOTAL NUMBER OF SPECIES		
		45
TOTAL NUMBER OF HYBRIDS		
		1
TOTAL NUMBER OF UNSPECIFIED		
		3

Appendix Figure C.7. Example of the summary table portion of the species listing computer print-out shown in Appendix Figure C.6. This summary shows each species, the number of stations at which each was taken, percent of total stations possible, total number of species occurrences, totals for each collector, and totals for number of species and hybrids.

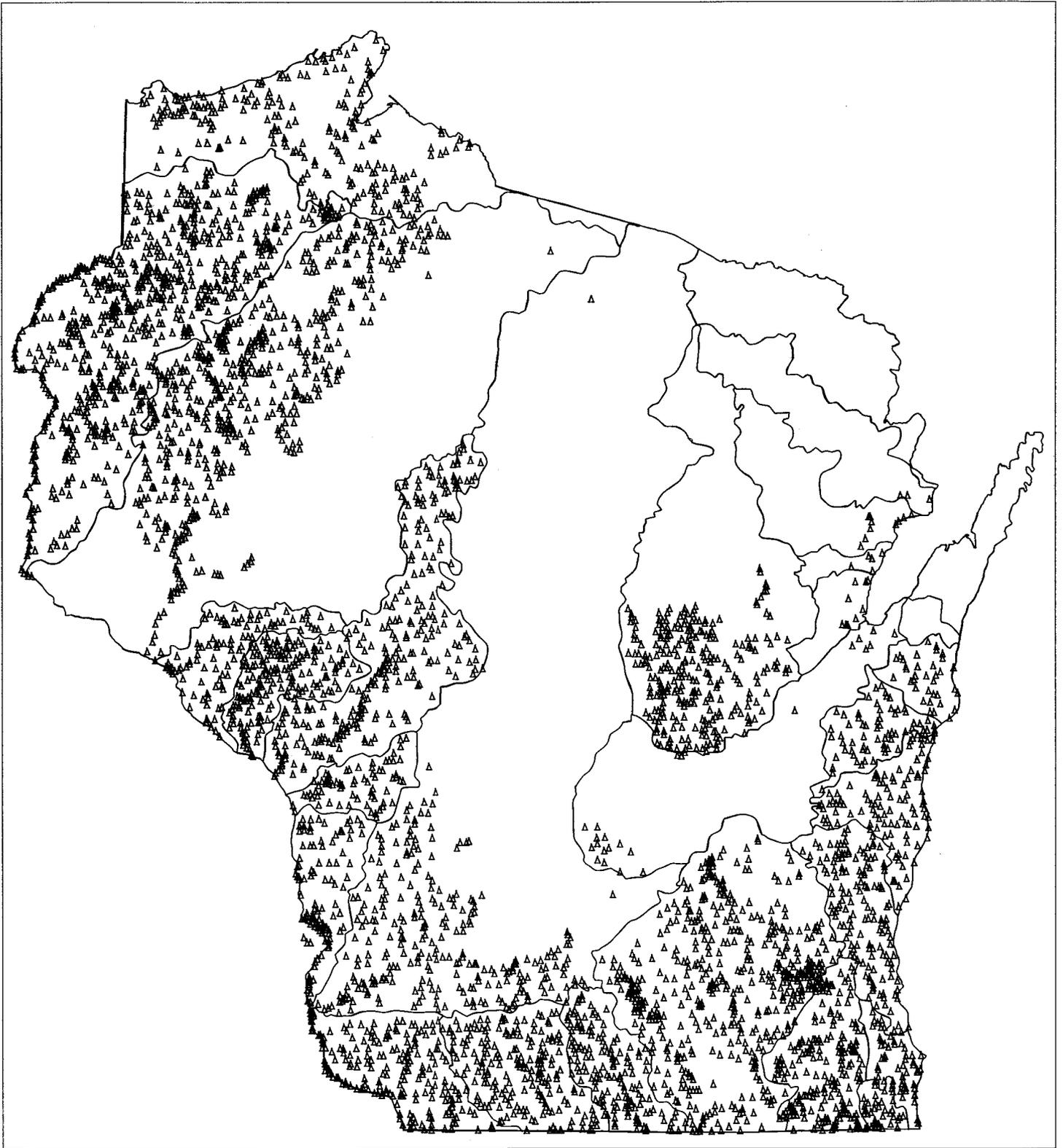
Appendix D. Locations of Sampling Stations



Appendix Figure D.1. Location of 3,635 stations in Wisconsin sampled during 1900-72. Due to lack of space, 673 stations are not shown.



Appendix Figure D.2. Location of 9,841 stations in Wisconsin sampled during 1974-86 by all collectors. Due to lack of space, 2,970 stations are not shown.

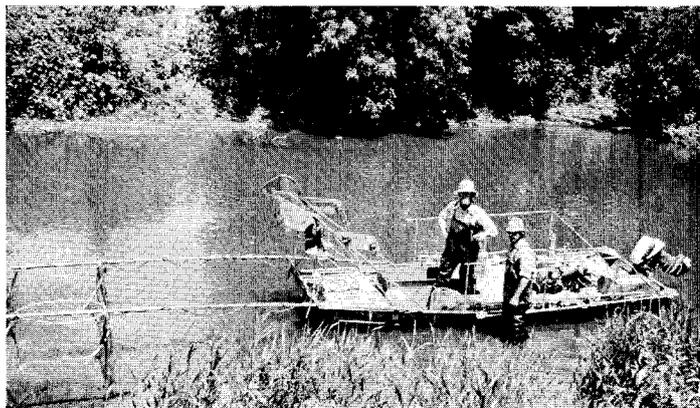


Appendix Figure D.3. Location of 5,396 stations in Wisconsin sampled during 1974-86 by Fish Distribution Study personnel. Due to lack of space, 1,109 stations are not shown.

Appendix E. Photos of Sampling Gear Used and Uncommon Species Collected



A. DC stream shocker in use in the La Crosse River by Kurt Osterby, David Siegler, and Keith Otis.



D. An early model, used in the mid-1970s, of a DC boom shocker. It is shown ready for operation in the Pecatonica River by Dale Becker and George VanDahm.



B. DC backpack shocker in use in Story Creek by Dale Becker and David Siegler. This early version of a DC backpack shocker, powered by a gasoline generator, was replaced by later versions that were battery-powered.



E. DC minishocker consisting of a 16-ft flatbottom aluminum boat, a 5-hp 240-volt DC generator, and a pulser control box. It is shown being used in the Apple River with Rick Tollefson dipping and David Siegler steering.

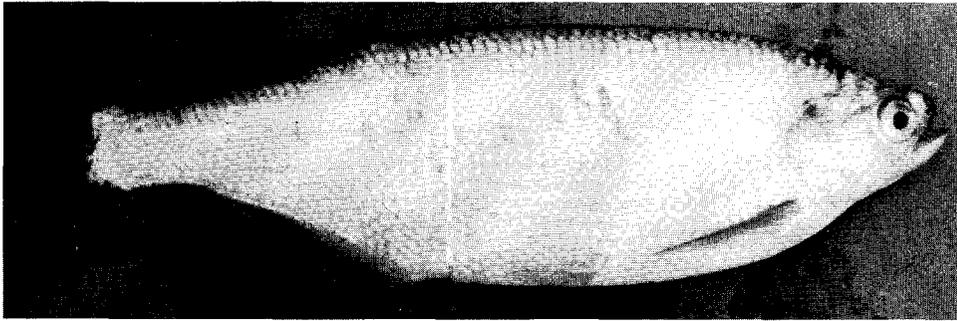


C. DC backpack shocker powered by a 12-volt, deep-cycle battery. Pictured are Rick Tollefson and David Siegler.

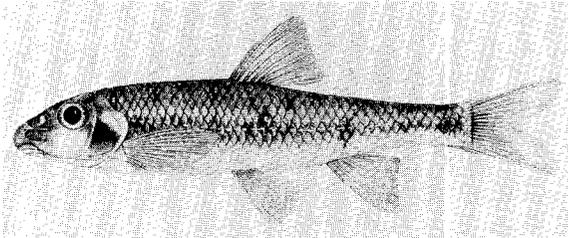


F. Small mesh seine, with a 4- by 4-ft bag at the right, in use in the Mississippi River by Tom Meyer, Keith Otis, and Paul Johnson.

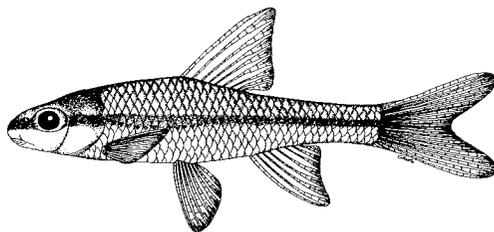
Appendix Figure E.1. Example of gear used during the recent (1974-86) survey of fish distribution. Other gear used but not shown were DC longline shockers and AC stream shockers. Members of the sampling crew are identified from left to right.



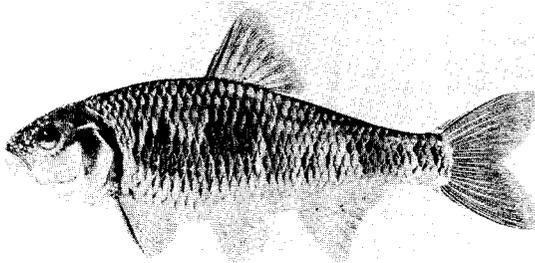
A. *Goldeye taken from the Chippewa River. They prefer large rivers.*



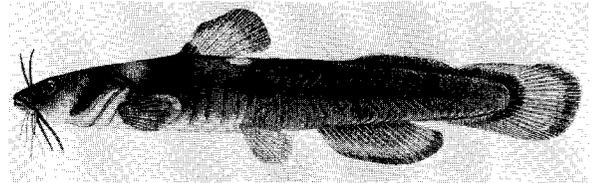
B. *Gravel chubs inhabit riffles of medium-to-large rivers.*



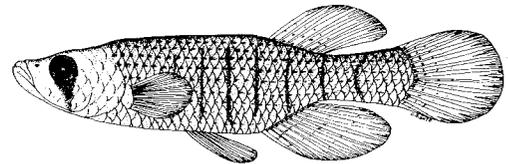
C. *Pallid shiners inhabit sluggish sections of large rivers.*



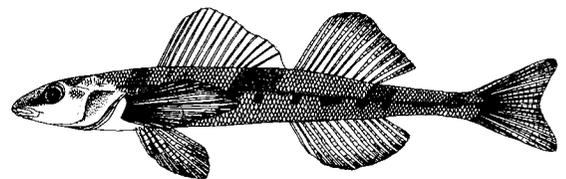
D. *Striped shiners appear to be restricted to 5 small-to medium-sized rivers in the Milwaukee River basin.*



E. *Slender madtom prefer riffle sections of streams.*



F. *Starhead topminnows prefer well-vegetated backwaters and sloughs of medium-to-large rivers and lakes.*

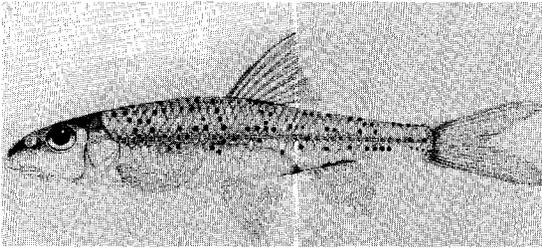


G. *Crystal darters prefer the riffle sections of large rivers.*

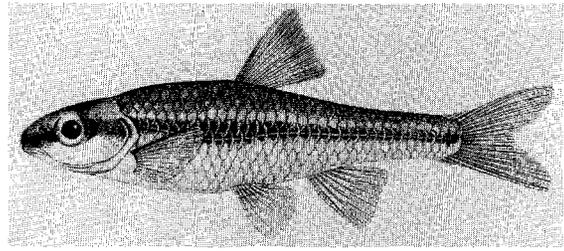


H. *Bluntnose darters inhabit sluggish stretches of large rivers.*

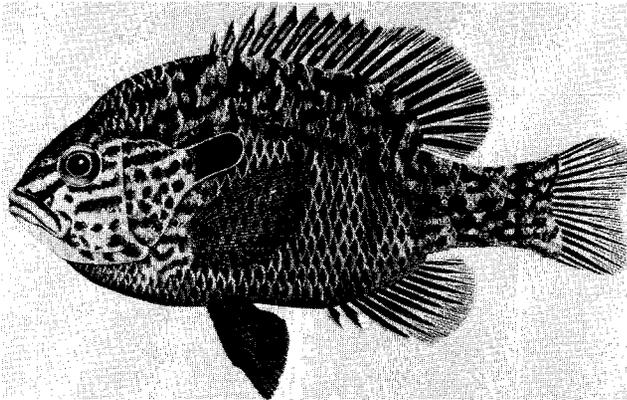
Appendix Figure E.2. *Illustrations and habitat preferences of endangered fish species that were collected in the recent period (1974-86).*



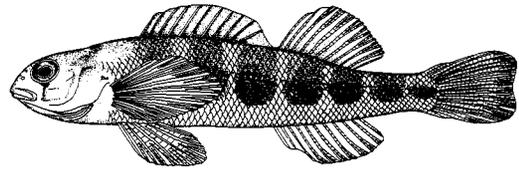
A. *Speckled chubs prefer sandy substrate in large rivers.*



B. *Ozark minnows inhabit moderately fast streams with gravel bottoms.*



C. *Longear sunfish prefer medium-to-large rivers and lakes.*



D. *Gilt darters inhabit riffles of large rivers.*



E. *Blue sucker (held by the author) taken from the St. Croix River. They prefer fast-moving sections of large rivers.*

F. *Black buffalo taken from Lake Wisconsin. They prefer the deep, swift channels of large rivers.*



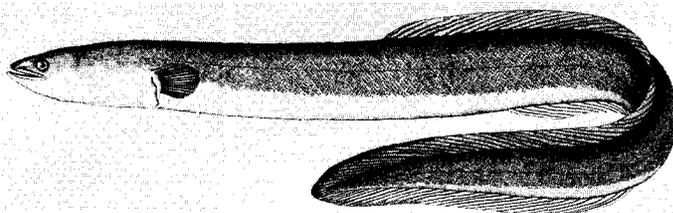
Appendix Figure E.3. *Illustrations and habitat preferences of threatened fish species that were collected in the recent period (1974-86).*



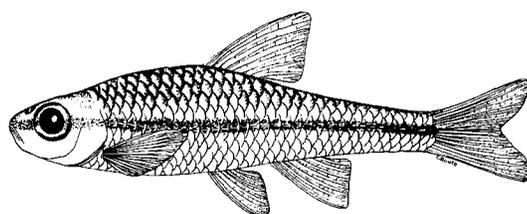
A. Lake sturgeon taken from Lake Wisconsin. They prefer large rivers and lakes.



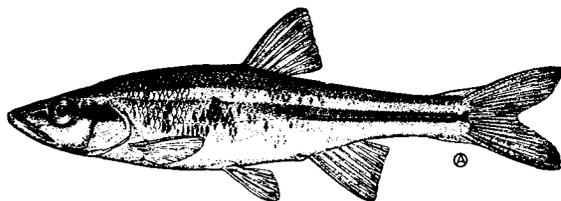
B. Paddlefish (held by Fred Hagstrom) taken from a small tributary to the Wisconsin River where it was presumably trying to spawn. They prefer large rivers.



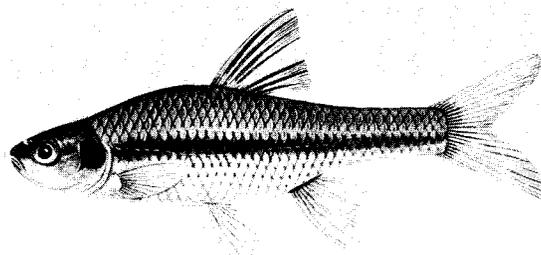
C. American eel prefer medium-to-large rivers. Only females are found in freshwater; they spawn in the Sargasso Sea.



E. Pugnose shiners prefer clear, weedy lakes.

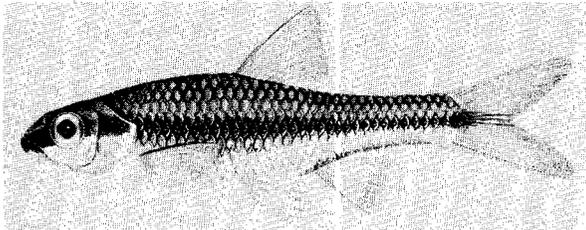


D. Redside dace prefer clear pools in small- to medium-sized streams.

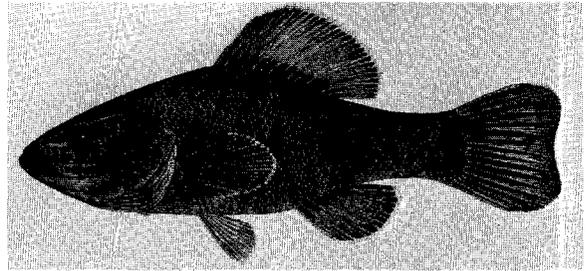


F. Pugnose minnows inhabit large low-gradient rivers.

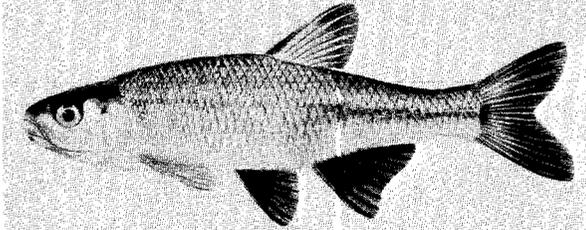
Appendix Figure E.4. Illustrations and habitat preferences of selected watch fish species that were collected in the recent period (1974-86).



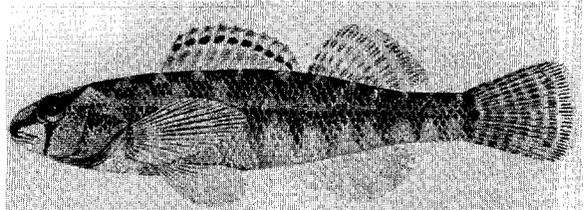
G. Weed shiners inhabit sluggish areas of medium-to-large rivers and lakes.



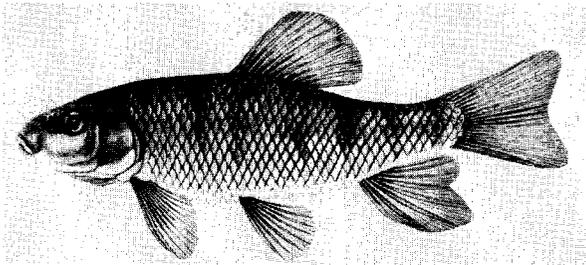
L. Pirate perch prefer small streams of the backwaters or sloughs of medium-to-large rivers.



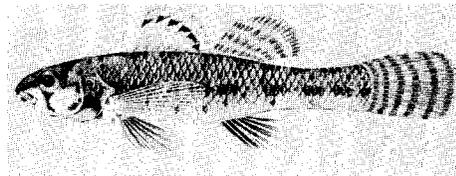
H. Redfin shiners inhabit slow pool areas of medium-to-large rivers and lakes.



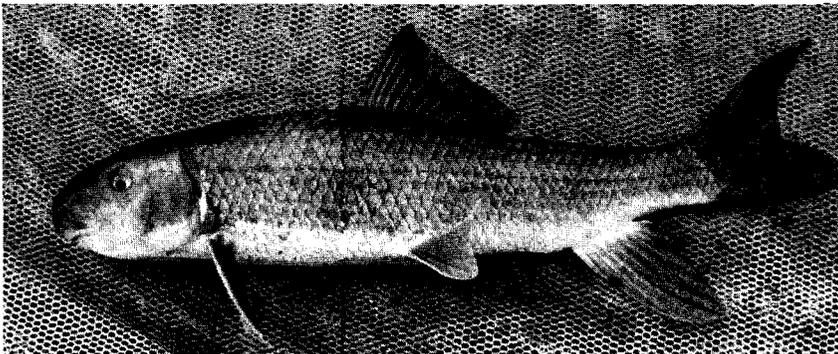
M. Mud darters prefer slow-moving, weedy areas adjacent to medium-to-large rivers.



I. Lake chubsuckers prefer lakes and sloughs of large rivers.



N. Least darters inhabit quiet, weedy areas of small streams.



J. River redhorse taken from the Rock River. They inhabit the fast-moving sections of large rivers.

K. Greater redhorse taken from Turtle Creek. They inhabit the fast-moving sections of large rivers.



Appendix F. Frequency of Species Occurrence by Water Type

Appendix Table F.1. Number of specimens of each species collected in streams, the percent of total stream stations at which each species was caught, and the number of stations at which <99, >98, or unknown numbers of each species were taken, 1974-86.

Species	No. Specimens*	Percent of Total Stream Stations	No. Stations**		
			<99	>98	Unknown
White sucker	150,000	66	4,203	641	238
Creek chub	100,000	54	3,321	360	487
Common shiner	95,000	35	2,046	528	168
Brook trout	66,000	26	1,731	303	15
Blacknose dace	59,000	35	2,050	213	425
Johnny darter	53,000	43	2,902	137	318
Bluntnose minnow	47,000	27	1,753	214	89
Central mudminnow	38,000	35	2,470	122	140
Brook stickleback	37,000	34	2,237	124	256
Mottled sculpin	36,000	22	1,511	118	102
Brown trout	32,000	20	1,419	108	8
Hornyhead chub	32,000	17	1,180	118	46
Fathead minnow	29,000	24	1,642	109	93
Fantail darter	28,000	15	838	134	203
Spotfin shiner	27,000	12	727	146	68
Longnose dace	21,000	17	990	70	244
Common carp	19,000	13	844	89	45
Southern redbelly dace	19,000	8	446	102	50
Pearl dace	17,000	12	866	55	16
Black bullhead	17,000	15	1,080	67	21
Bluegill	17,000	13	910	75	23
Bigmouth shiner	16,000	10	594	67	55
Northern redbelly dace	15,000	11	741	58	23
Sand shiner	13,000	7	457	65	37
Shorthead redhorse	13,000	10	676	40	24
Northern hog sucker	12,000	11	718	31	76
Brassy minnow	11,000	10	750	34	9
Emerald shiner	11,000	5	345	62	18
Yellow perch	11,000	12	851	21	23
Rock bass	9,300	12	878	12	17
Blackside darter	8,900	11	797	17	37
Green sunfish	8,400	12	900	11	19
Golden redhorse	7,300	7	523	14	7
Smallmouth bass	7,100	9	707	10	2
Bullhead minnow	6,900	3	210	38	9
Pumpkinseed	6,700	12	881	7	12
Rainbow darter	6,600	3	190	33	26
Largemouth bass	6,500	11	844	13	16
Rosyface shiner	6,400	4	308	16	3
Golden shiner	6,300	9	635	13	16
Northern pike	6,100	18	1,330	7	35
Logperch	6,000	8	562	14	39
River shiner	5,700	3	160	30	6
Central stoneroller	5,000	12	754	4	224
Black crappie	4,700	7	515	14	10
Blacknose shiner	4,600	5	356	12	5
Burbot	4,200	8	559	5	3
Silver redhorse	3,900	5	352	8	6

Appendix Table F.1. *Continued.*

Species	No. Specimens*	Percent of Total Stream Stations	No. Stations**		
			<99	>98	Unknown
Banded darter	3,900	4	287	8	6
Rainbow trout	3,800	3	212	18	1
Quillback	3,700	4	294	8	5
Mimic shiner	3,500	3	173	19	4
American brook lamprey	3,400	6	434	1	9
Gizzard shad	3,200	2	111	16	4
Walleye	3,200	7	497	4	7
Yellow bullhead	3,100	7	498	4	16
Stonecat	3,000	5	403	4	14
Largescale stoneroller	2,700	5	368	2	4
Slimy sculpin	2,600	2	89	7	58
Spottail shiner	2,500	2	179	7	30
Redside dace	2,200	2	128	6	39
Suckermouth minnow	2,100	2	163	5	6
Finescale dace	2,100	3	215	4	15
Tadpole madtom	2,000	3	266	2	1
Brook silverside	2,000	2	159	7	1
Iowa darter	2,000	4	273	4	5
White bass	1,900	2	167	7	2
Mississippi silvery minnow	1,800	1	65	10	0
Freshwater drum	1,500	2	156	3	5
Spotted sucker	1,300	2	110	3	2
Channel catfish	1,200	3	243	1	4
Blackstripe topminnow	1,200	1	82	4	1
Trout-perch	1,100	1	87	2	0
Sauger	1,000	2	137	2	2
Alewife	960	t	7	9	1
Mooneye	880	2	123	0	0
Orangespotted sunfish	840	1	93	2	3
Brown bullhead	830	2	116	3	5
Blackchin shiner	820	1	94	2	1
White crappie	810	2	131	1	3
Pugnose minnow	700	1	81	1	1
Slenderhead darter	700	1	103	0	2
Western sand darter	690	1	77	2	1
Lake chub	630	1	37	2	0
Ozark minnow	600	1	47	1	0
Weed shiner	590	1	51	2	3
Highfin carpsucker	590	1	76	0	2
Bowfin	580	2	108	2	4
Blue sucker	490	1	54	0	0
River redhorse	490	1	72	1	0
Bigmouth buffalo	480	1	94	1	2
Smallmouth buffalo	450	1	74	0	0
Speckled chub	440	t***	25	2	1
Longnose gar	430	1	88	0	2
Greater redhorse	430	1	99	0	1
River carpsucker	420	1	67	0	1

Appendix Table F.1. *Continued.*

Species	No. Specimens*	Percent of Total Stream Stations	No. Stations**		
			<99	>98	Unknown
Goldfish	400	1	32	2	0
Gilt darter	400	1	41	1	2
Mud darter	390	1	69	0	0
Chestnut lamprey	360	2	130	0	1
River darter	360	1	64	1	4
Coho salmon	350	t	34	1	0
Least darter	340	1	46	1	0
Slender madtom	280	t	28	0	0
Northern brook lamprey	270	1	75	0	5
Silver chub	250	1	64	0	2
Gravel chub	250	1	41	0	0
Lake chubsucker	240	1	48	0	0
Flathead catfish	230	1	49	0	0
Shortnose gar	220	1	68	0	1
Grass pickerel	220	1	75	0	2
Longnose sucker	190	t	25	0	0
Pallid shiner	180	t	17	0	0
Warmouth	180	1	37	0	0
Redfin shiner	160	t	19	0	0
Yellow bass	160	t	24	0	0
Chinook salmon	150	t	25	0	0
Rainbow smelt	150	t	5	1	1
Longear sunfish	150	t	17	0	0
Paddlefish	140	t	10	1	2
Muskellunge	130	1	52	0	1
Crystal darter	120	t	19	0	0
Shovelnose sturgeon	110	t	32	0	0
Banded killifish	100	t	27	0	1
Pirate perch	80	t	23	0	1
Striped shiner	75	t	13	0	0
Silver lamprey	71	1	51	0	1
American eel	51	t	29	0	0
Lake sturgeon	44	t	16	0	1
Goldeye	31	t	15	0	0
Starhead topminnow	23	t	4	0	0
Pugnose shiner	17	t	8	0	0
Bloater	14	t	1	0	0
Black buffalo	11	t	9	0	2
Sea lamprey	8	t	4	0	0
Pink salmon	6	t	4	0	0
Ninespine stickleback	2	t	1	0	0
Bluntnose darter	2	t	2	0	0
Total	1,244,365		60,625	4,686	4,113

* Rounded to 2 significant figures for each species.

** <99 = 98 or fewer specimens taken/station.

>98 = 99 or more specimens taken/station (99 used in count of total).

Unknown = counts of specimens were not made.

*** t = less than 0.5%.

Appendix Table F.2. Number of specimens of each species collected in lakes, the percent of total lake stations at which each species was caught, and the number of stations at which <99, >98, or unknown numbers of each species were taken, 1974-86.

Species	No. Specimens*	Percent of Total Lake Stations	No. Stations**		
			<99	>98	Unknown
Bluegill	55,000	72	1,078	326	20
Yellow perch	42,000	68	1,083	228	26
Bluntnose minnow	38,000	43	596	248	16
Largemouth bass	20,000	62	1,151	53	16
Pumpkinseed	17,000	53	964	62	14
Black crappie	15,000	35	612	72	15
White sucker	11,000	31	502	54	55
Walleye	10,000	18	289	67	5
Golden shiner	8,700	28	440	50	59
Black bullhead	7,900	19	293	49	28
Northern pike	7,700	32	600	24	16
Blacknose shiner	6,700	14	240	35	7
Mimic shiner	6,000	9	145	33	1
Brook silverside	5,400	10	140	31	12
Johnny darter	5,300	29	548	12	11
Rock bass	5,100	24	453	8	10
Common carp	4,800	13	201	29	23
Yellow bullhead	4,800	13	214	26	19
Common shiner	4,200	13	211	19	31
Blackchin shiner	4,200	10	174	17	2
Brown bullhead	4,100	13	215	18	27
Iowa darter	3,700	19	357	7	6
Spotfin shiner	3,600	7	124	19	1
Fathead minnow	3,600	11	189	17	12
Green sunfish	2,600	15	278	7	7
Spottail shiner	2,200	14	138	7	6
Smallmouth bass	2,200	15	288	3	3
Logperch	2,200	12	217	2	15
Banded killifish	1,800	9	174	2	0
Muskellunge	1,400	6	101	4	5
Central mudminnow	1,300	8	129	6	25
Brook trout	1,200	3	53	4	0
Emerald shiner	1,200	6	107	5	3
Creek chub	1,200	4	74	4	7
Brook stickleback	1,000	4	62	2	3
Shorthead redhorse	920	4	70	2	3
White crappie	900	4	75	4	1
White bass	860	4	82	1	0
Northern redbelly dace	820	3	43	4	2
Brassy minnow	780	2	30	5	2
Cisco	770	2	23	7	1
Gizzard shad	580	1	16	4	1
Sand shiner	580	2	28	3	1
Freshwater drum	520	3	46	2	2
Golden redhorse	490	2	28	3	1
Warmouth	480	4	82	0	2
Yellow bass	460	2	43	1	0

Appendix Table F.2. *Continued.*

Species	No. Specimens*	Percent of Total Lake Stations	No. Stations**		
			<99	>98	Unknown
Bullhead minnow	420	2	29	0	2
Bigmouth buffalo	420	1	23	3	0
Rosyface shiner	416	1	10	3	0
Bowfin	410	4	69	0	12
Hornyhead chub	360	2	43	1	1
Pearl dace	360	2	29	1	1
Least darter	360	2	41	1	0
Pugnose shiner	320	3	50	0	0
Finescale dace	320	1	21	0	1
River shiner	310	1	16	1	1
Channel catfish	310	3	49	1	1
Orangespotted sunfish	310	1	24	0	0
Silver redhorse	300	2	31	1	0
Weed shiner	280	1	20	1	1
Lake chubsucker	270	2	46	0	3
Tadpole madtom	270	4	75	0	1
Pugnose minnow	240	2	34	0	0
Spotted sucker	240	1	26	1	0
Trout-perch	220	1	16	1	4
Rainbow trout	210	1	23	1	2
Blacknose dace	210	1	19	0	1
Brown trout	170	1	20	1	1
Burbot	170	2	36	0	2
Longnose gar	150	3	48	0	5
Goldfish	150	1	11	1	1
Mottled sculpin	150	3	51	0	5
Grass pickerel	140	3	52	0	1
Longear sunfish	130	1	9	1	0
Sauger	120	1	12	0	0
Lake sturgeon	110	1	14	0	2
Smallmouth buffalo	110	t***	5	1	0
Quillback	91	1	20	0	1
Redfin shiner	89	t	6	0	0
Bigmouth shiner	86	1	10	0	10
Blackstripe topminnow	80	1	14	0	1
Pallid shiner	60	t	6	0	0
Rainbow darter	58	1	23	0	1
River darter	57	t	9	0	0
Mooneye	40	1	10	0	1
Northern hog sucker	32	1	11	0	0
Starhead topminnow	31	t	4	0	0
Shortnose gar	30	1	13	0	0

Appendix Table F.2. *Continued.*

Species	No. Specimens*	Percent of Total Lake Stations	No. Stations**		
			<99	>98	Unknown
Lake whitefish	29	t	2	0	0
Largescale stoneroller	27	1	10	0	0
Blackside darter	25	1	10	0	2
Silver chub	20	t	7	0	0
American brook lamprey	18	t	1	0	0
Suckermouth minnow	17	t	2	0	0
Mud darter	16	t	6	0	0
Fantail darter	16	1	11	0	1
Highfin carpsucker	15	t	6	0	0
River redhorse	14	t	3	0	0
Central stoneroller	13	t	5	0	0
Rainbow smelt	12	t	2	0	1
Chestnut lamprey	9	t	5	0	1
River carpsucker	8	t	5	0	0
Greater redhorse	7	t	6	0	0
Ozark minnow	6	t	2	0	2
Black buffalo	6	t	2	0	0
Slenderhead darter	5	t	3	0	0
Goldeye	4	t	1	0	0
Flathead catfish	4	t	4	0	0
Banded darter	4	t	4	0	0
Silver lamprey	3	t	3	0	0
Lake trout	3	t	1	0	1
Redside dace	3	t	1	0	0
Mississippi silvery minnow	3	t	2	0	0
Slimy sculpin	3	t	1	0	0
Shovelnose sturgeon	2	t	2	0	0
Skipjack herring	2	t	2	0	0
Longnose dace	2	t	2	0	0
Paddlefish	1	t	1	0	0
American eel	1	t	1	0	1
Speckled chub	1	t	1	0	0
Striped shiner	1	t	1	0	1
Longnose sucker	1	t	1	0	0
Stonecat	1	t	1	0	1
Western sand darter	1	t	1	0	0
Alewife	-	t	0	0	1
Total	329,173		14,202	1,606	596

* Rounded to 2 significant figures for each species.

** <99 = 98 or fewer specimens taken/station.

>98 = 99 or more specimens taken/station (99 used in count of total).

Unknown = counts of specimens were not made.

*** t = less than 0.5%.

Appendix Table F.3. Number of specimens of each species collected in all water types and the number of stations at which <99, >98, or unknown numbers of each species were taken, 1974-86.*

Species	No. Specimens**	No. Stations ^a		
		<99	>98	Unknown
White sucker	170,000	4,744	700	296
Common shiner	100,000	2,272	548	199
Creek chub	100,000	3,402	366	495
Bluntnose minnow	86,000	2,381	465	109
Bluegill	73,000	2,039	409	44
Brook trout	68,000	1,785	310	15
Blacknose dace	60,000	2,075	213	426
Johnny darter	59,000	3,465	149	330
Yellow perch	52,000	1,971	252	50
Central mudminnow	39,000	2,614	130	165
Brook stickleback	38,000	2,312	126	260
Mottled sculpin	36,000	1,567	118	107
Hornyhead chub	33,000	1,226	119	47
Brown trout	32,000	1,442	109	9
Fathead minnow	32,000	1,844	126	106
Spotfin shiner	31,000	931	170	19
Fantail darter	28,000	849	135	204
Common carp	27,000	1,074	144	73
Largemouth bass	27,000	2,044	66	32
Black bullhead	25,000	1,396	118	50
Pumpkinseed	24,000	1,887	69	26
Longnose dace	21,000	997	70	245
Black crappie	21,000	1,162	88	26
Southern redbelly dace	19,000	446	103	51
Pearl dace	17,000	899	56	17
Bigmouth shiner	16,000	606	67	55
Northern redbelly dace	16,000	790	62	25
Golden shiner	15,000	1,106	63	76
Rock bass	15,000	1,347	20	27
Northern pike	14,000	1,970	32	51
Sand shiner	14,000	491	69	38
Shorthead redhorse	14,000	766	42	27
Walleye	14,000	820	72	12
Emerald shiner	13,000	481	69	21
Brassy minnow	12,000	785	40	11
Northern hog sucker	12,000	731	31	76
Blacknose shiner	11,000	599	47	12
Green sunfish	11,000	1,196	18	26
Mimic shiner	9,600	319	53	5
Smallmouth bass	9,400	1,016	13	15
Blackside darter	9,000	809	17	39
Logperch	8,300	795	16	54
Yellow bullhead	8,100	728	30	35
Golden redhorse	7,800	553	17	8
Brook silverside	7,700	310	40	14
Bullhead minnow	7,600	252	39	11
Rosyface shiner	6,800	319	19	3
Rainbow darter	6,600	214	33	27
River shiner	6,100	183	31	7

Appendix Table F.3. *Continued.*

Species	No. Specimens**	No. Stations ^a		
		<99	>98	Unknown
Iowa darter	5,700	632	11	11
Central stoneroller	5,000	761	4	135
Blackchin shiner	5,000	268	19	3
Spottail shiner	5,000	341	15	14
Brown bullhead	5,000	334	22	32
Burbot	4,400	598	5	46
Silver redhorse	4,200	394	9	7
Rainbow trout	4,000	237	19	3
Gizzard shad	3,900	137	20	5
Quillback	3,900	324	8	6
Banded darter	3,900	291	8	6
American brook lamprey	3,500	436	1	8
Freshwater drum	3,300	223	16	7
Stonecat	3,000	405	4	14
White bass	2,900	270	8	2
Largescale stoneroller	2,800	379	2	4
Slimy sculpin	2,600	90	7	58
Finescale dace	2,400	238	4	16
Redside dace	2,200	129	6	39
Tadpole madtom	2,200	346	2	2
Suckermouth minnow	2,100	166	5	6
White crappie	2,100	227	7	4
Banded killifish	1,900	201	2	1
Mississippi silvery minnow	1,800	67	10	0
Spotted sucker	1,700	143	5	3
Channel catfish	1,600	310	2	5
Muskellunge	1,500	155	4	6
Trout-perch	1,400	105	3	4
Blackstripe topminnow	1,300	100	4	2
Orangespotted sunfish	1,300	131	2	3
Bowfin	1,200	193	4	25
Sauger	1,200	159	2	2
Alewife	1,000	8	9	2
Bigmouth buffalo	1,000	126	5	2
Pugnose minnow	980	125	1	1
Mooneye	950	140	0	1
Weed shiner	900	74	3	4
Cisco or lake herring	770	23	7	1
Least darter	710	87	2	0
Slenderhead darter	710	106	0	2
Western sand darter	690	78	2	1
Lake chub	680	38	2	0
Warmouth	660	121	0	2
Yellow bass	630	72	1	0
Highfin carpsucker	610	83	0	2
Longnose gar	600	143	0	8
Ozark minnow	600	49	1	0
Goldfish	560	53	3	1
Smallmouth buffalo	560	81	1	0
Lake chubsucker	520	95	0	3

Appendix Table F.3. *Continued.*

Species	No. Specimens**	No. Stations ^a		
		<99	>98	Unknown
River redhorse	500	75	1	0
Blue sucker	490	54	0	0
Speckled chub	440	26	2	1
River carpsucker	440	75	0	1
Greater redhorse	430	105	0	1
Mud darter	430	80	0	0
River darter	420	76	1	4
Gilt darter	400	41	1	2
Chestnut lamprey	370	134	0	2
Grass pickerel	360	127	0	3
Shortnose gar	350	83	1	1
Coho salmon	350	34	1	0
Pugnose shiner	340	58	0	0
Shovelnose sturgeon	320	35	2	5
Slender madtom	280	28	0	0
Northern brook lamprey	270	76	0	5
Silver chub	270	76	0	2
Longear sunfish	270	26	1	0
Gravel chub	250	41	0	0
Pallid shiner	250	26	0	0
Redfin shiner	250	27	0	0
Flathead catfish	230	53	0	0
Chinook salmon	200	26	0	0
Longnose sucker	190	26	0	0
Rainbow smelt	160	7	1	2
Lake sturgeon	150	31	0	3
Paddlefish	140	11	1	2
Crystal darter	120	19	0	0
Striped shiner	92	15	0	0
Pirate perch	80	24	0	1
Silver lamprey	78	57	0	1
Starhead topminnow	55	9	0	0
American eel	52	30	0	8
Goldeye	35	16	0	0
Lake whitefish	30	3	0	0
Black buffalo	17	11	0	0
Sea Lamprey	8	4	0	0
Pink salmon	6	4	0	0
Lake trout	3	1	0	0
Ninespine stickleback	3	2	0	0
Skipjack herring	2	2	0	0
Bluntnose darter	2	2	0	0
Total	1,600,000	75,958	6,388	4,629

* Numbers in this table are not the sums of corresponding figures in Tables 6 and 7 because this table includes data from the 122 stations for which water type was unknown or a mixture of lake and stream environments.

** Rounded to 2 significant figures for each species.

^a<99 = 98 or fewer specimens taken/station.

>98 = 99 or more specimens taken/station (99 used in count of total).

Unknown = counts of specimens were not made.

Appendix G. Distribution Maps for All Species

How to Use the Maps. Readers interested in seeing the distribution of certain fish may look for the distribution maps of those fish in the following appendix. Maps are identified by a number and by the common name of the fish species covered. For most species, 2 maps are presented, one for the early period (1900-72) and one for the late period (1974-86). In the map numbering, these periods are identified as early (E) and late (L).

Map Sequence and Numbers. Sequence of the maps follows the phylogenetic order of the fish species. This sequence parallels that used in the master table of fish records, Table 6, which also lists the map numbers in ascending order. Readers unfamiliar with the location of species within phylogenetic order may use Index B to find the fish they are interested in. Found on the last inside page of this report, Index B lists the common names of mapped species in alphabetical order. After each common name in the index, the appropriate map numbers are given for the 2 time periods.

Water Body Locations. Once the desired maps are located, one of the clear base maps at the back of the report can be removed and placed on top of the distribution maps. This base map places and names major water bodies in the state. It serves as a reference tool for identifying the approximate location of the records shown on the maps.

Map Symbols and Captions. The 2 symbols used throughout the maps are a triangle—for collections by collectors whose identification we accepted—and a circle—for collections by collectors we were uncertain about.

Captions for each map summarize the actual number of collections for each species. For the 2 map symbols, the first number given in the map caption is the number of collections shown on the map for that period. The number in parentheses is the number of collections that could not be shown on the map because of space limitations.

Map captions also divide the total number of collections for each species into the number of collections made by DNR personnel and the number made by others. As for the map symbols, these numbers give first the number shown on the map and in parentheses the number not mapped.

Further explanation on certainty of species identification, names of non-DNR collectors, and the computer plotting of records is given in the "Fish Identification, Enumeration, and Status Listing" and "Data Handling" sections of this report.

Map Interpretation. Readers are reminded that the maps show distribution only in that part of the state that has been sampled. Since sampling has been completed in only about half of the state, empty portions of the distribution maps may mean that area has not yet been surveyed. Figure 1 of this report identifies where sampling has been completed. Further explanation of what the maps mean is given in the "Differences Between Time Periods" section of this report.

Map caption examples:

Map 1(E)

Chestnut lamprey

△ Accepted	6(0)
○ Uncertain	31(2)
	DNR 30(2)
	Other 7(0)

Map 1(L)

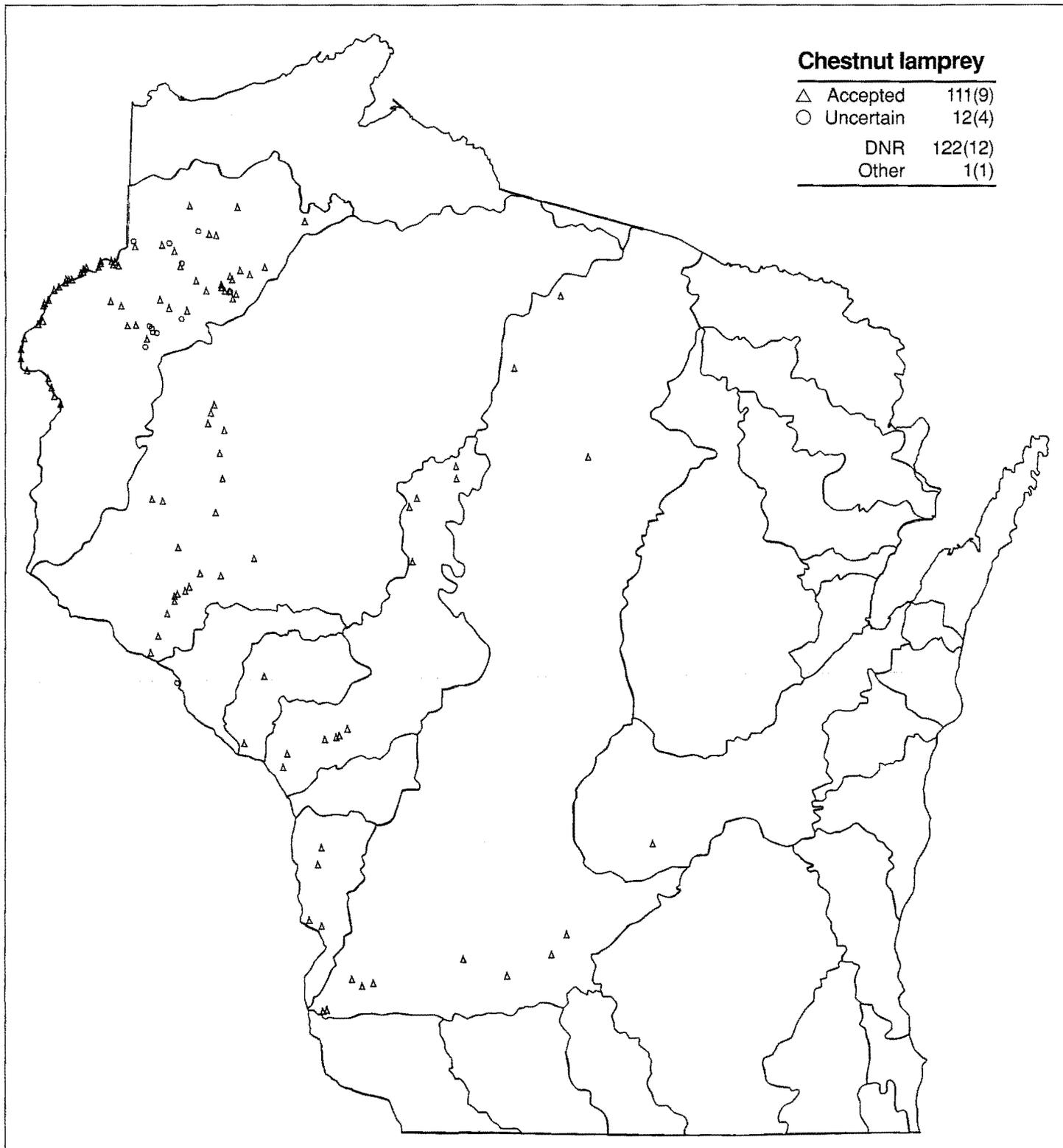
Chestnut lamprey

△ Accepted	111(9)
○ Uncertain	12(4)
	DNR 122(12)
	Other 1(1)

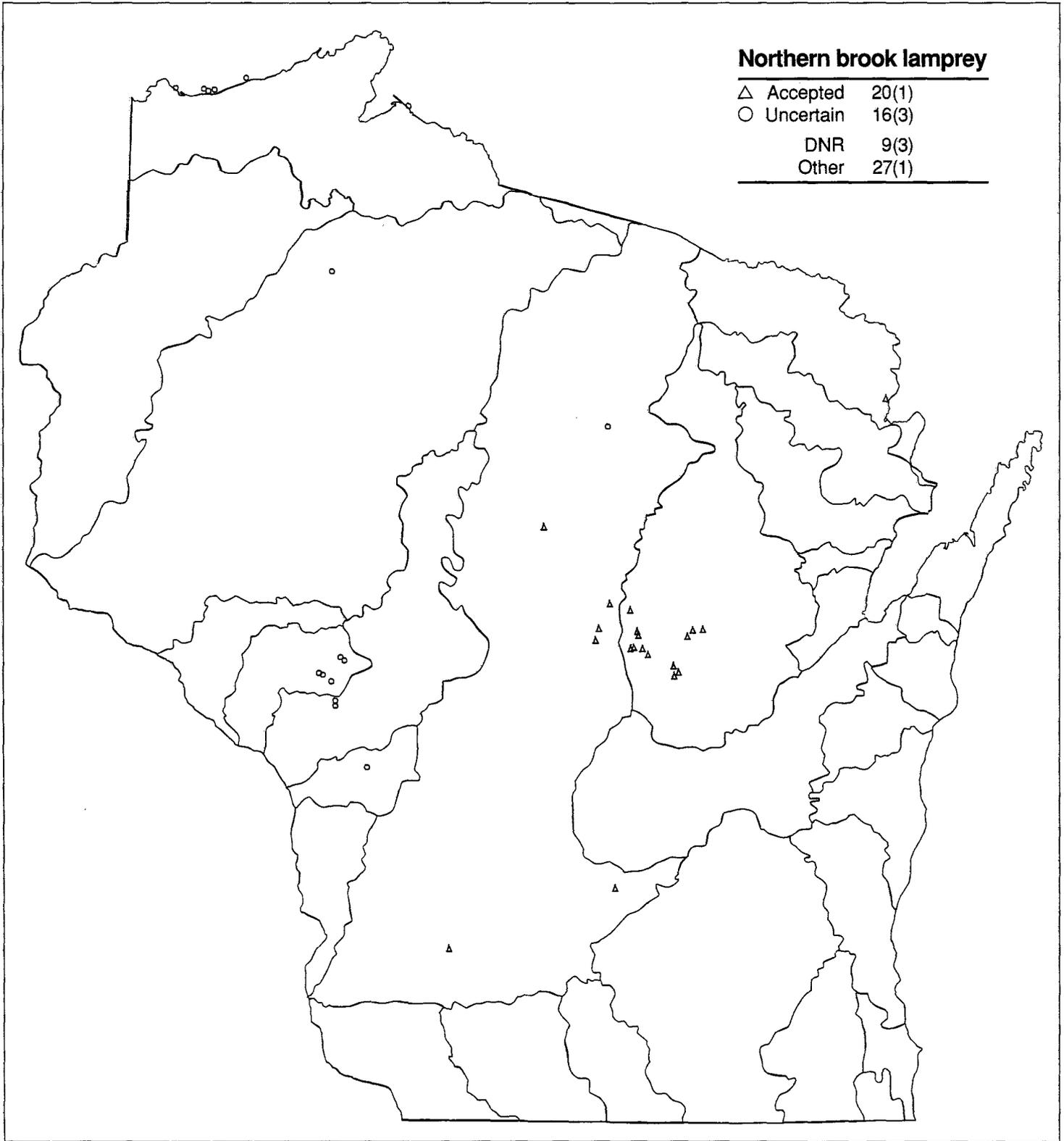
Map 1(E)



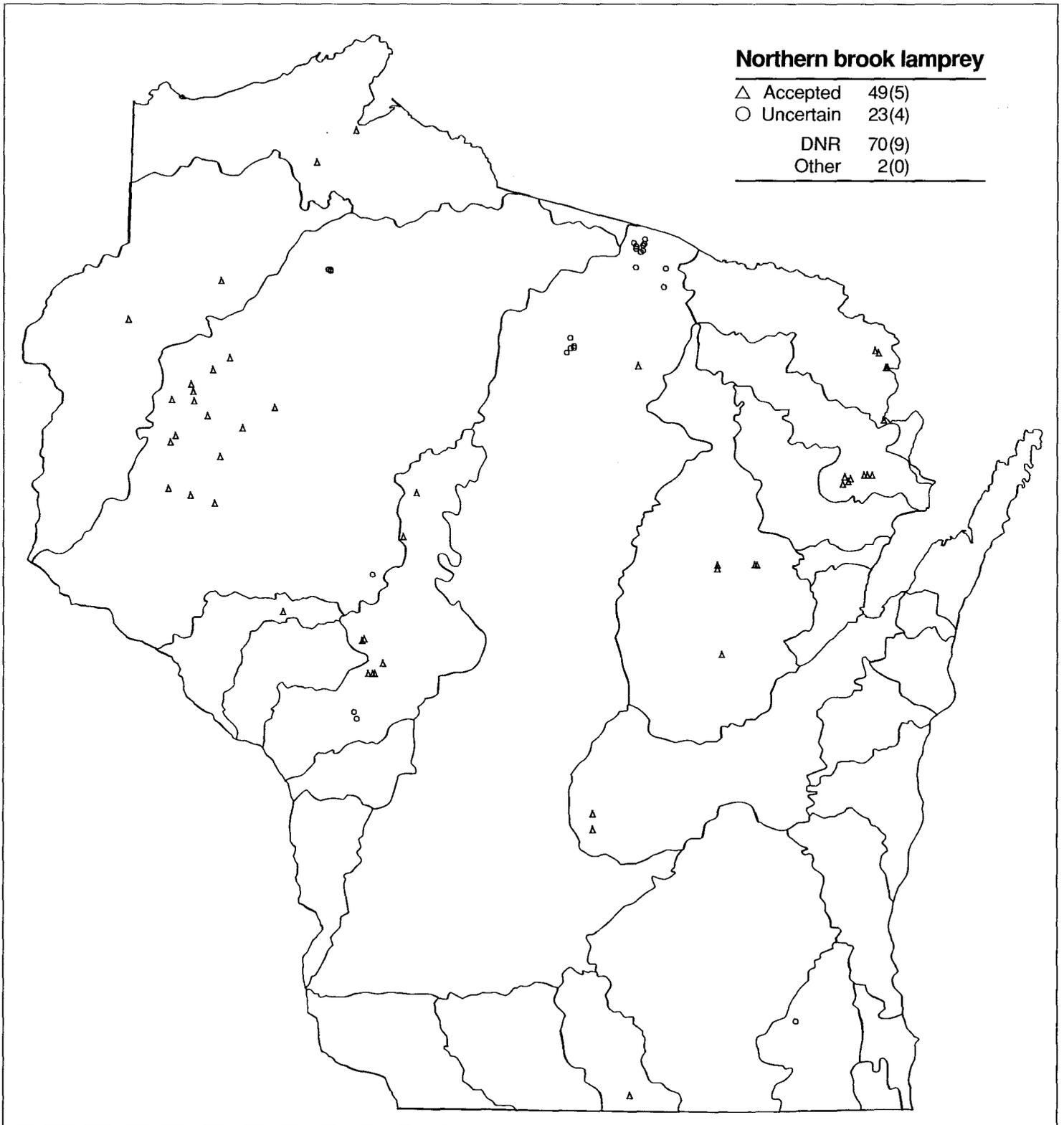
Map 1(L)



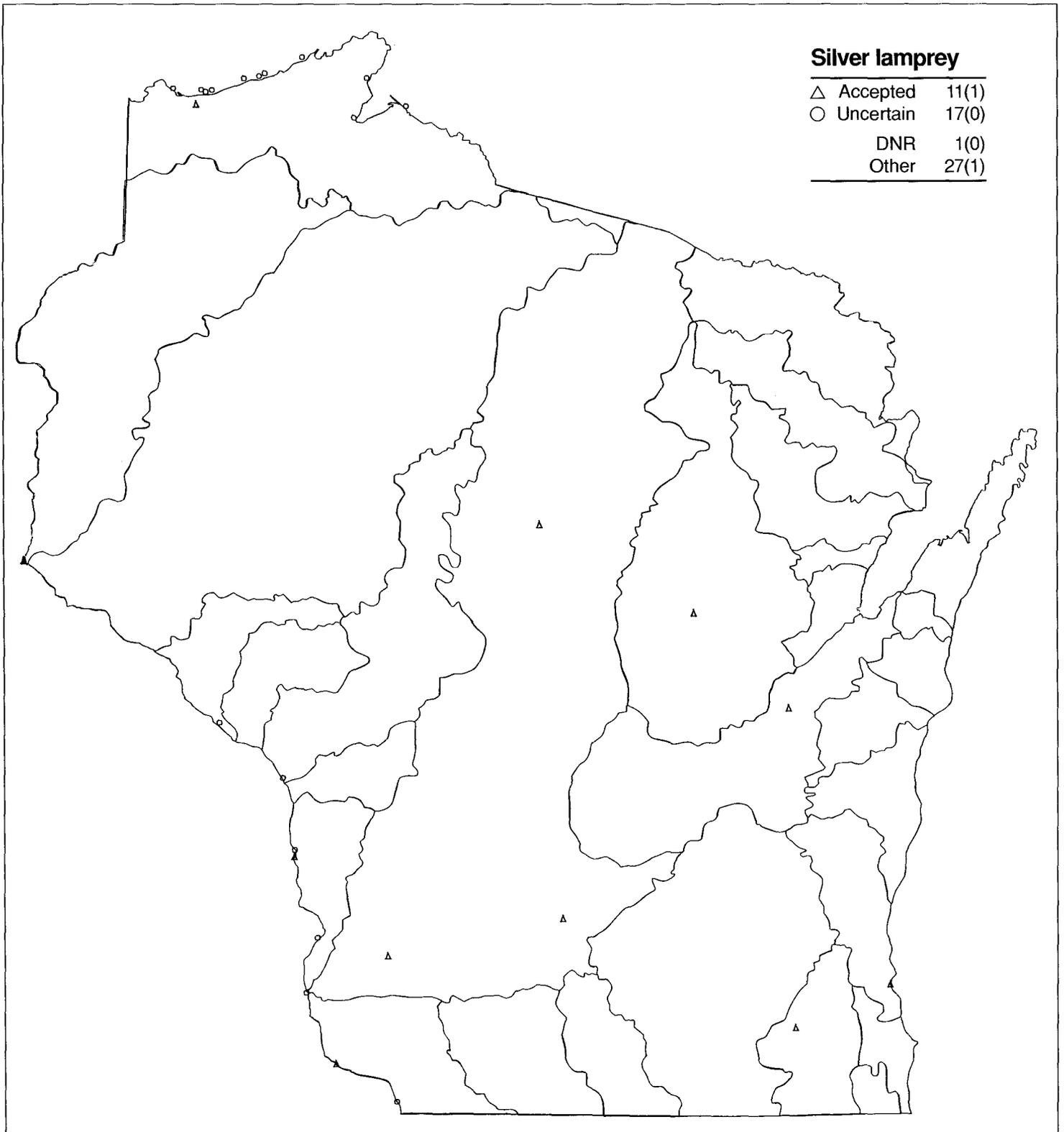
Map 2(E)



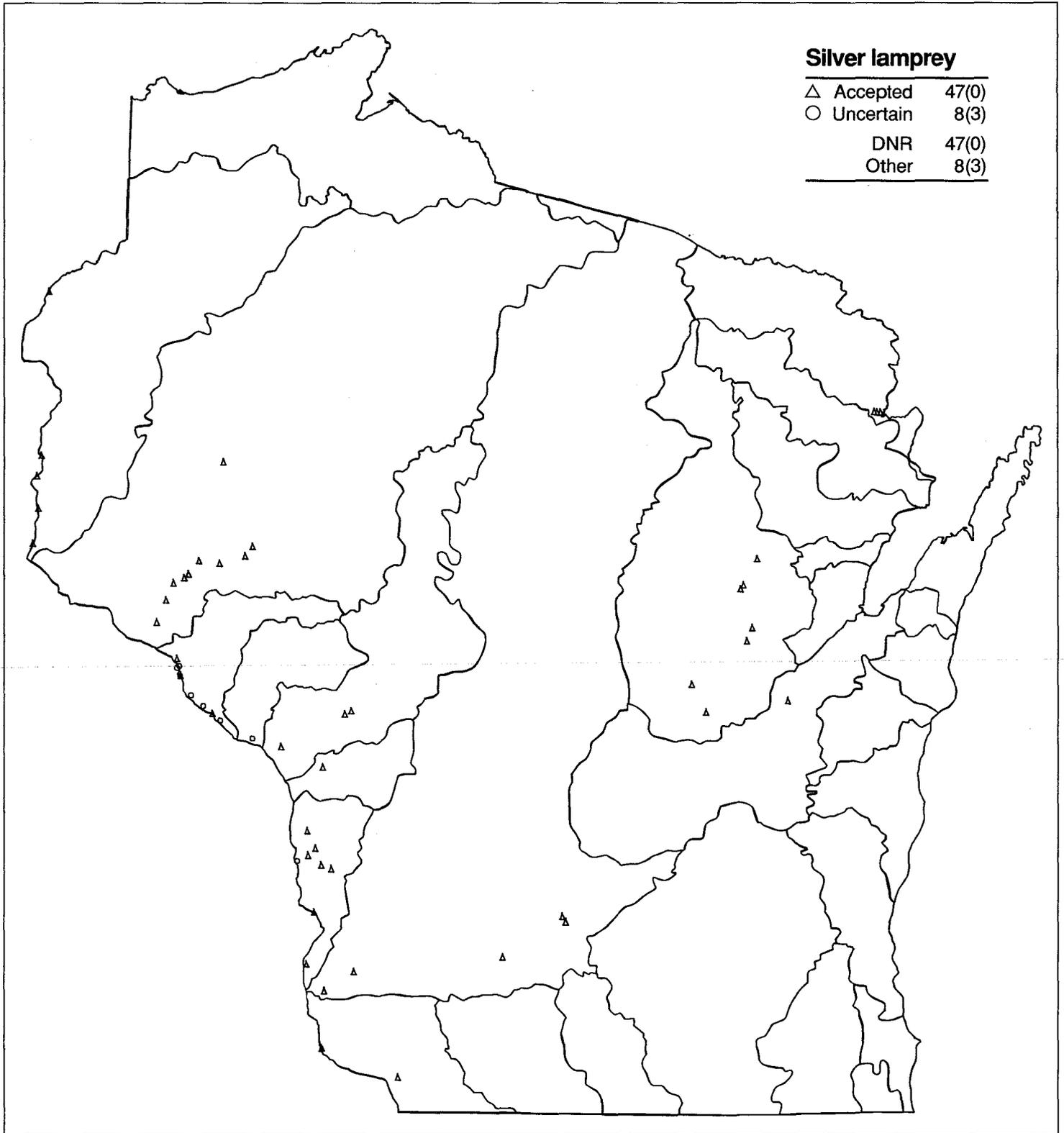
Map 2(L)



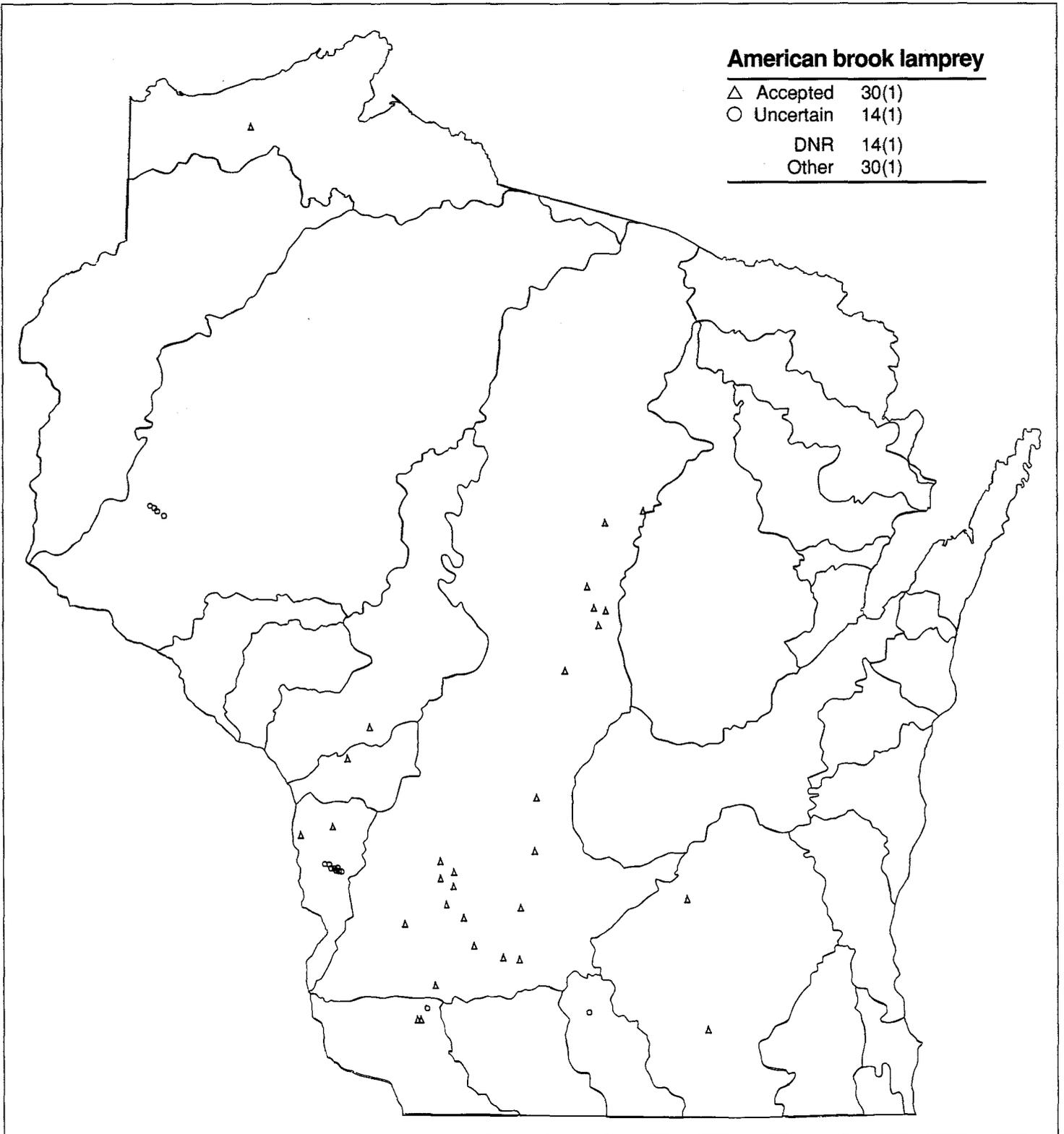
Map 3(E)



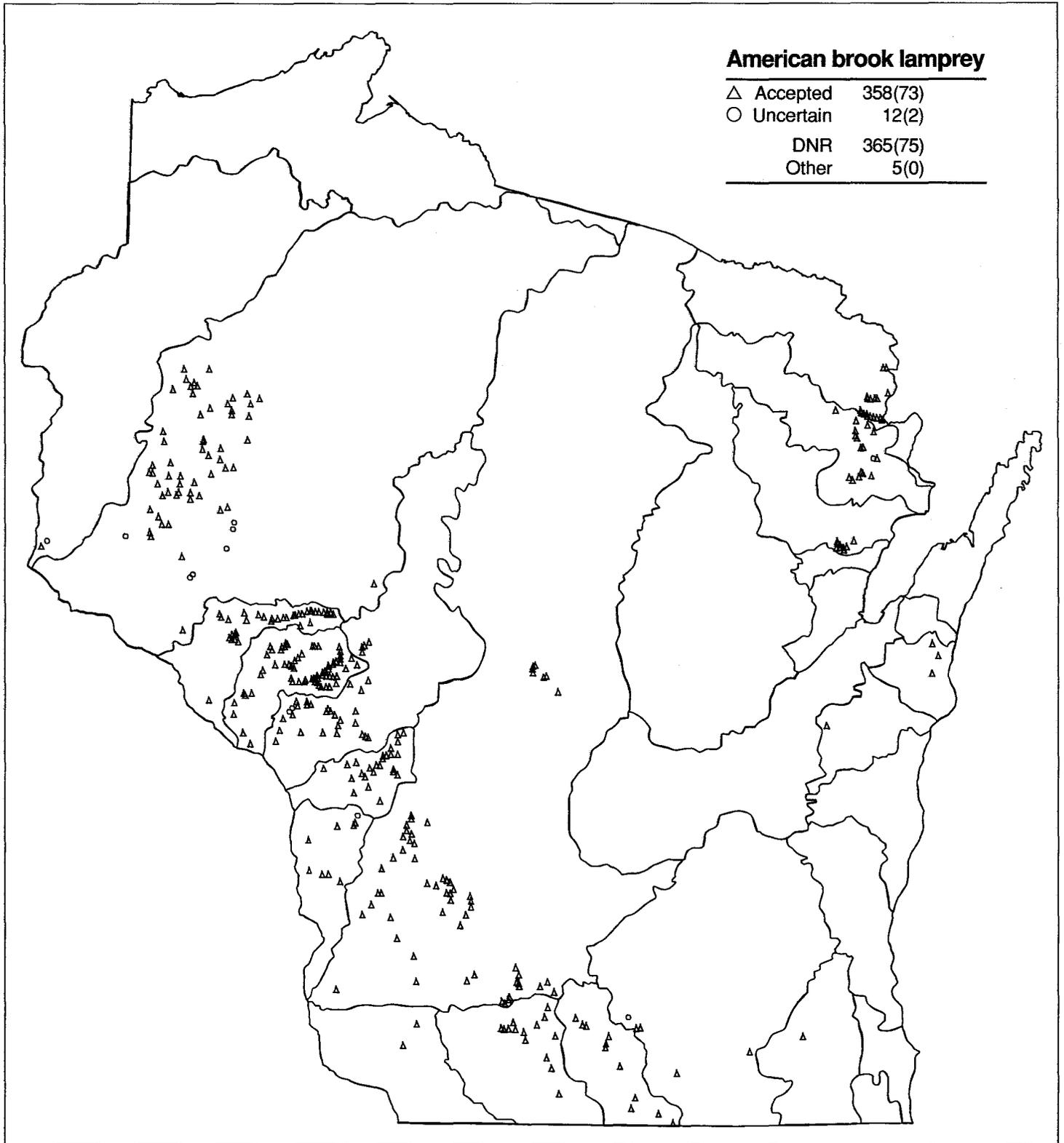
Map 3(L)



Map 4(E)



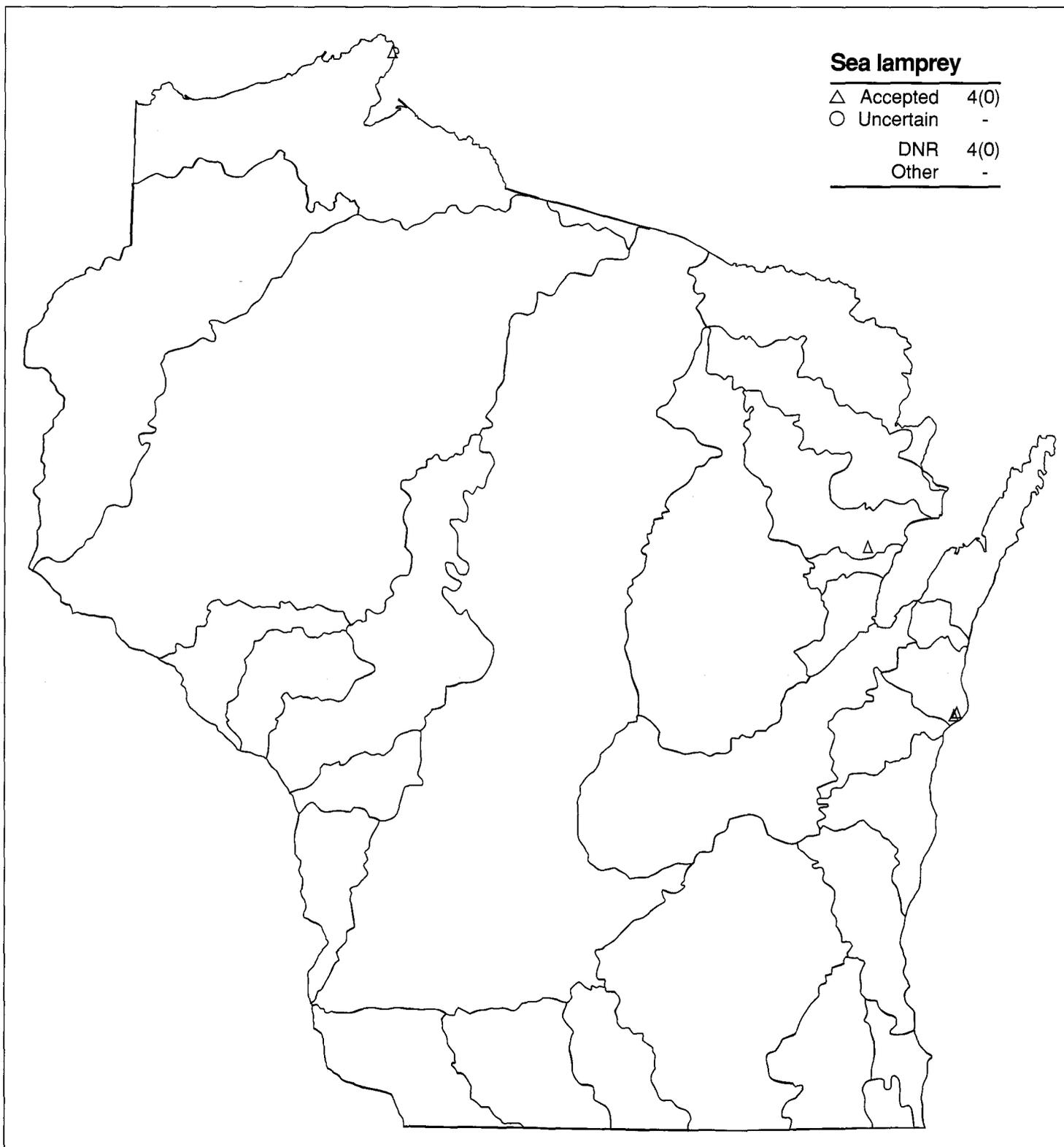
Map 4(L)



Map 5(E)



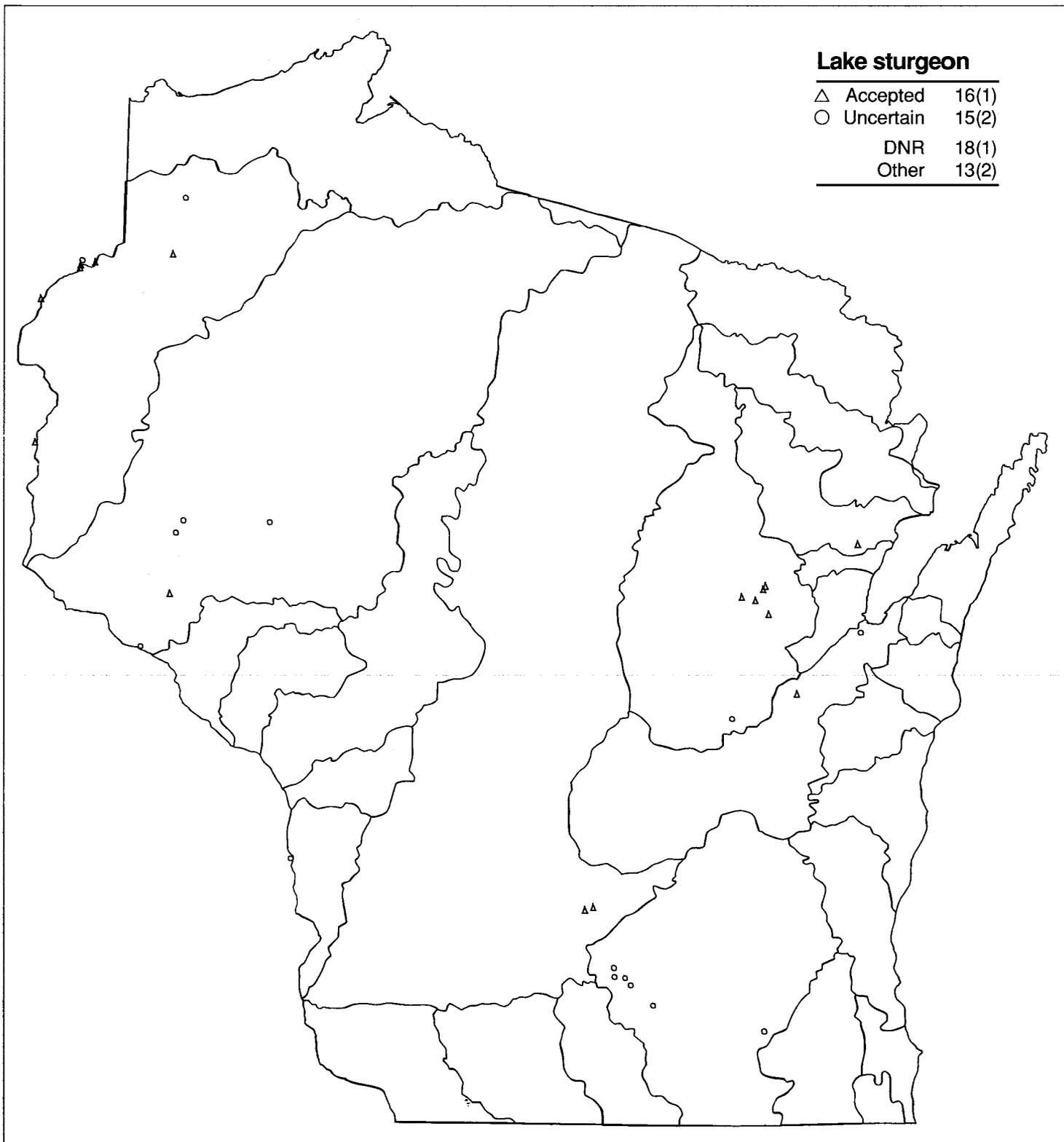
Map 5(L)



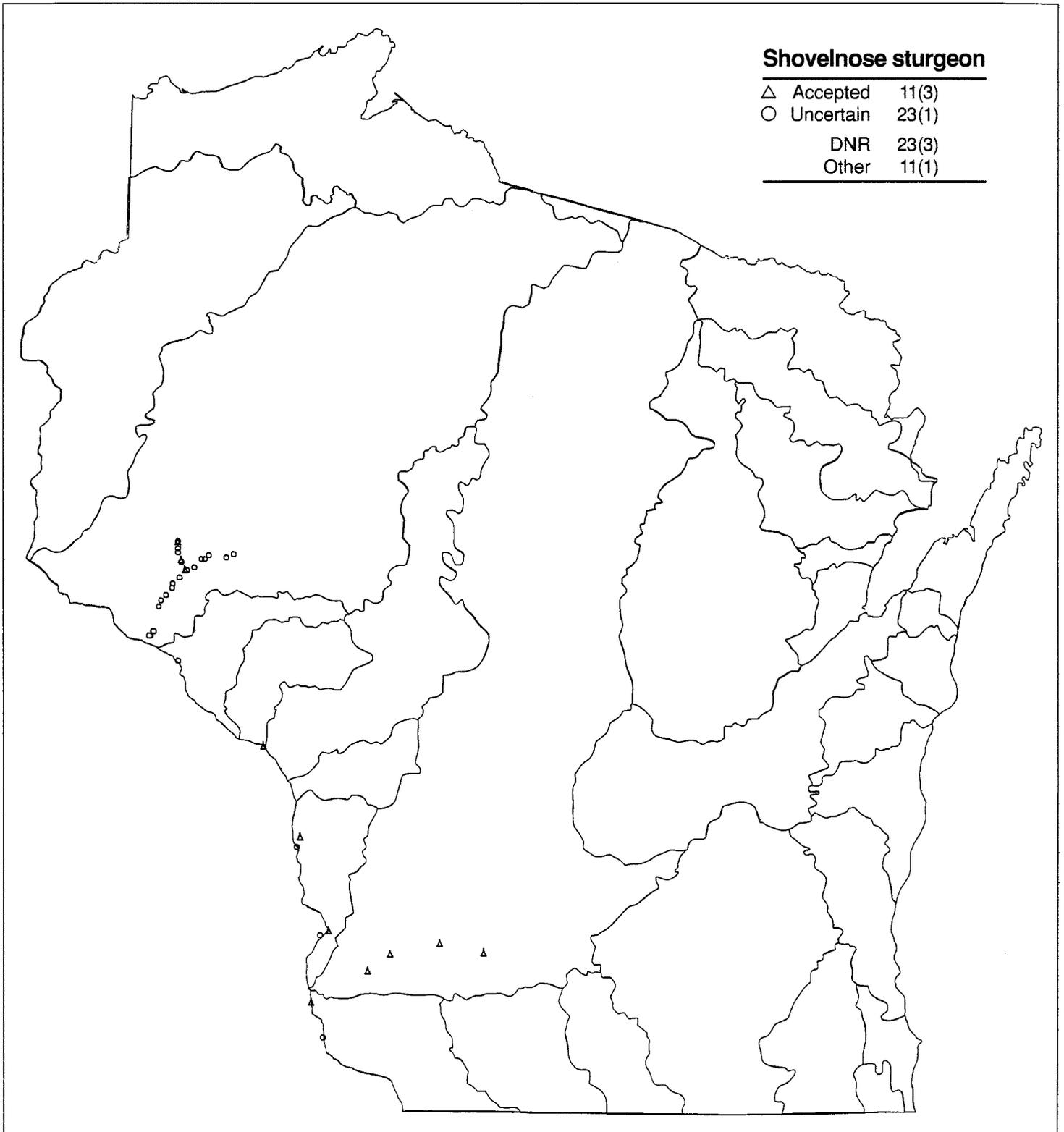
Map 6(E)



Map 6(L)

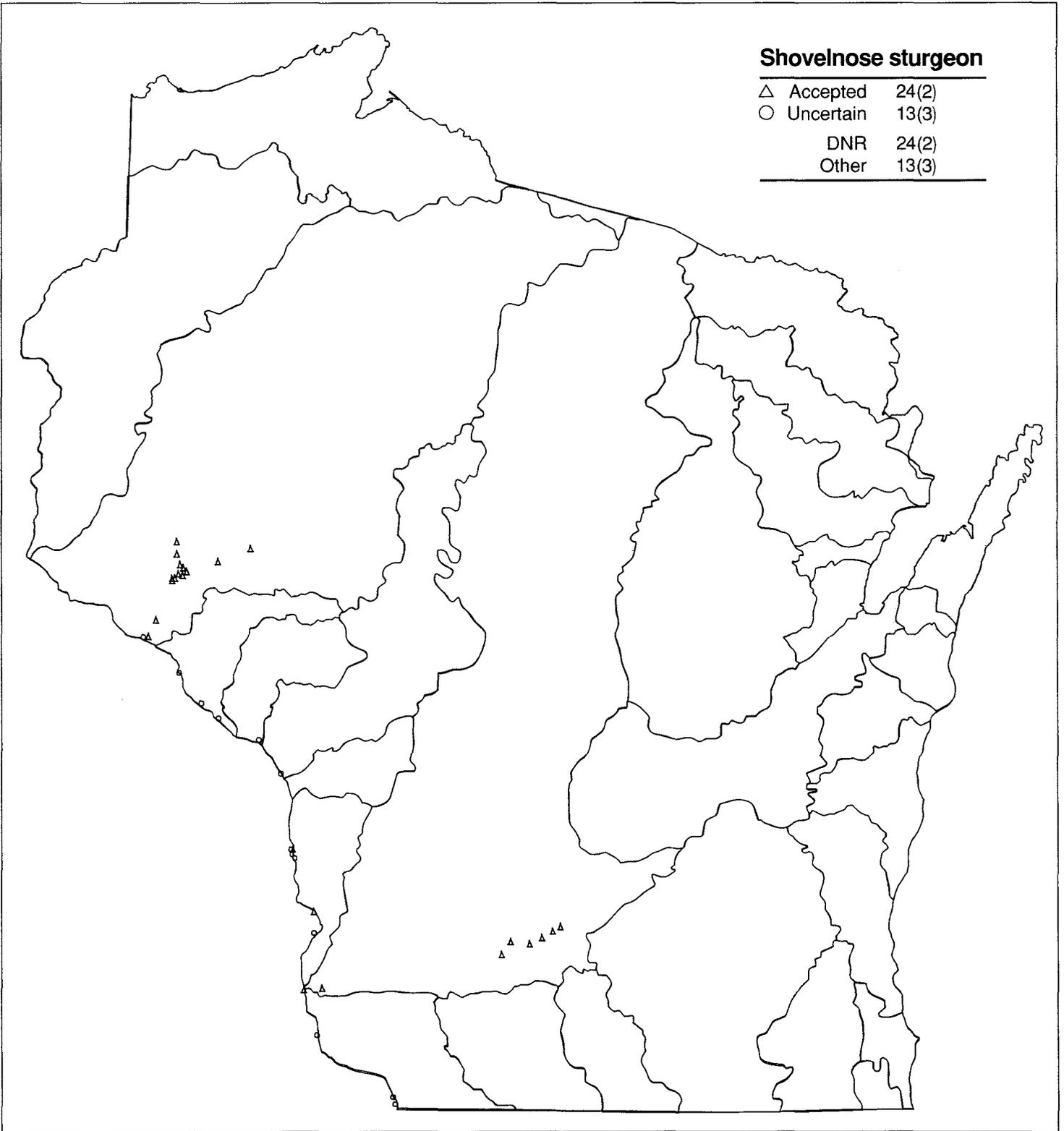


Map 7(E)



Shovelnose sturgeon

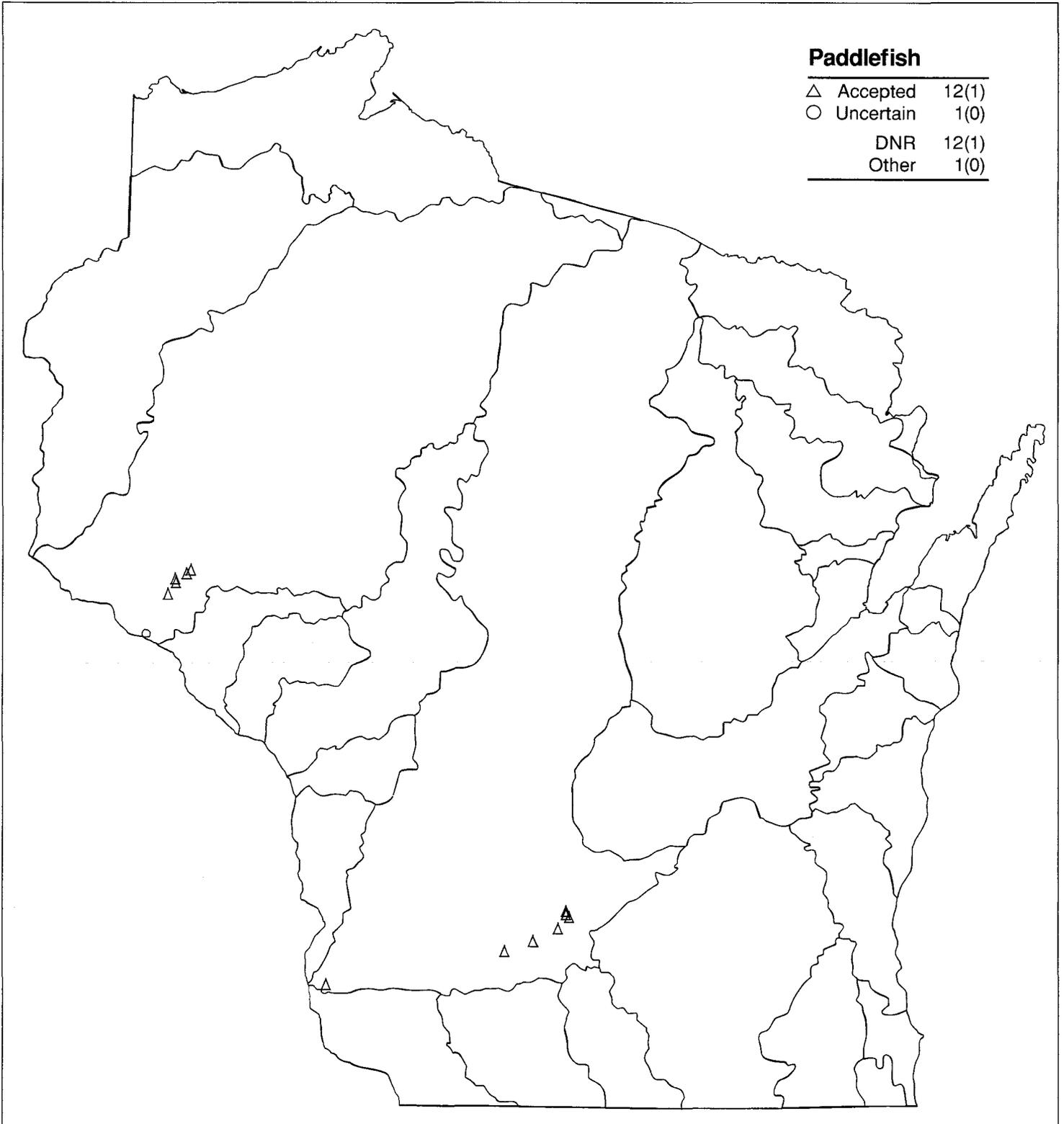
△	Accepted	24(2)
○	Uncertain	13(3)
	DNR	24(2)
	Other	13(3)



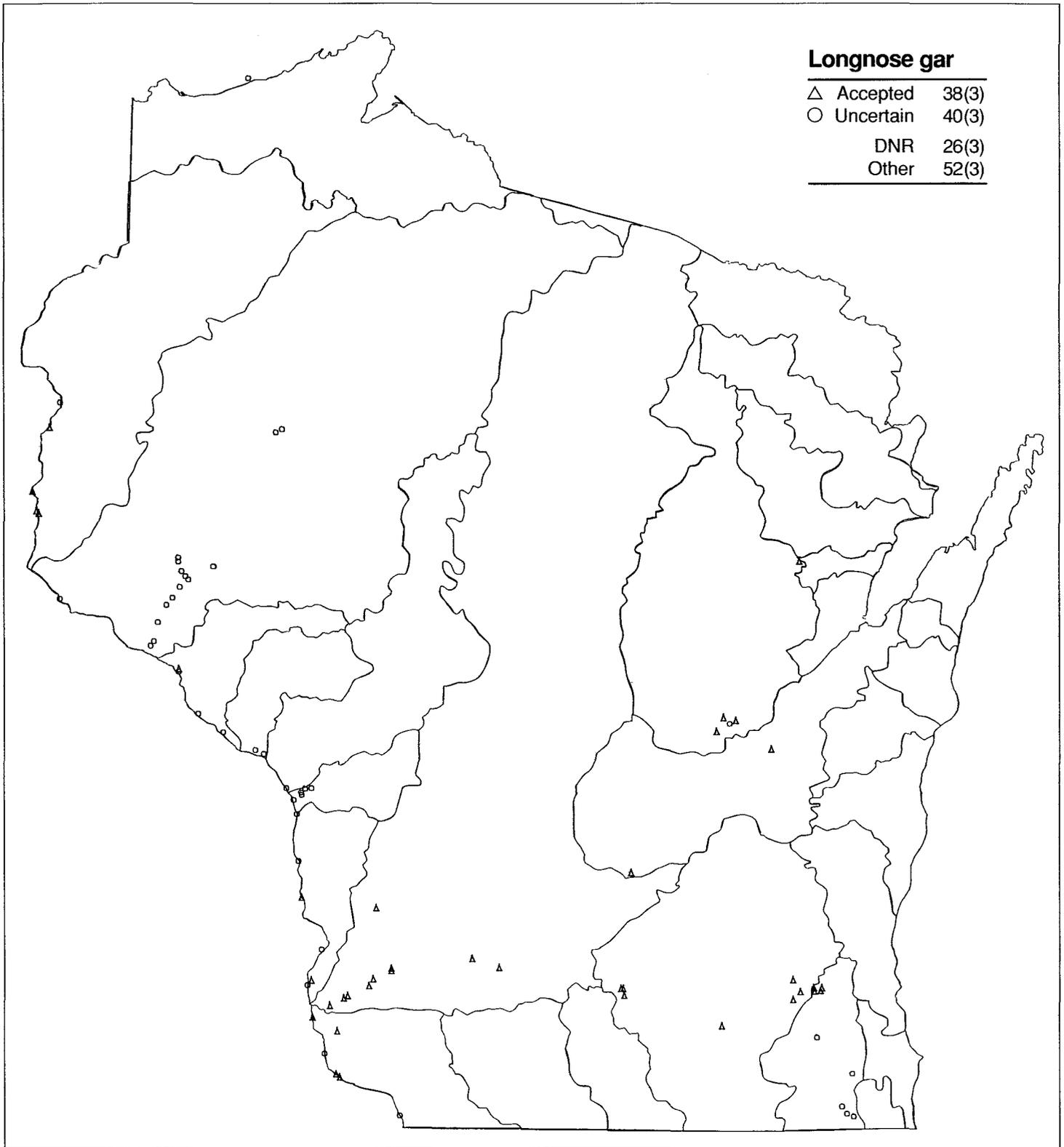
Map 8(E)



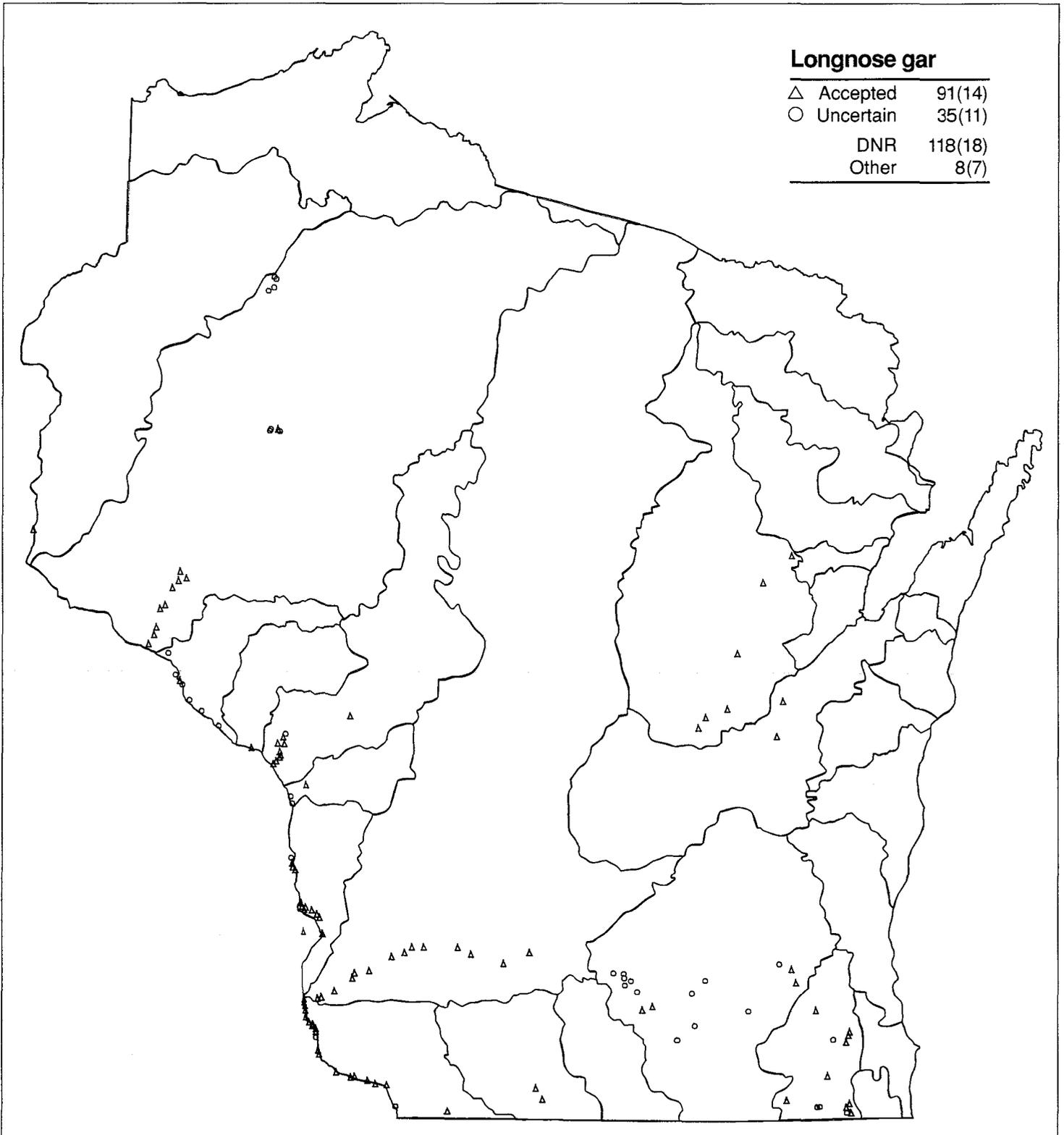
Map 8(L)



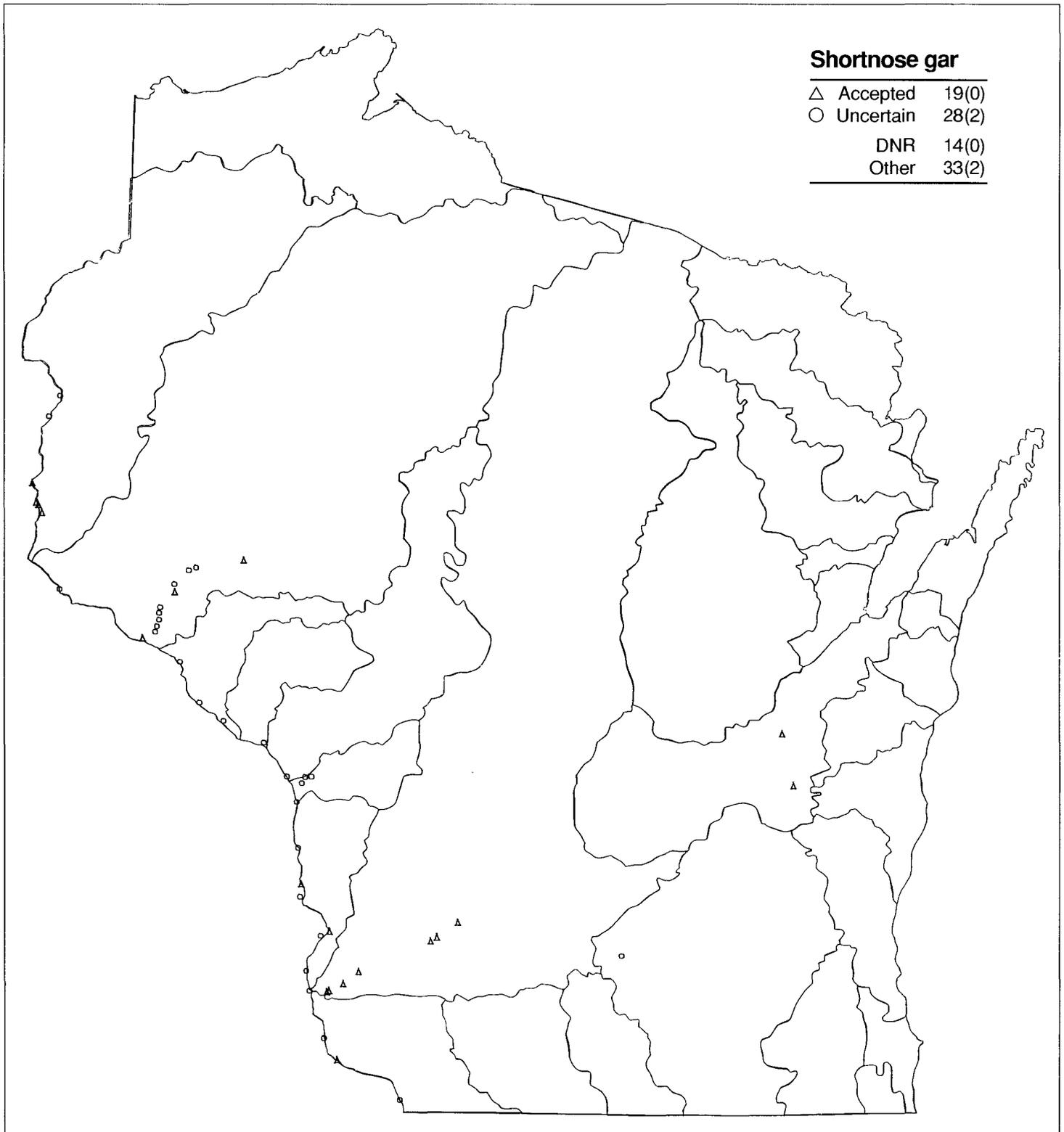
Map 9(E)



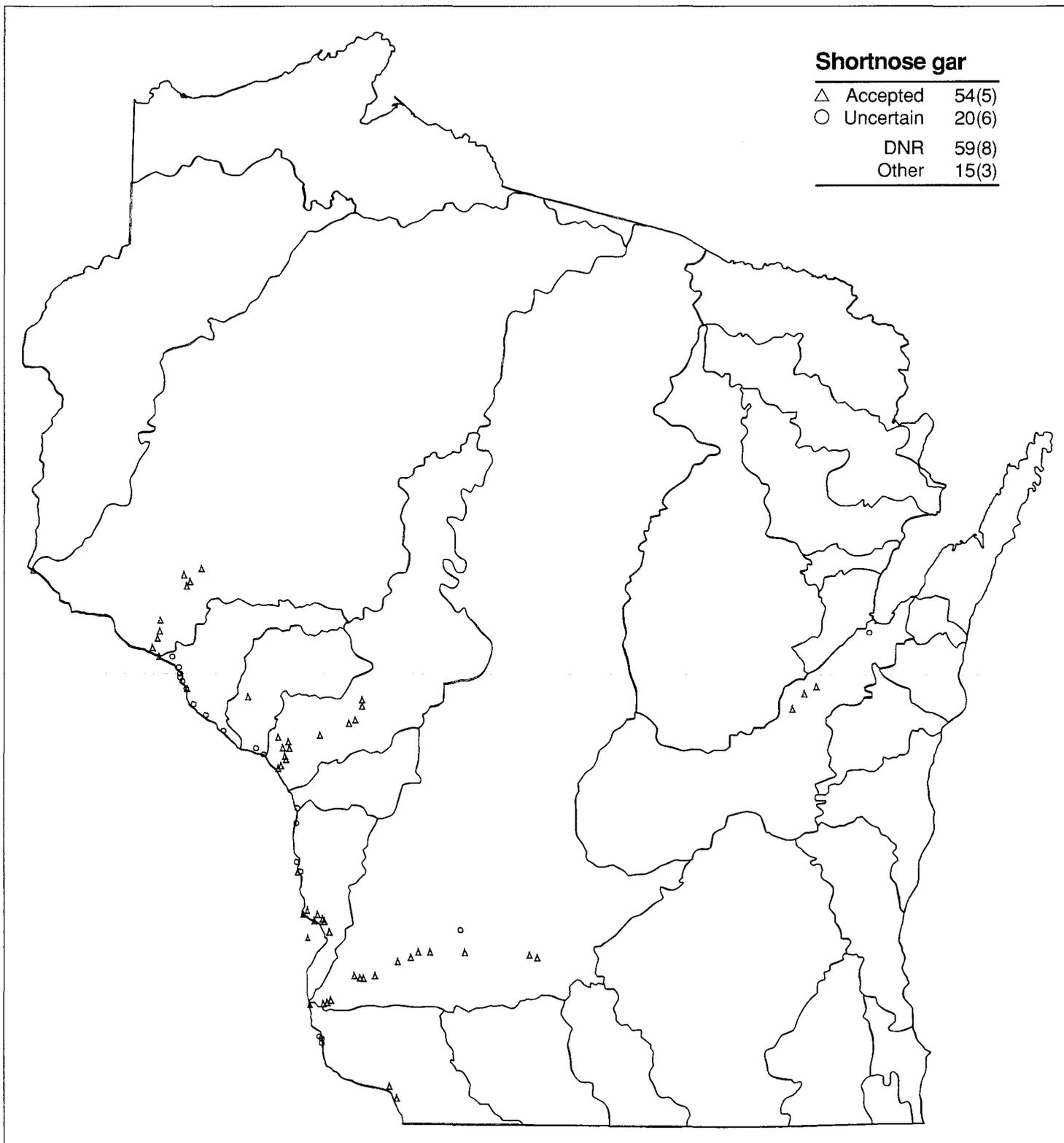
Map 9(L)



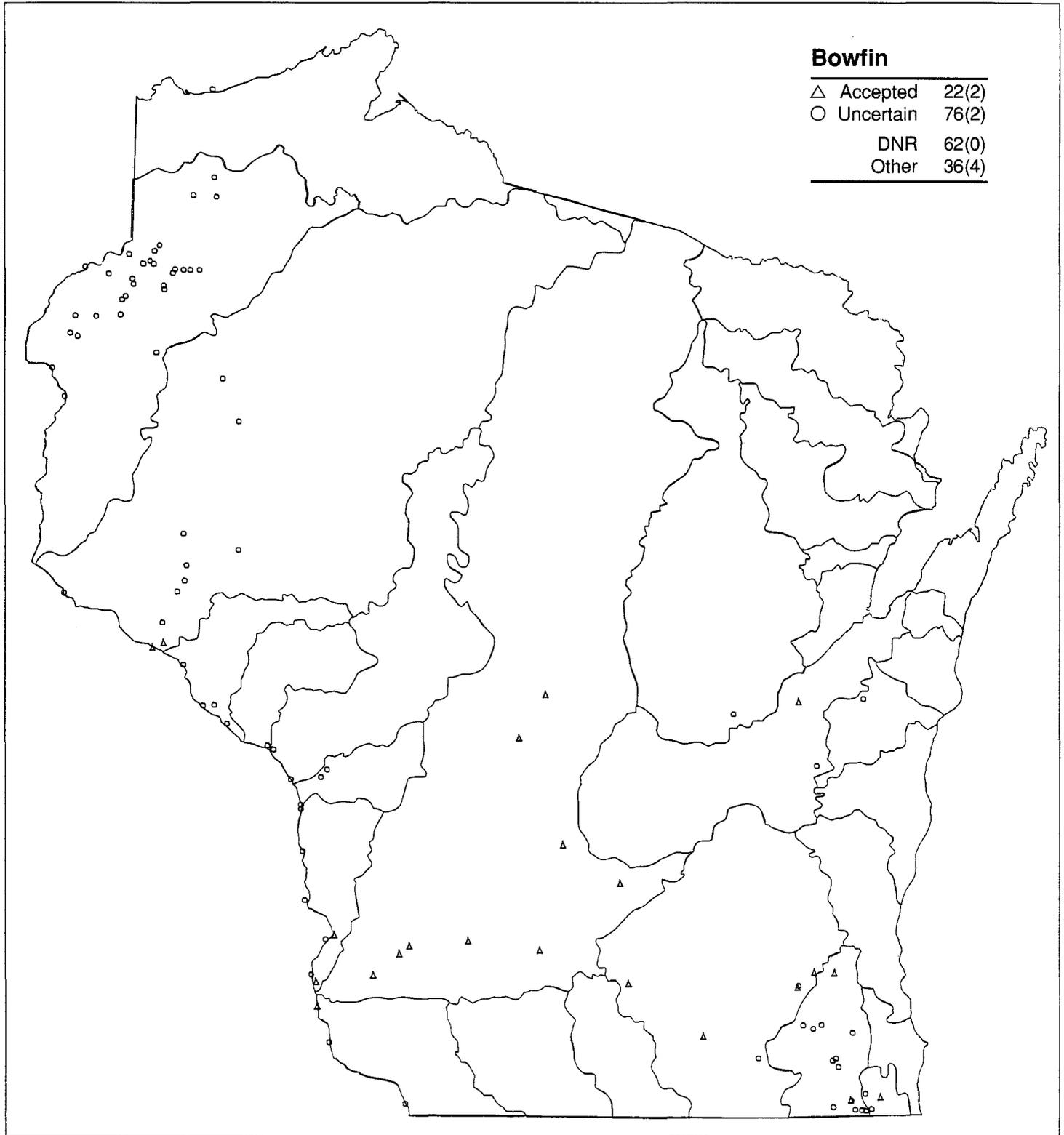
Map 10(E)

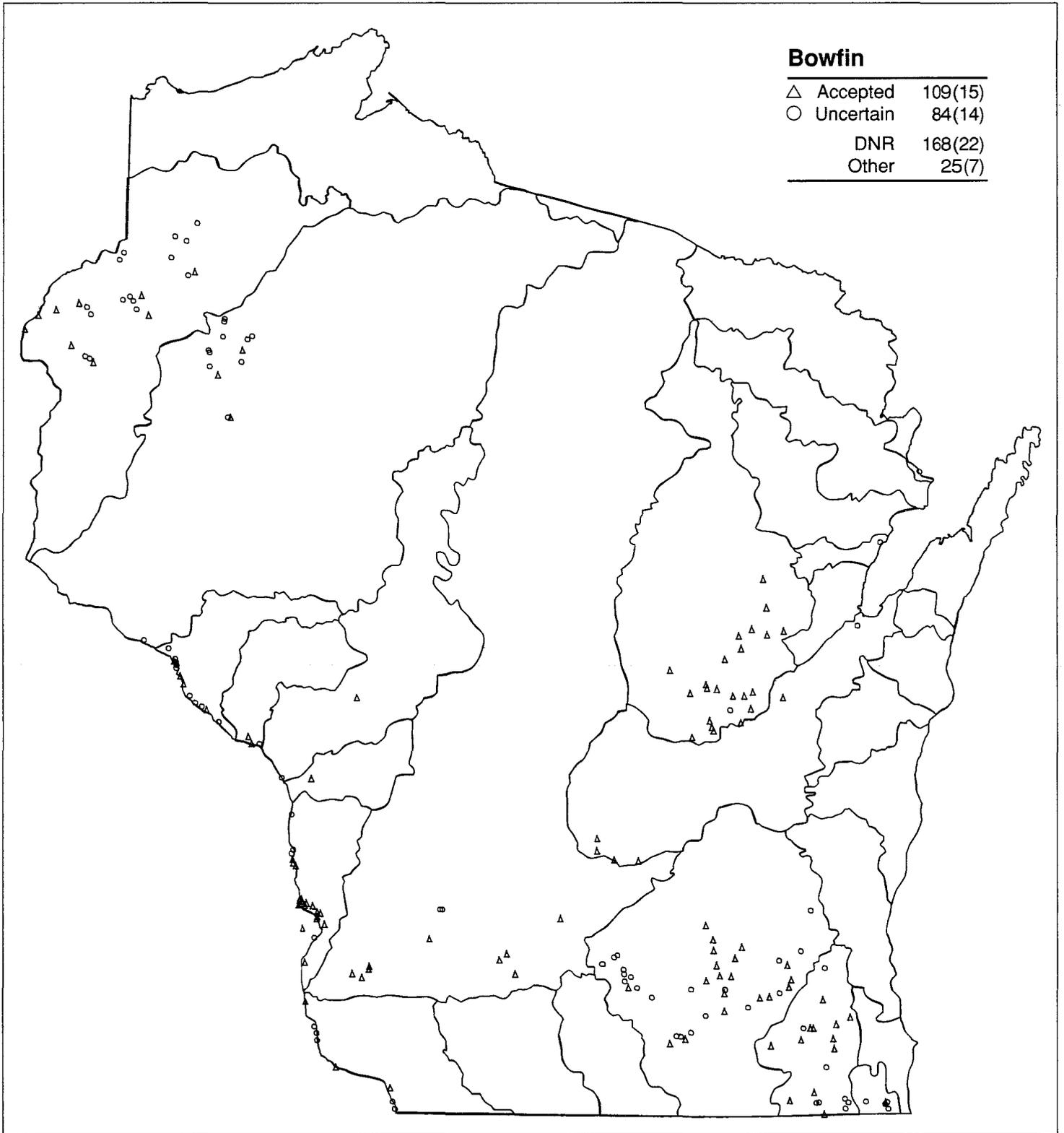


Map 10(L)

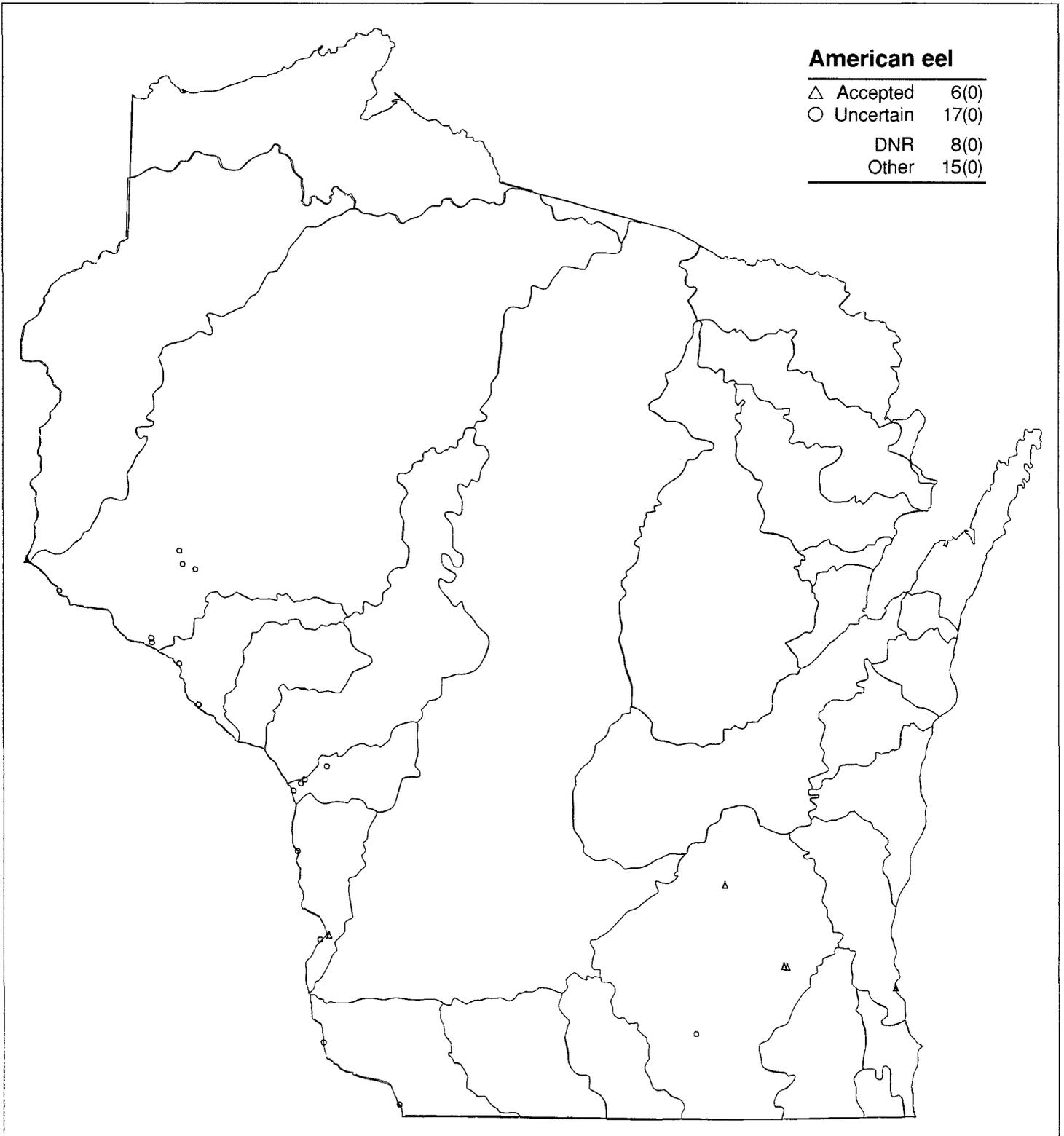


Map 11(E)

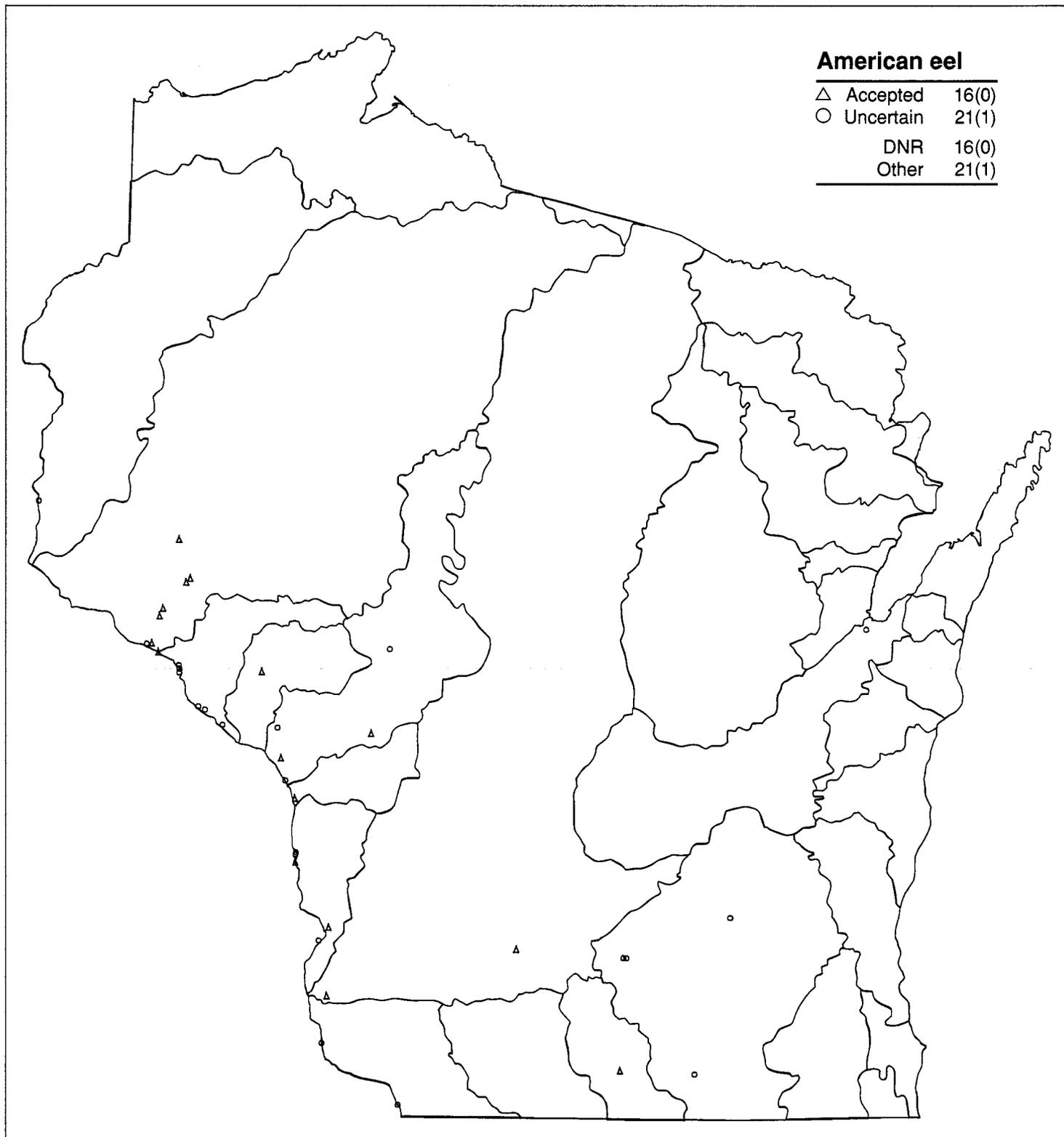




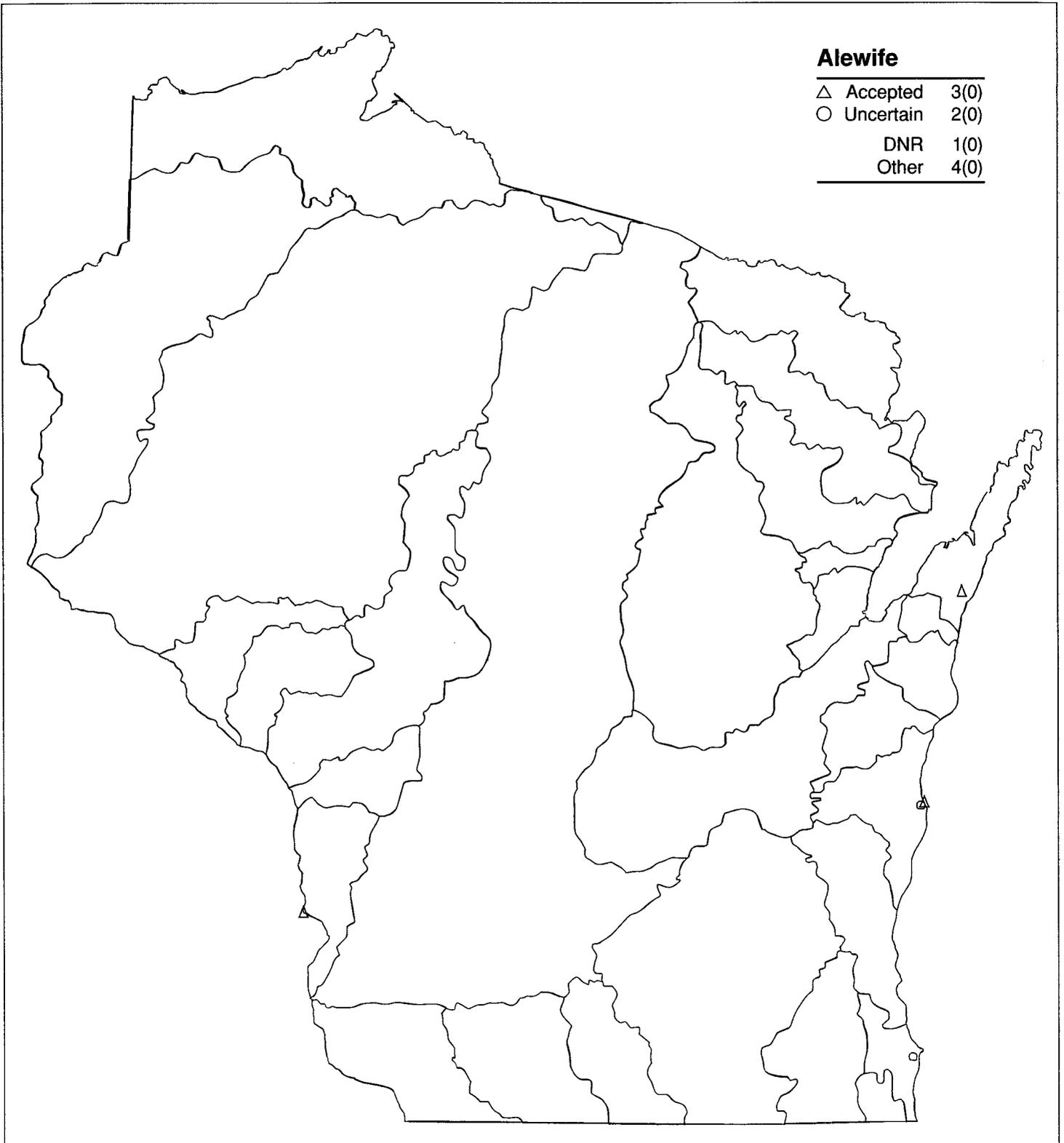
Map 12(E)



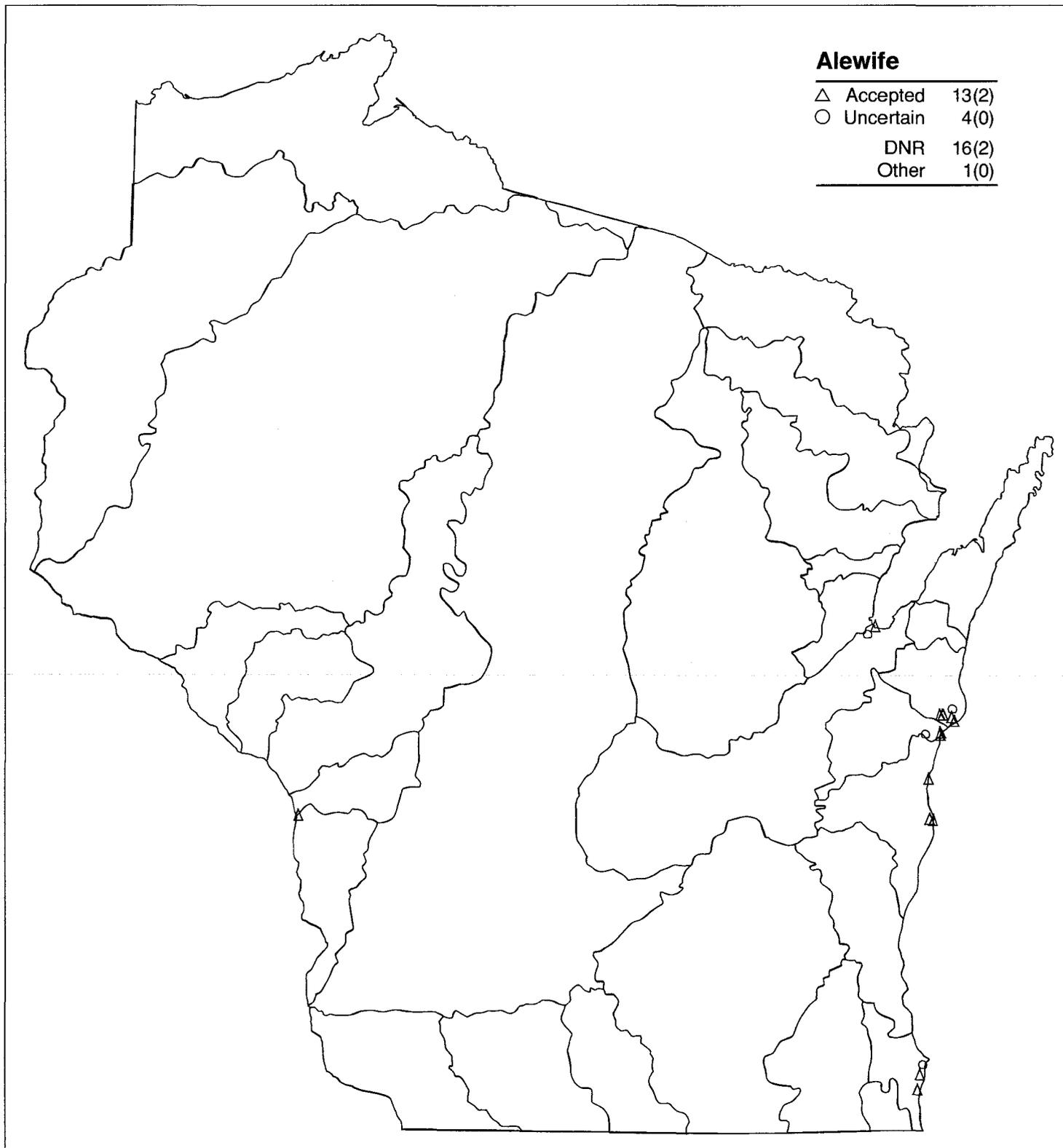
Map 12(L)



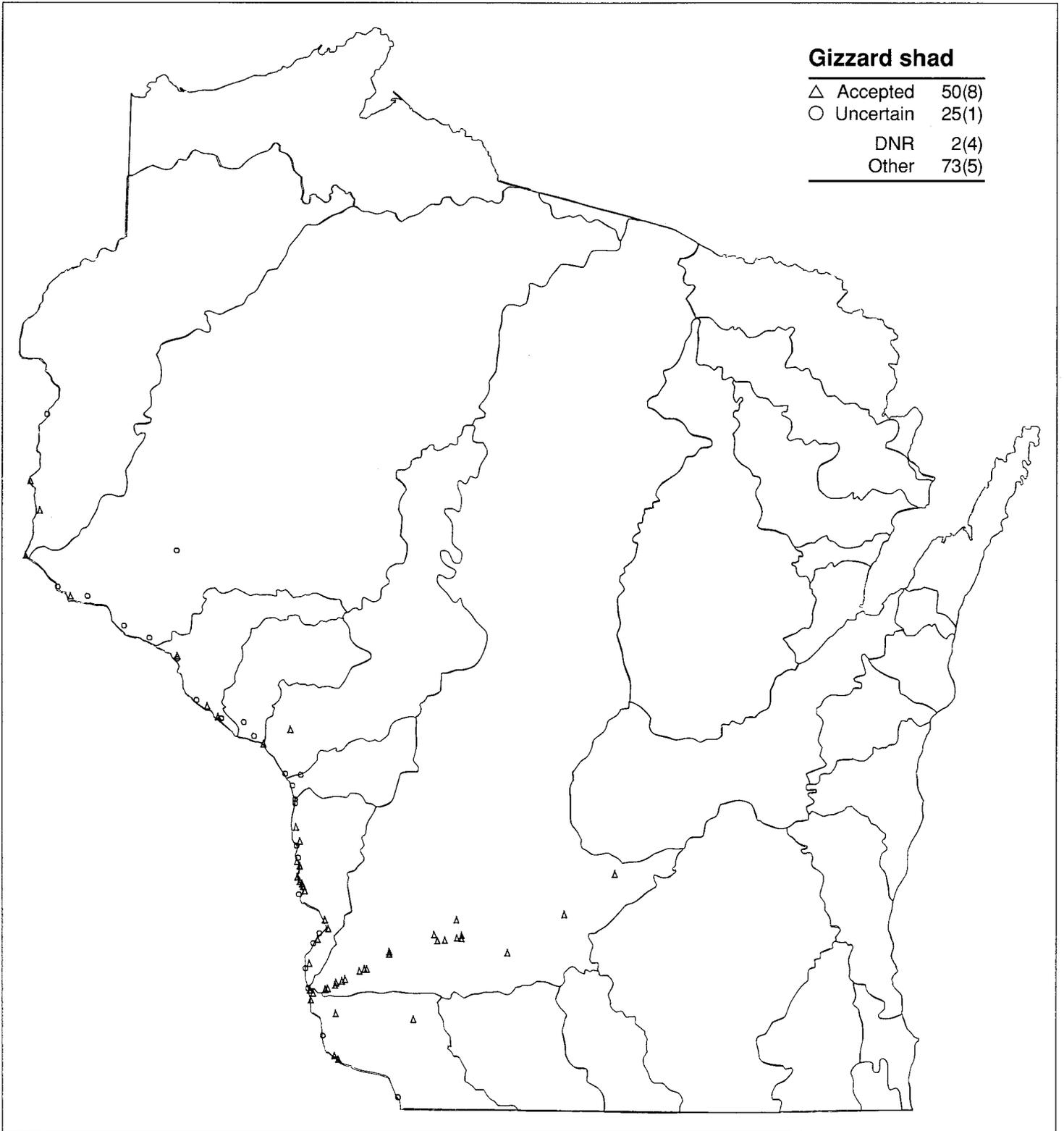
Map 13(E)



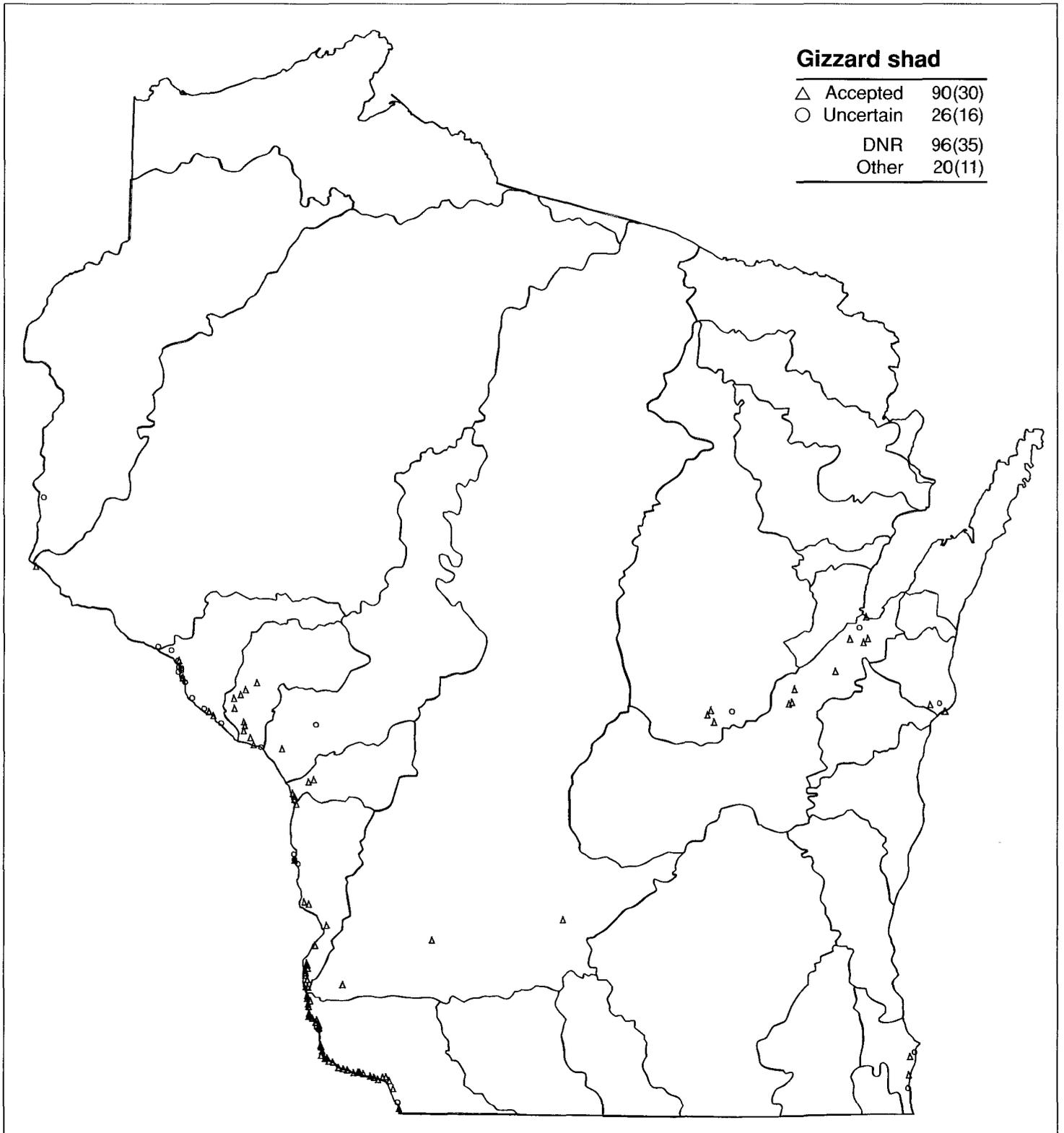
Map 13(L)



Map 14(E)



Map 14(L)



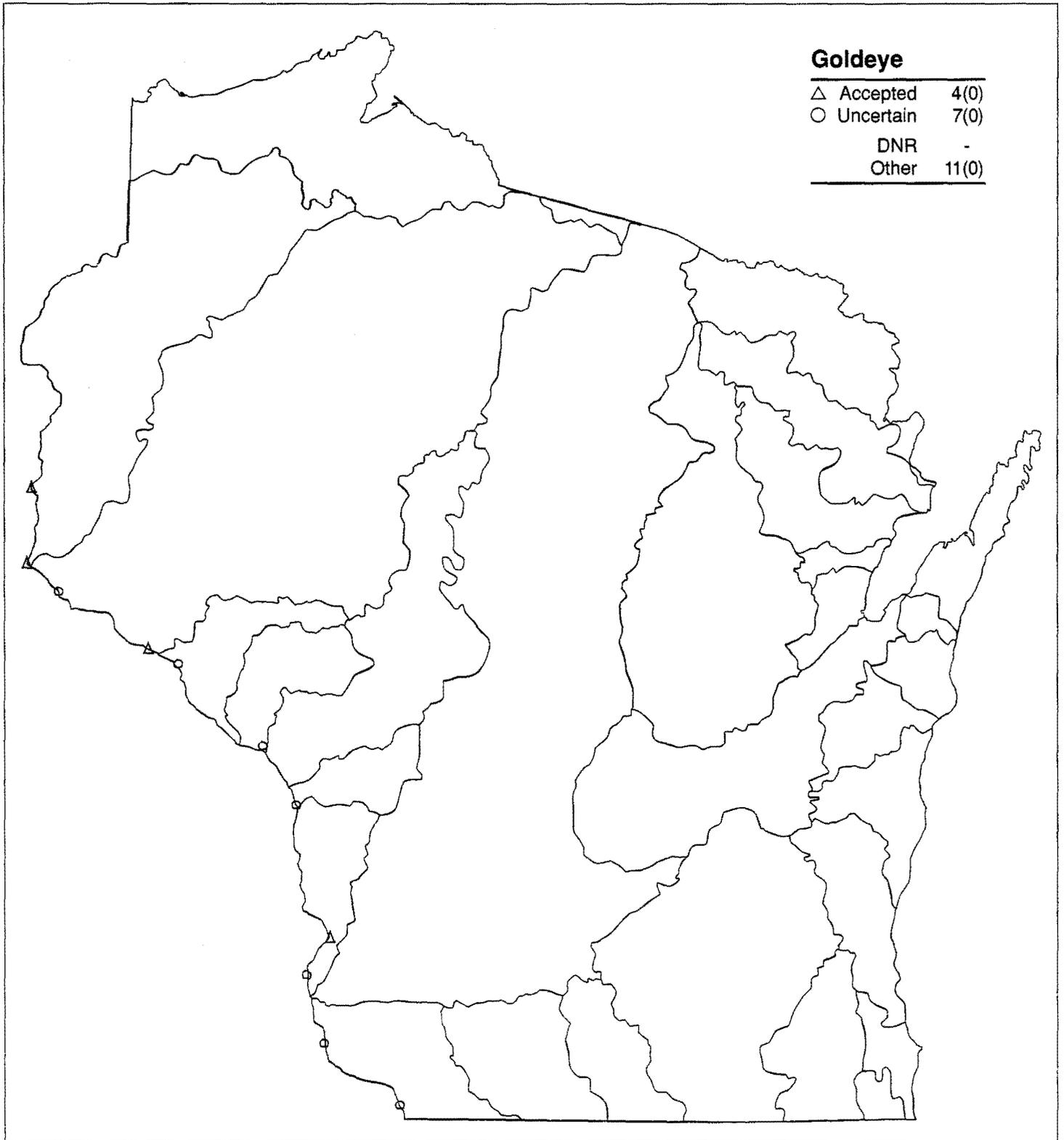
Map 15(E)



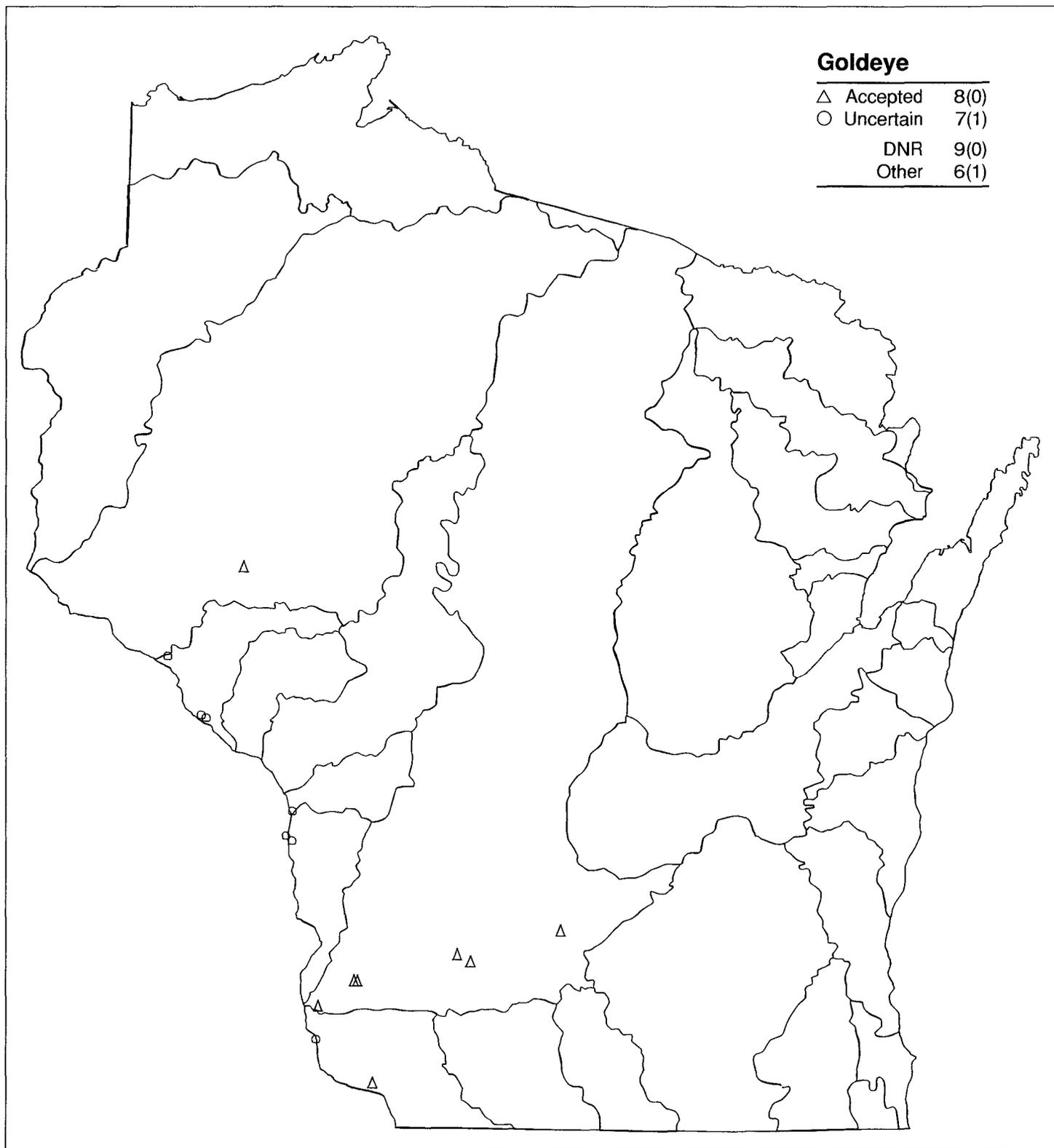
Map 15(L)



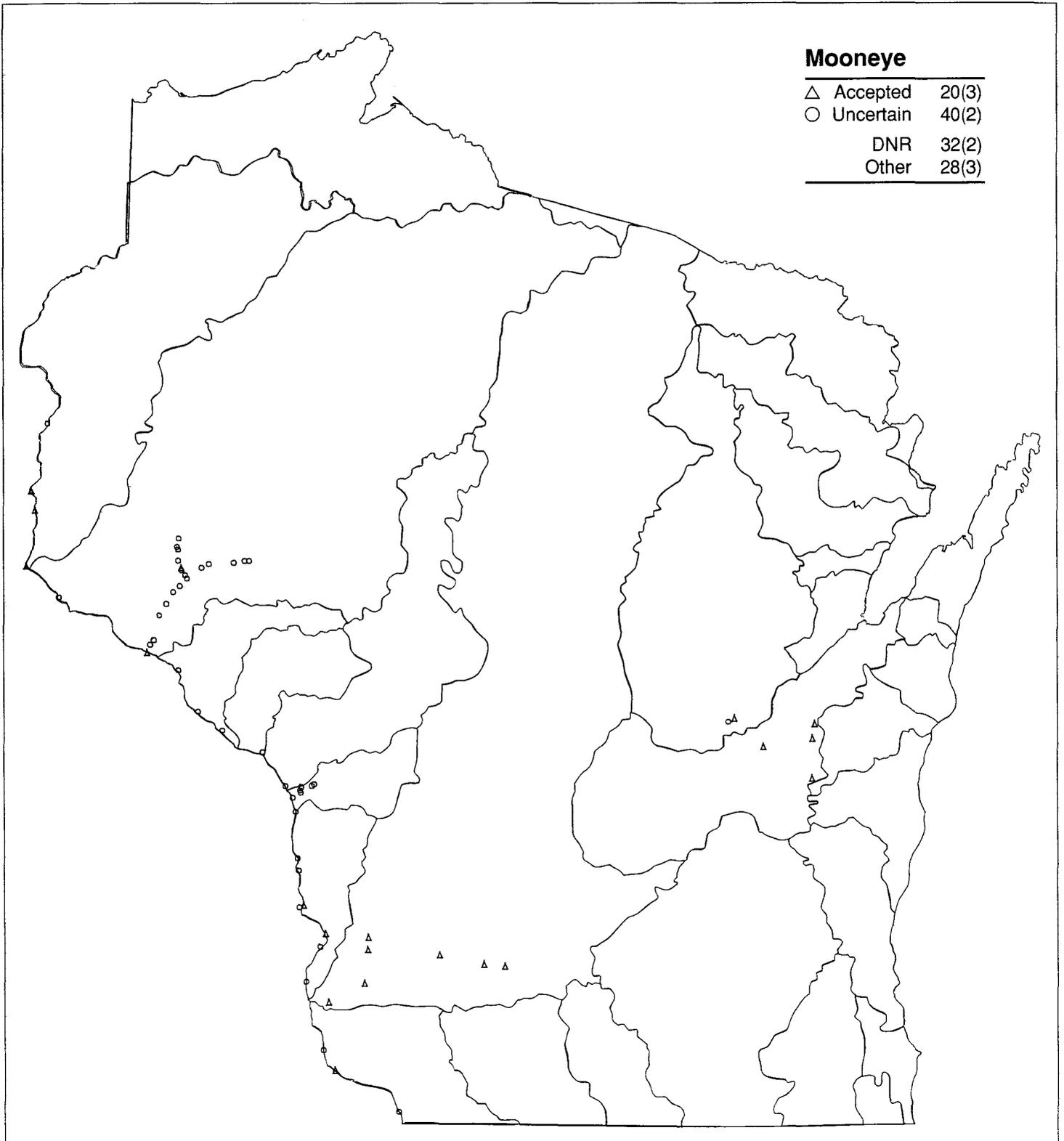
Map 16(E)

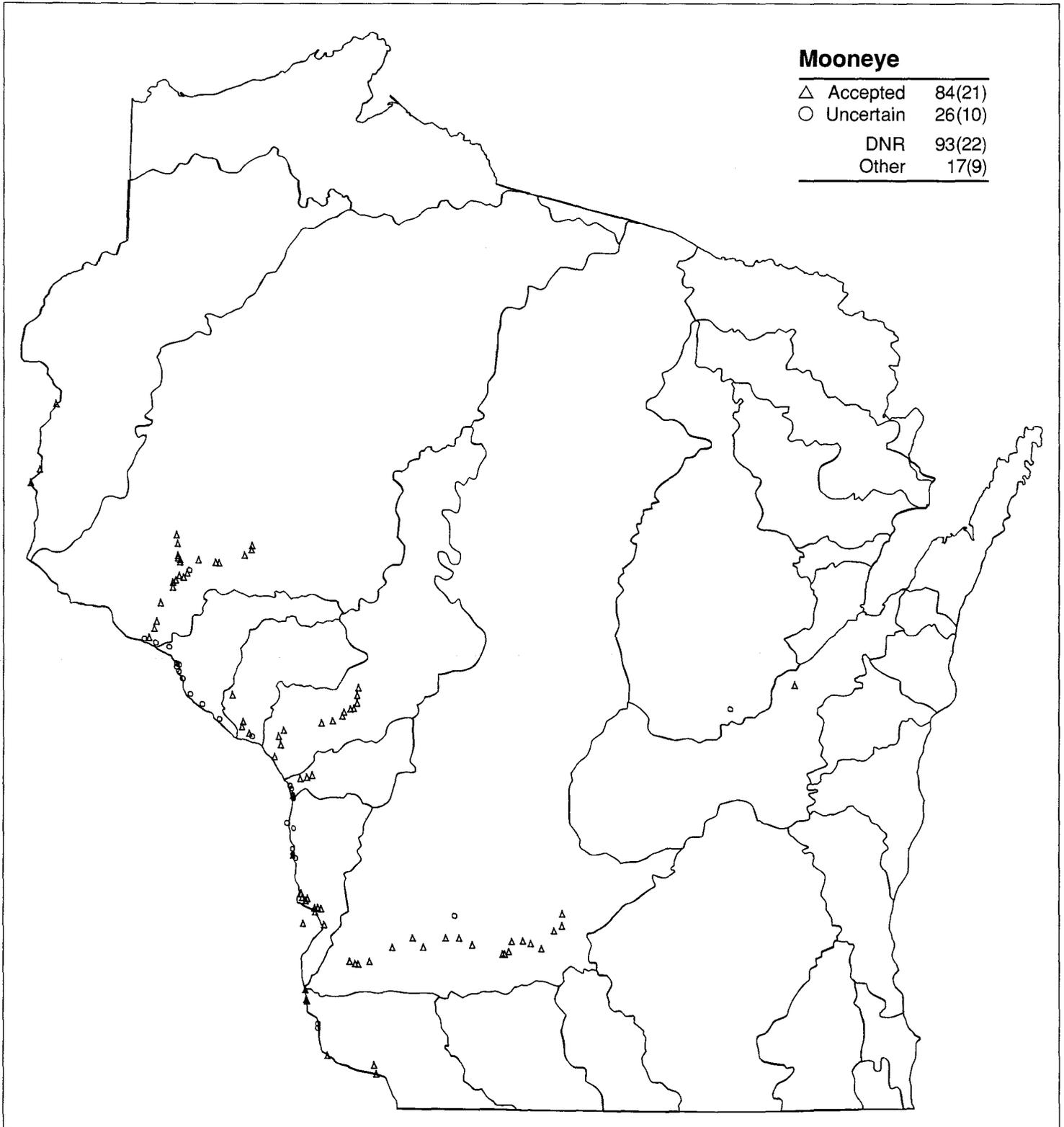


Map 16(L)



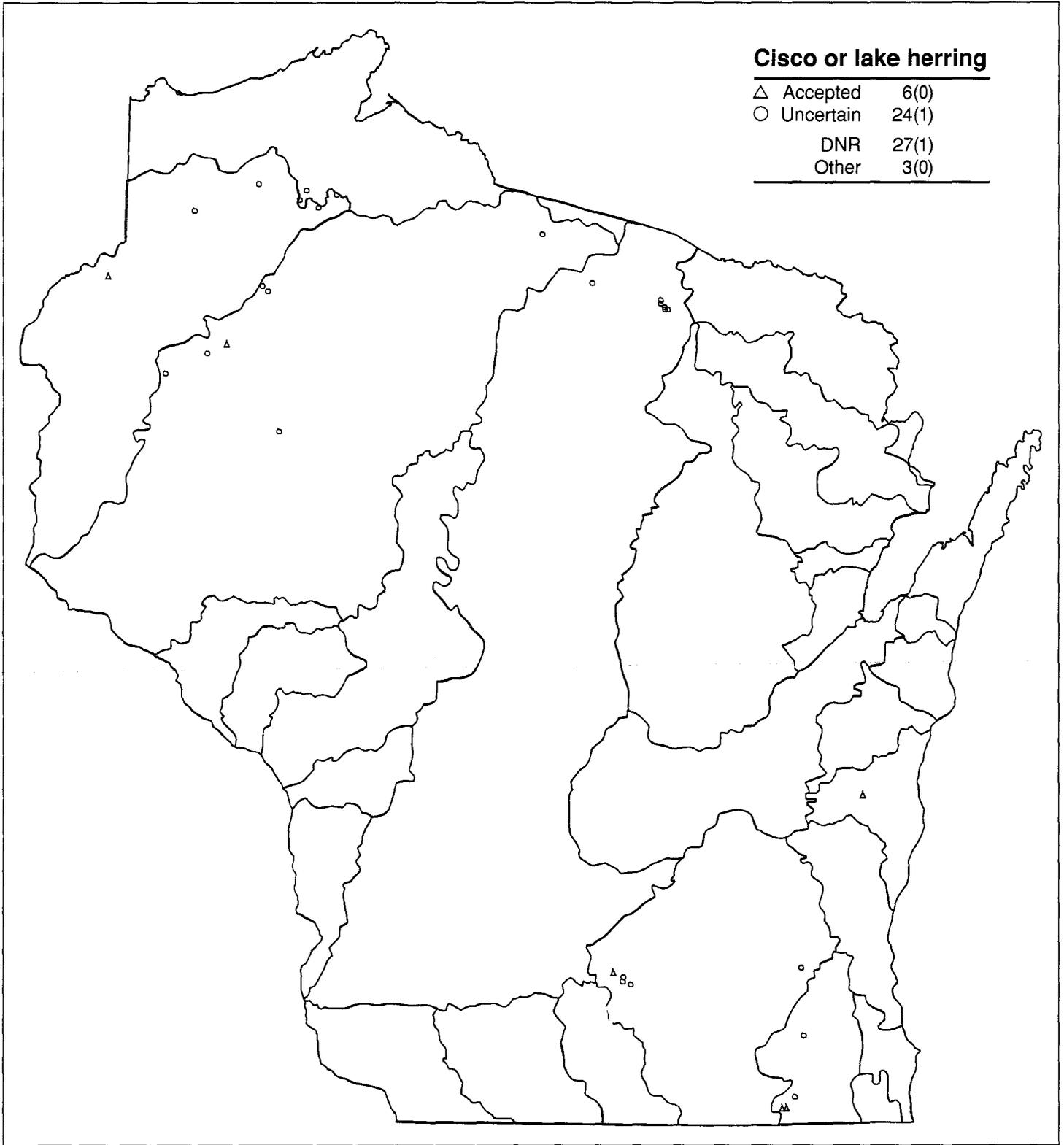
Map 17(E)



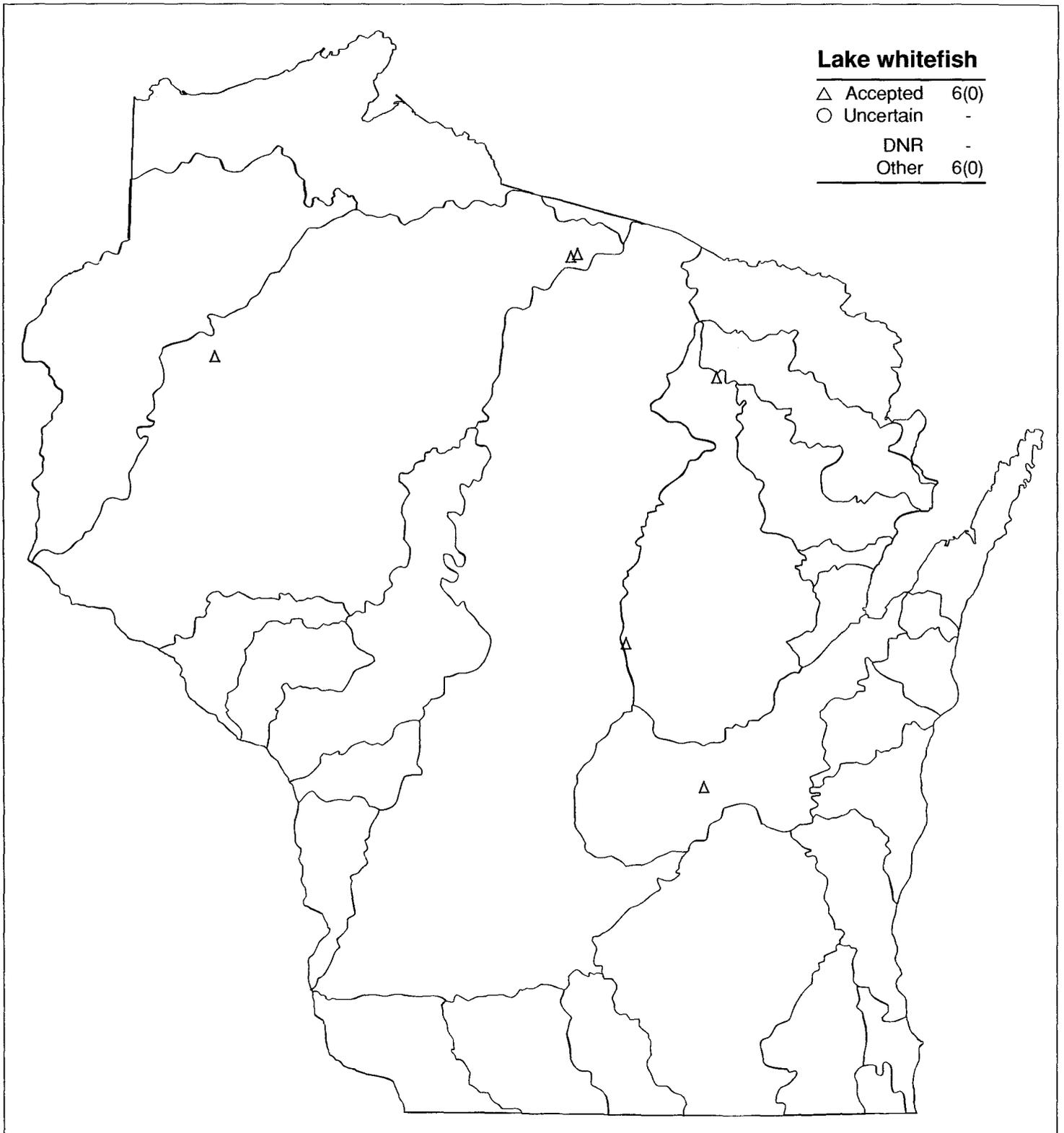


Map 18(E)





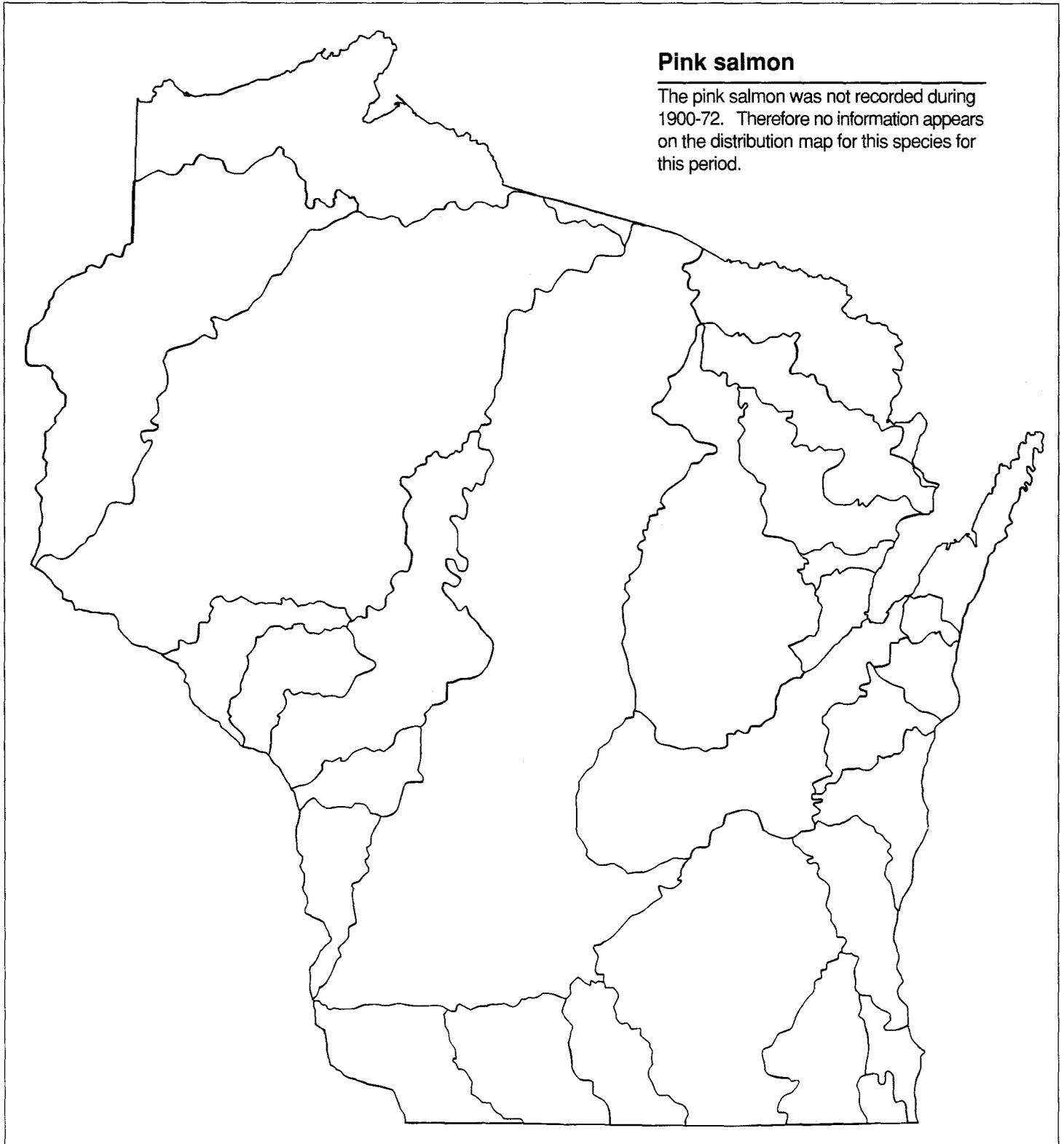
Map 19(E)



Map 19(L)

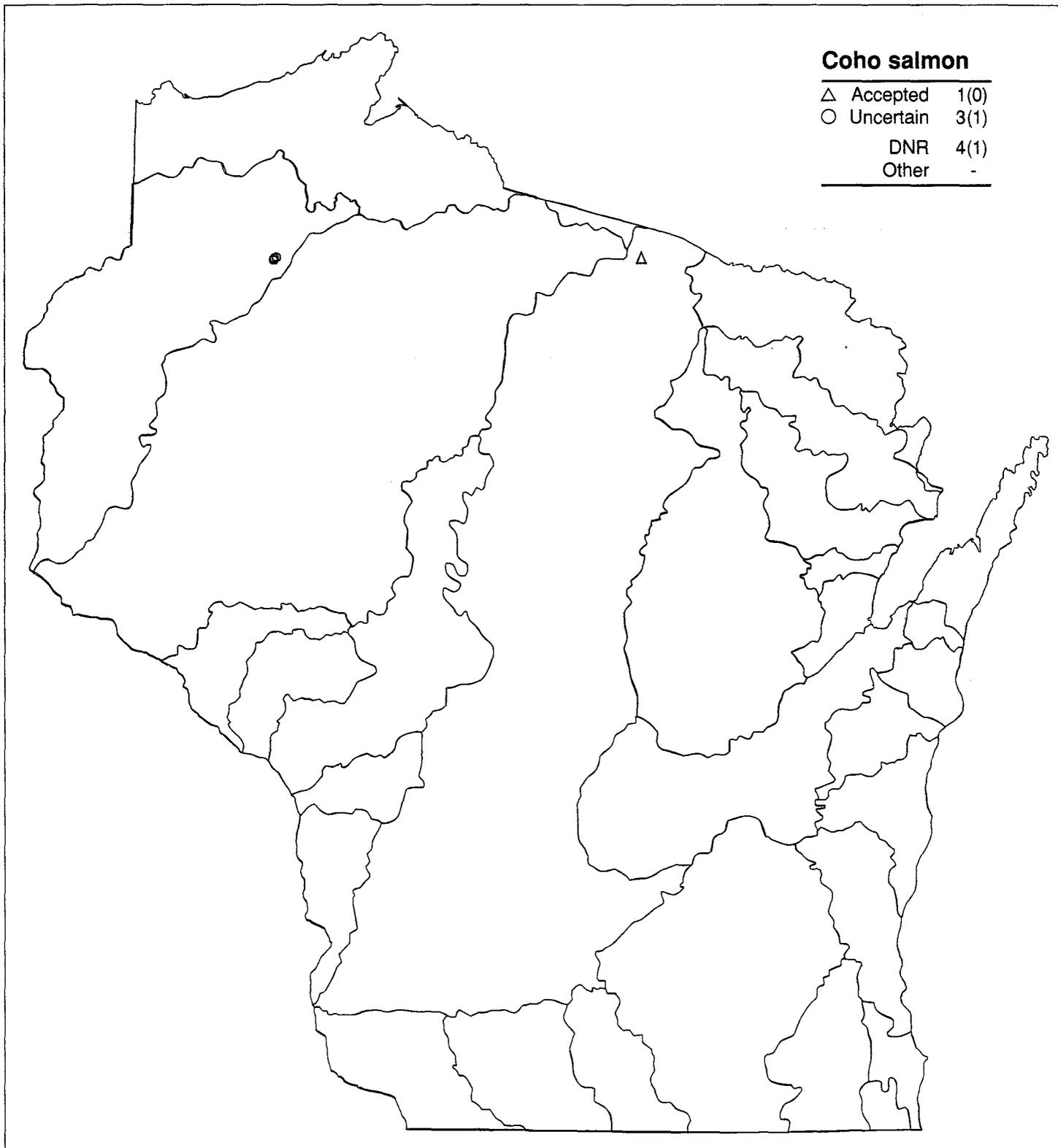


Map 20(E)

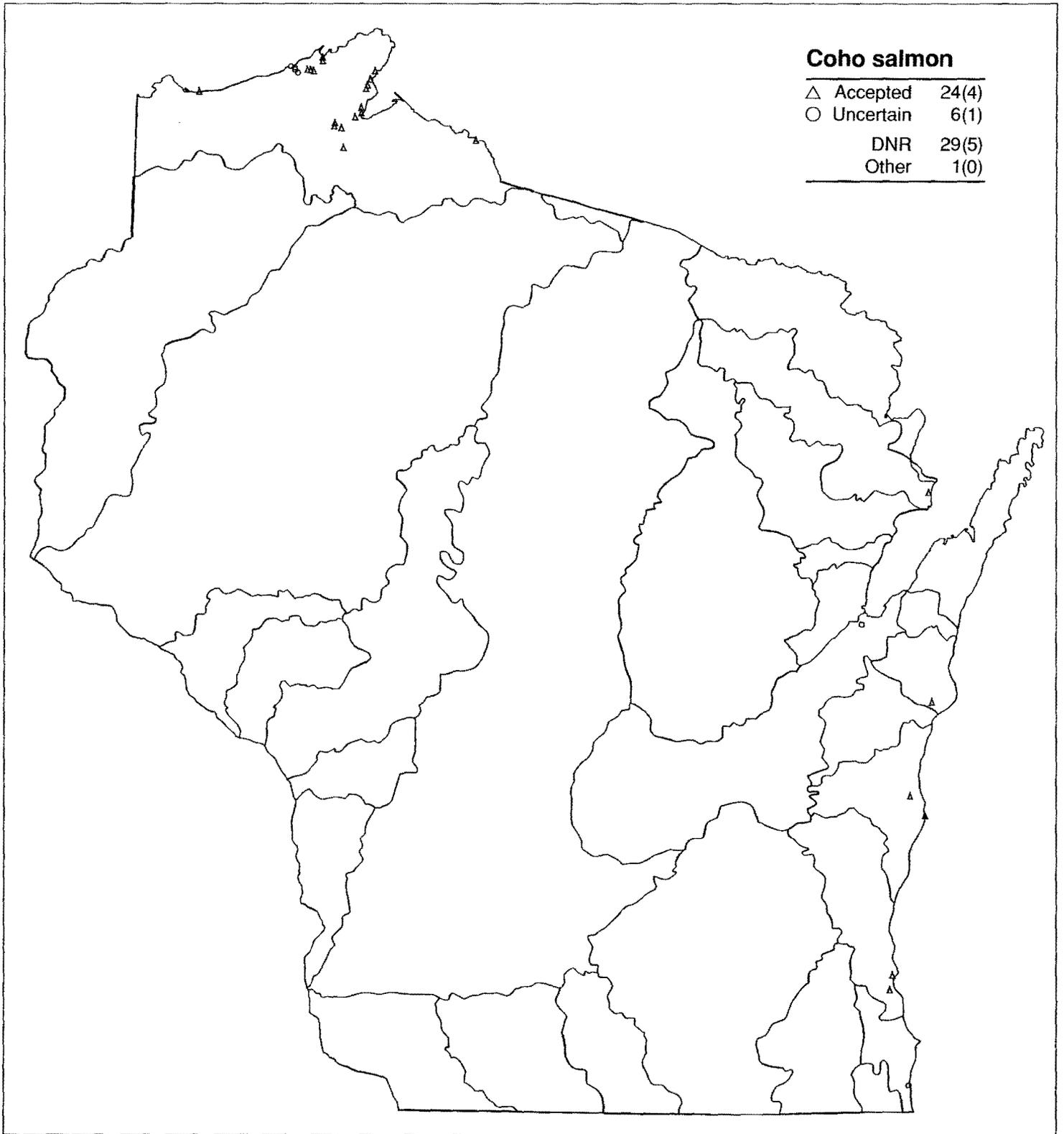




Map 21(E)



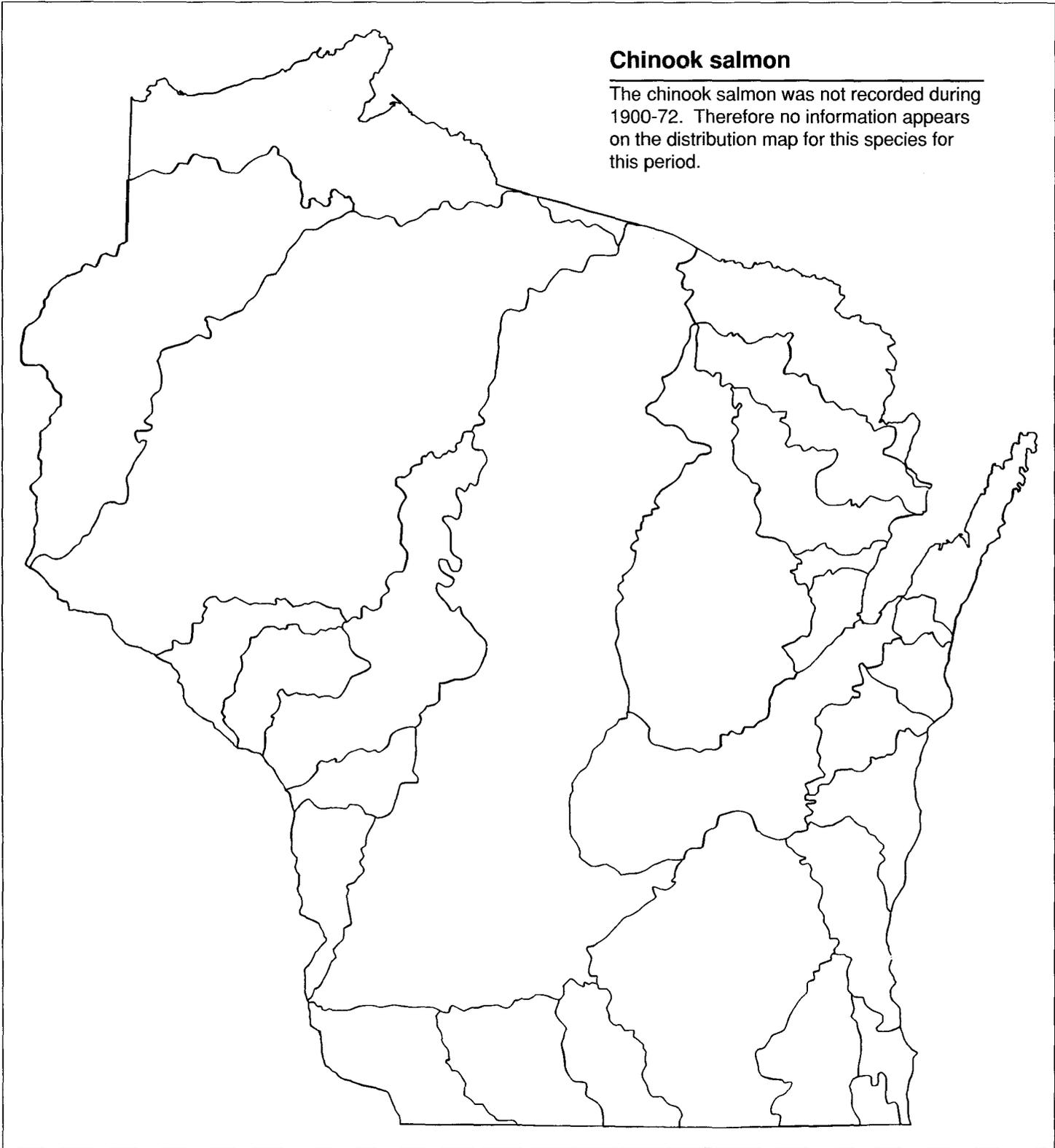
Map 21(L)



Map 22(E)

Chinook salmon

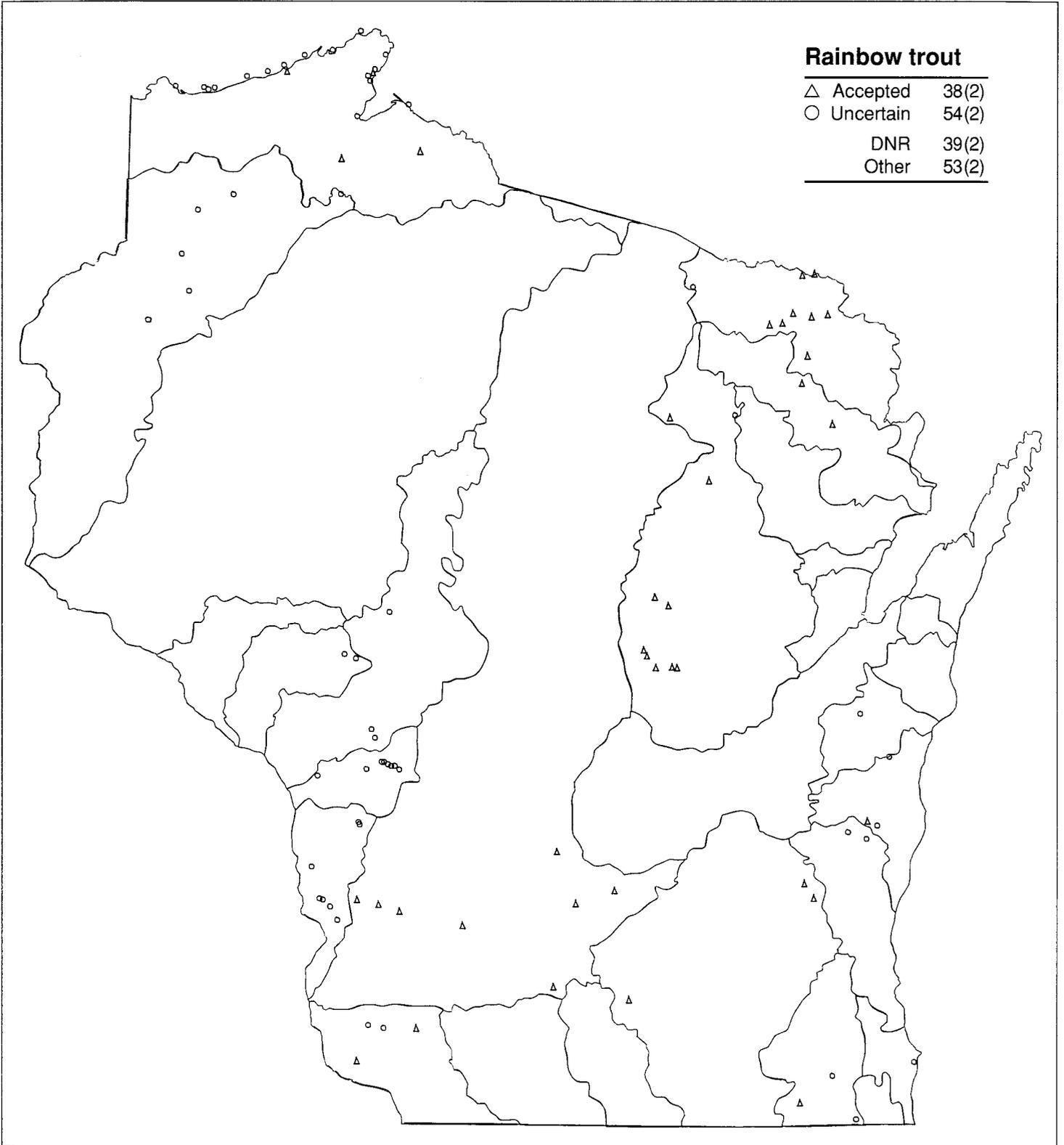
The chinook salmon was not recorded during 1900-72. Therefore no information appears on the distribution map for this species for this period.

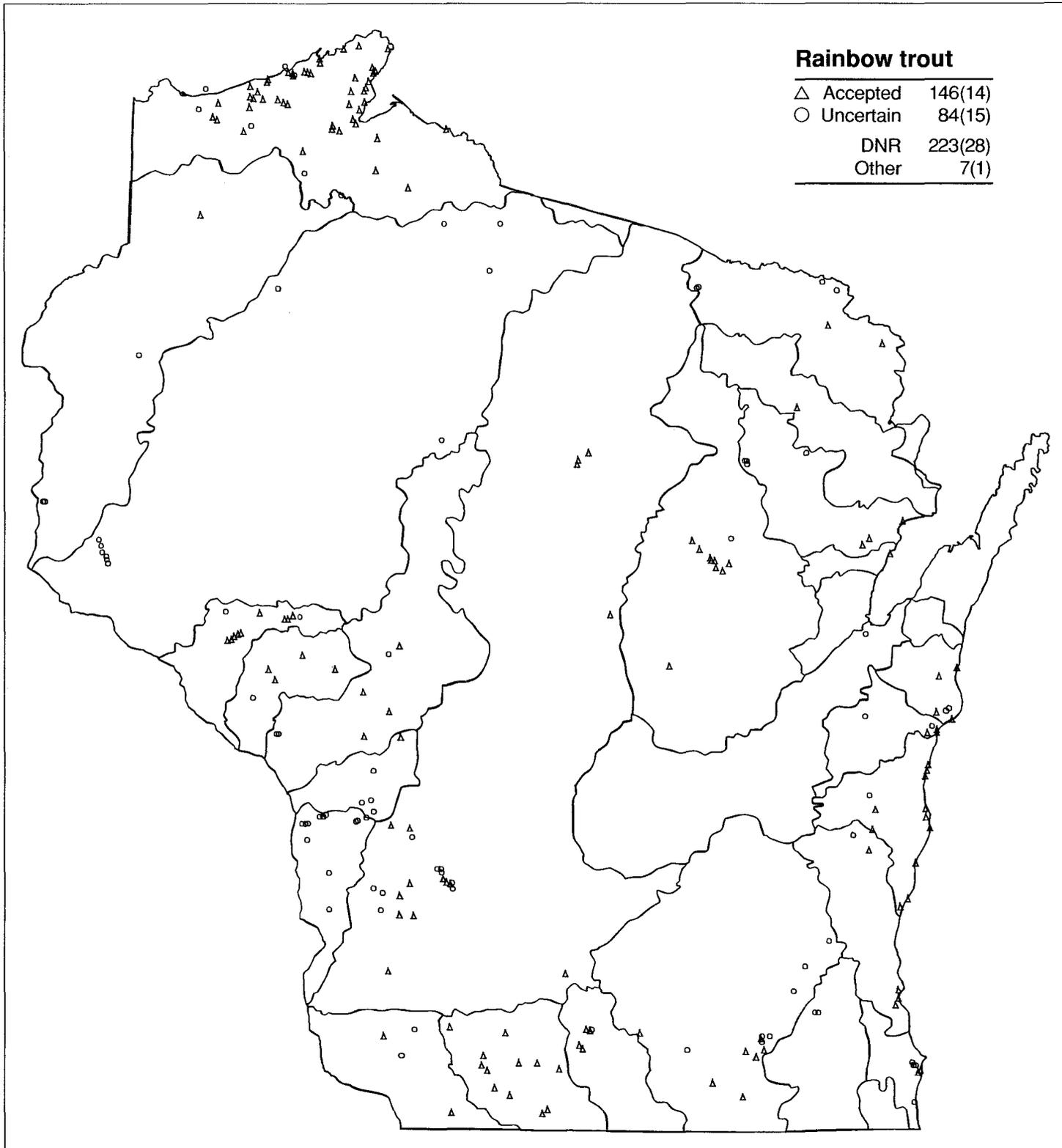


Map 22(L)

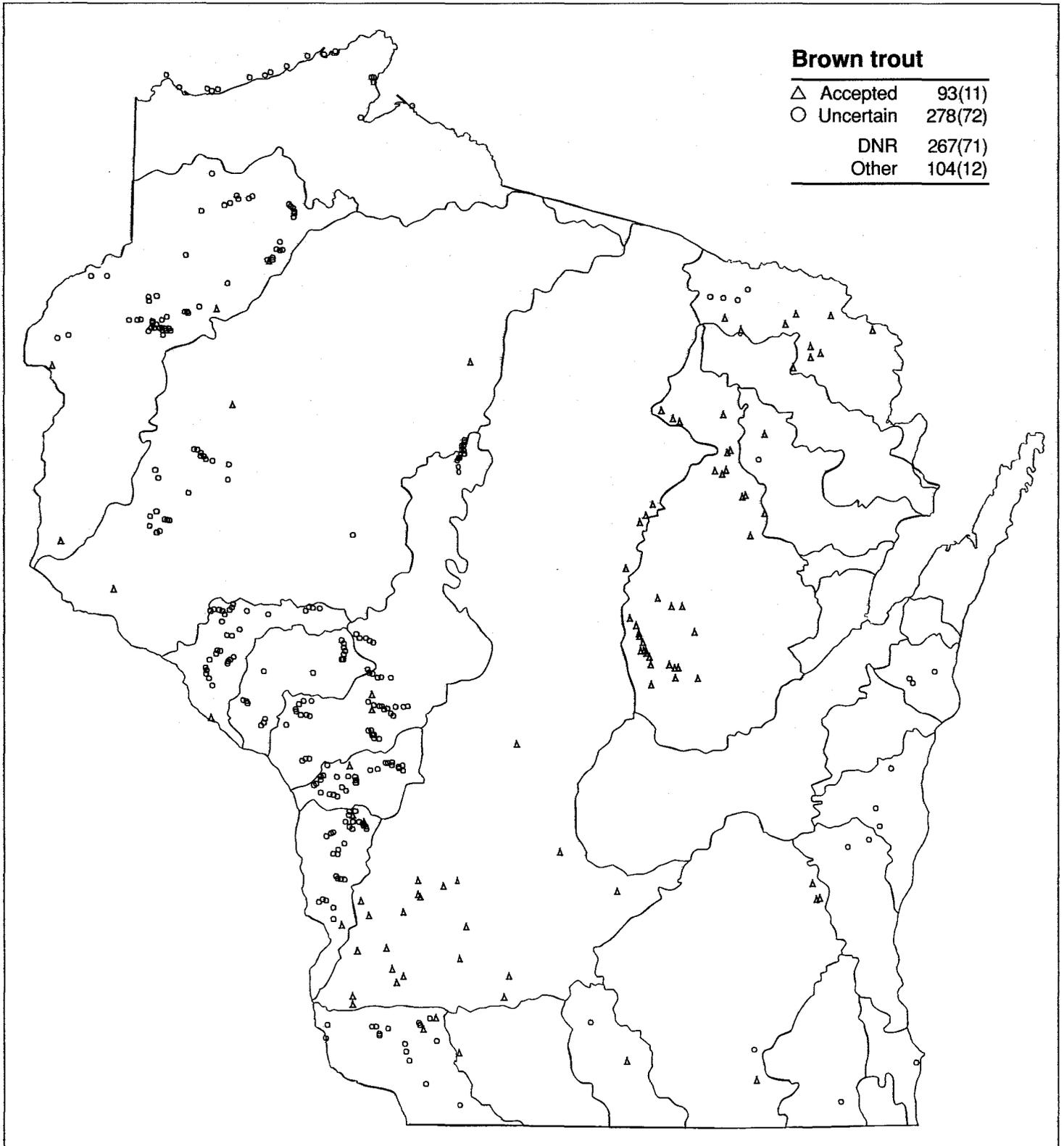


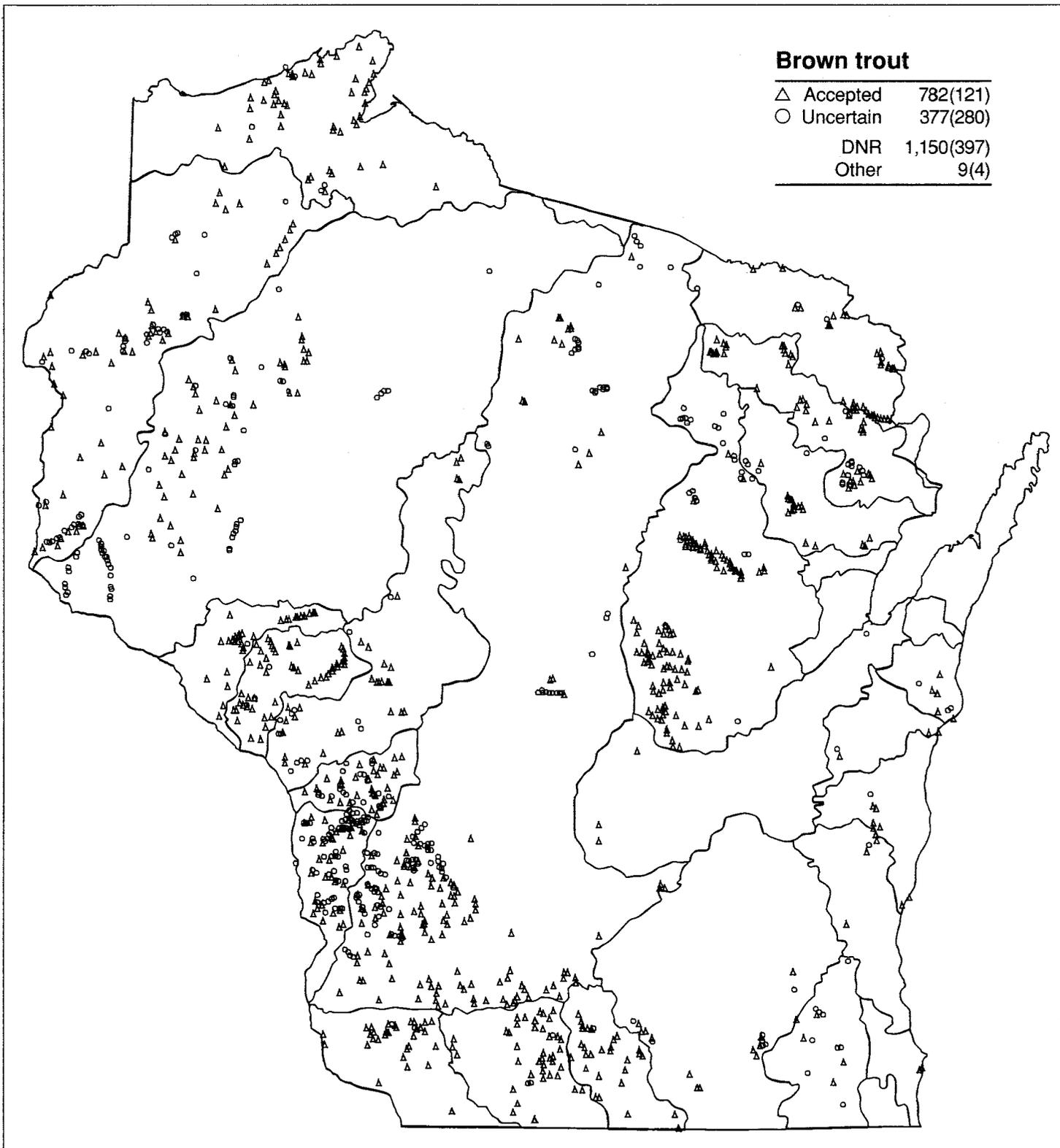
Map 23(E)



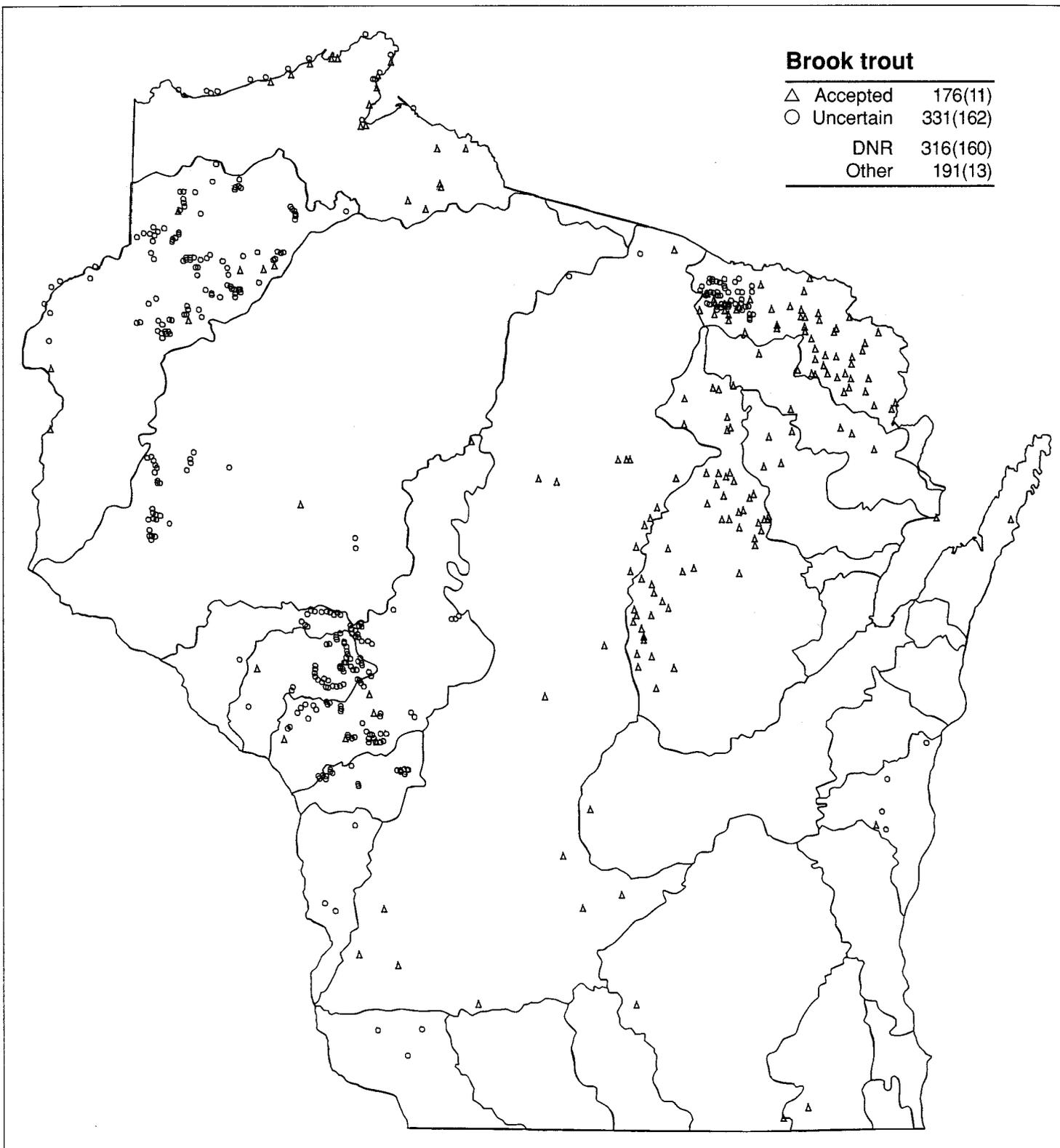


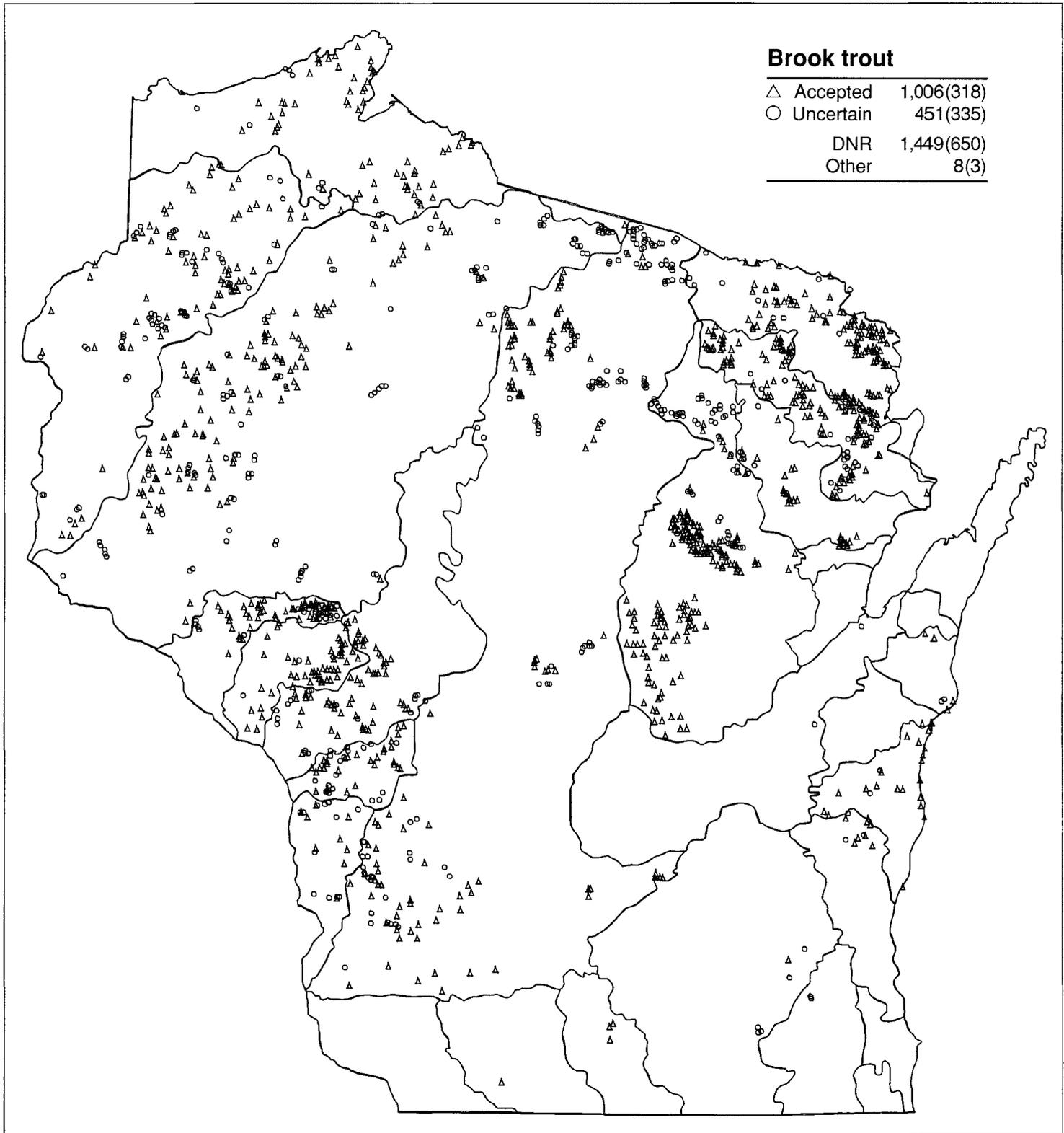
Map 24(E)



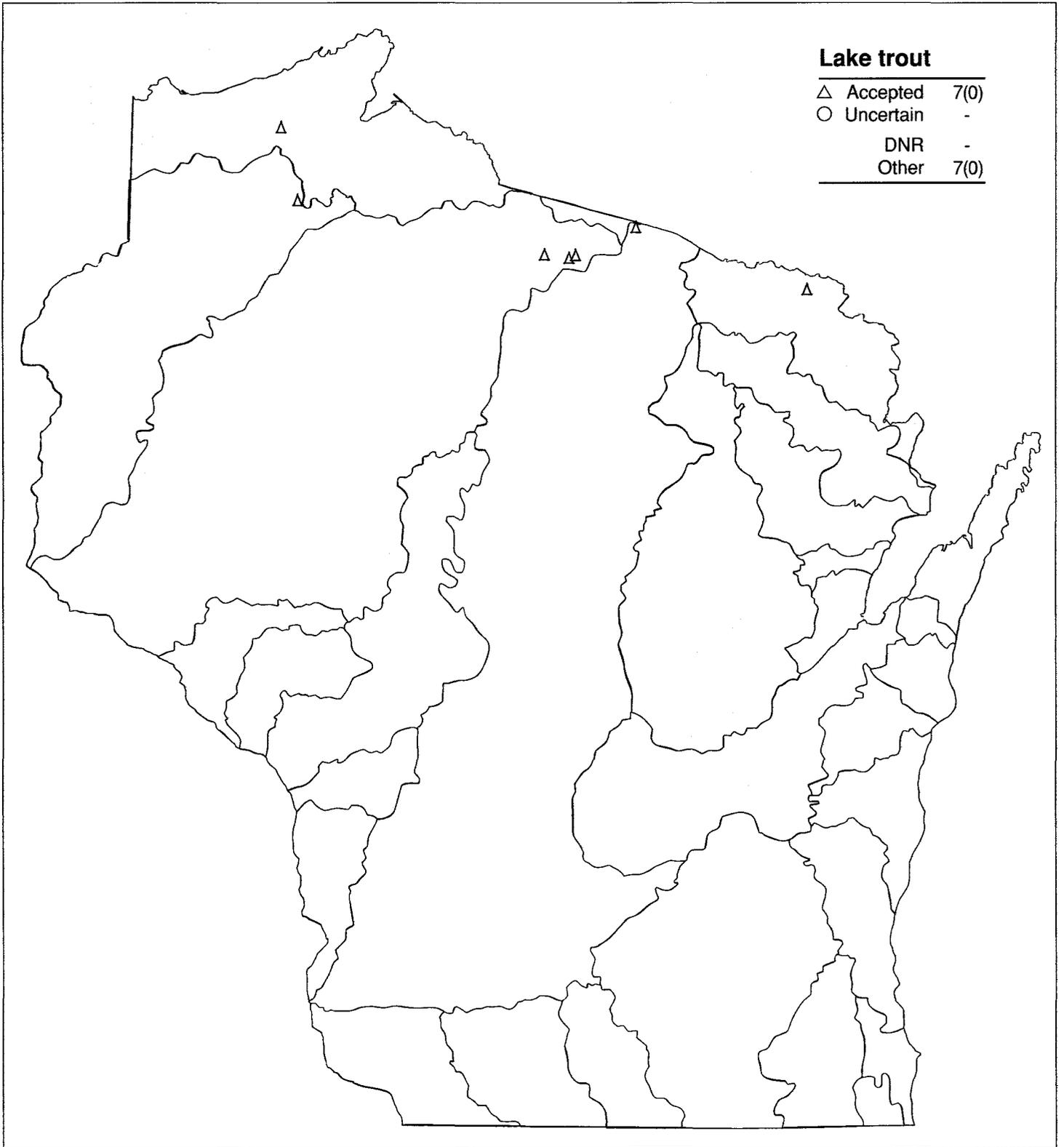


Map 25(E)

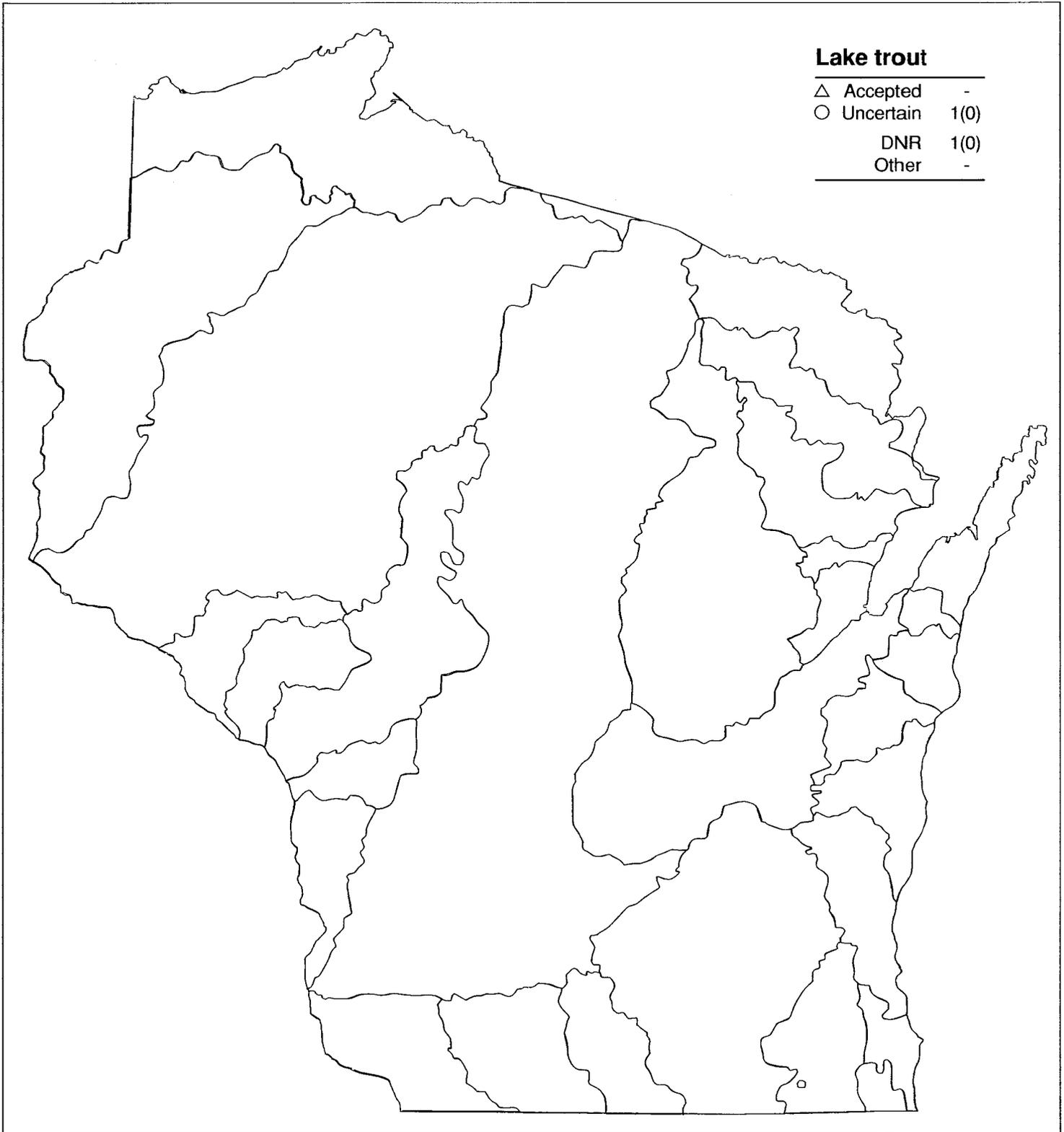




Map 26(E)



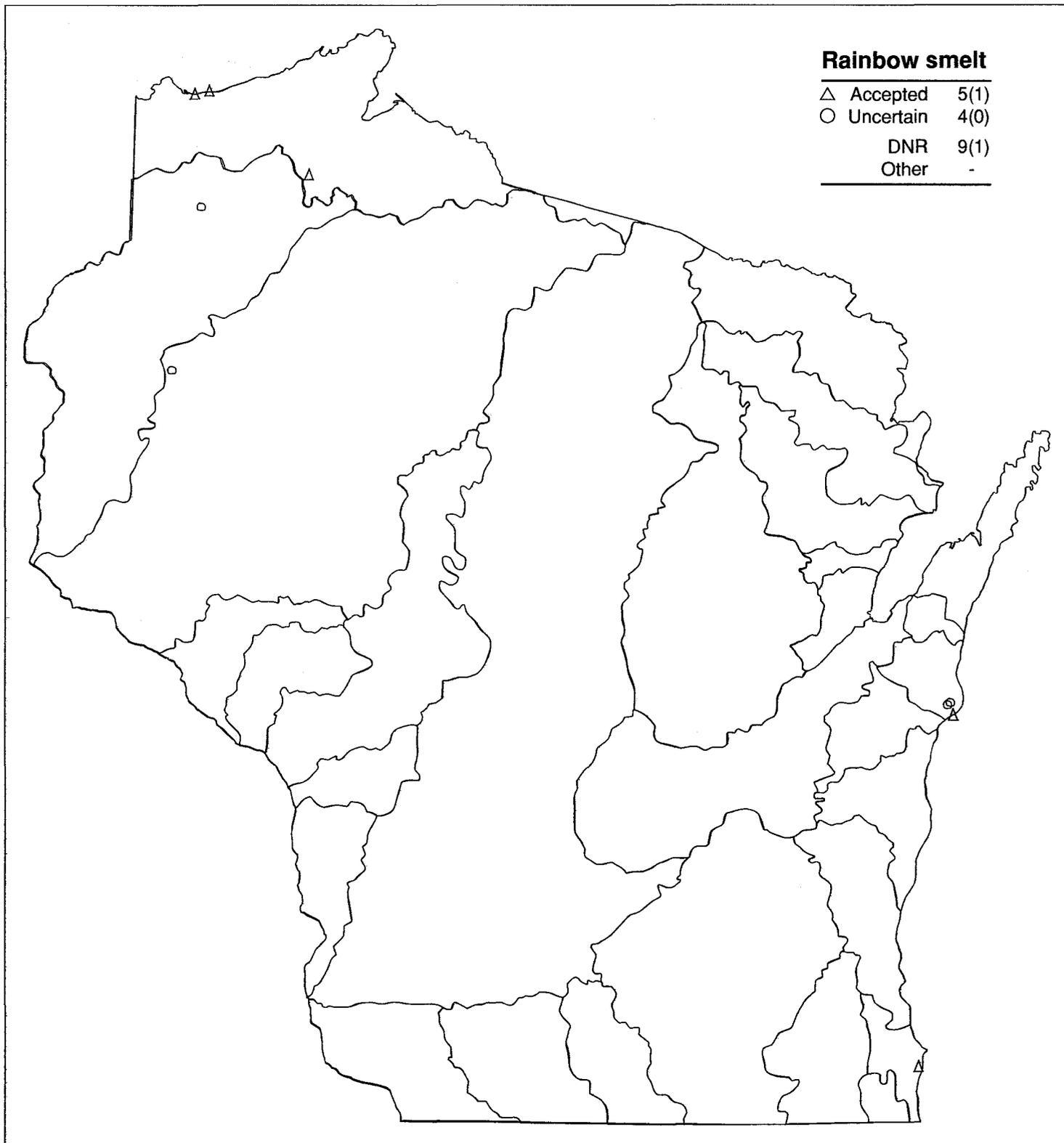
Map 26(L)



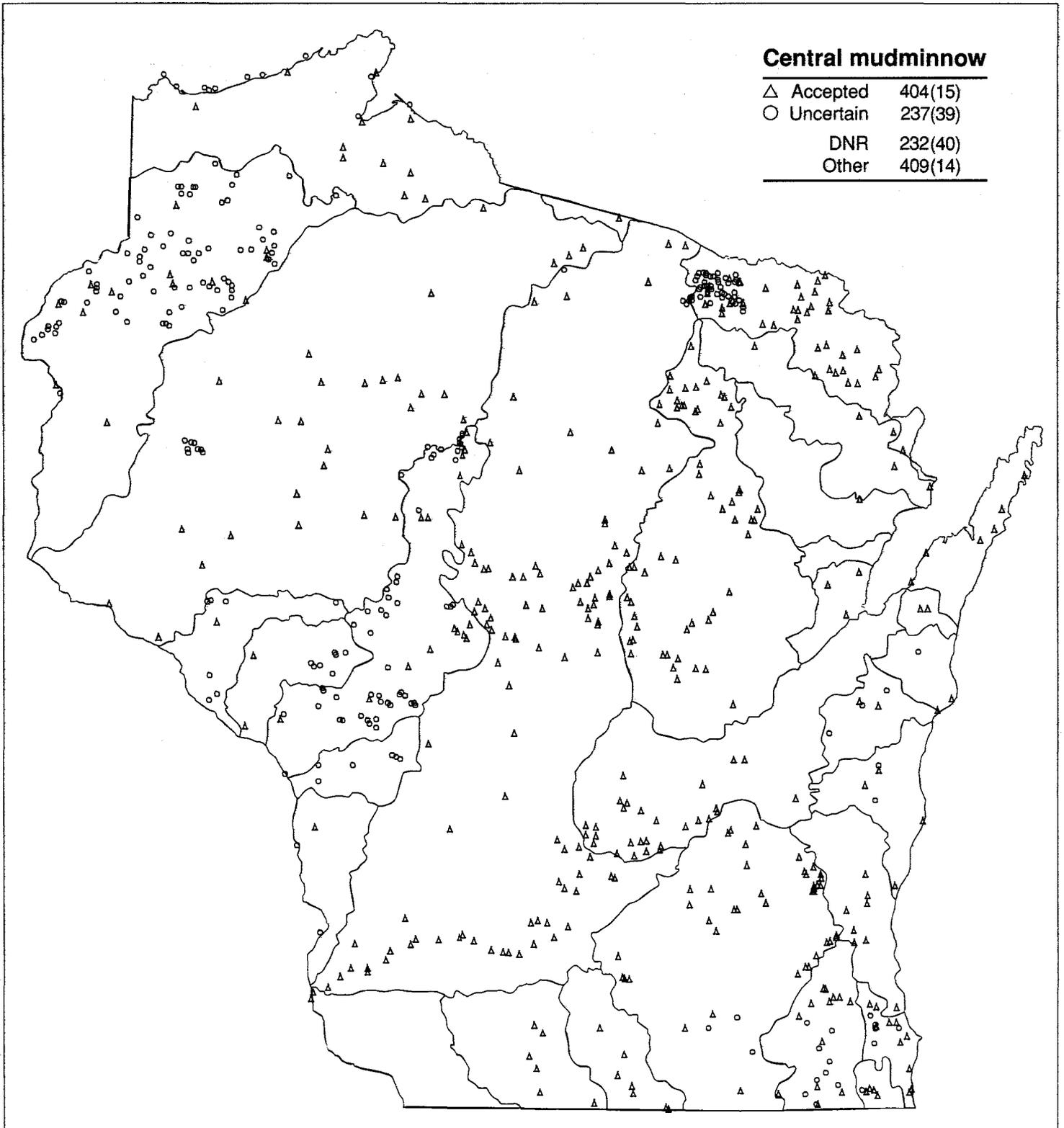
Map 27(E)

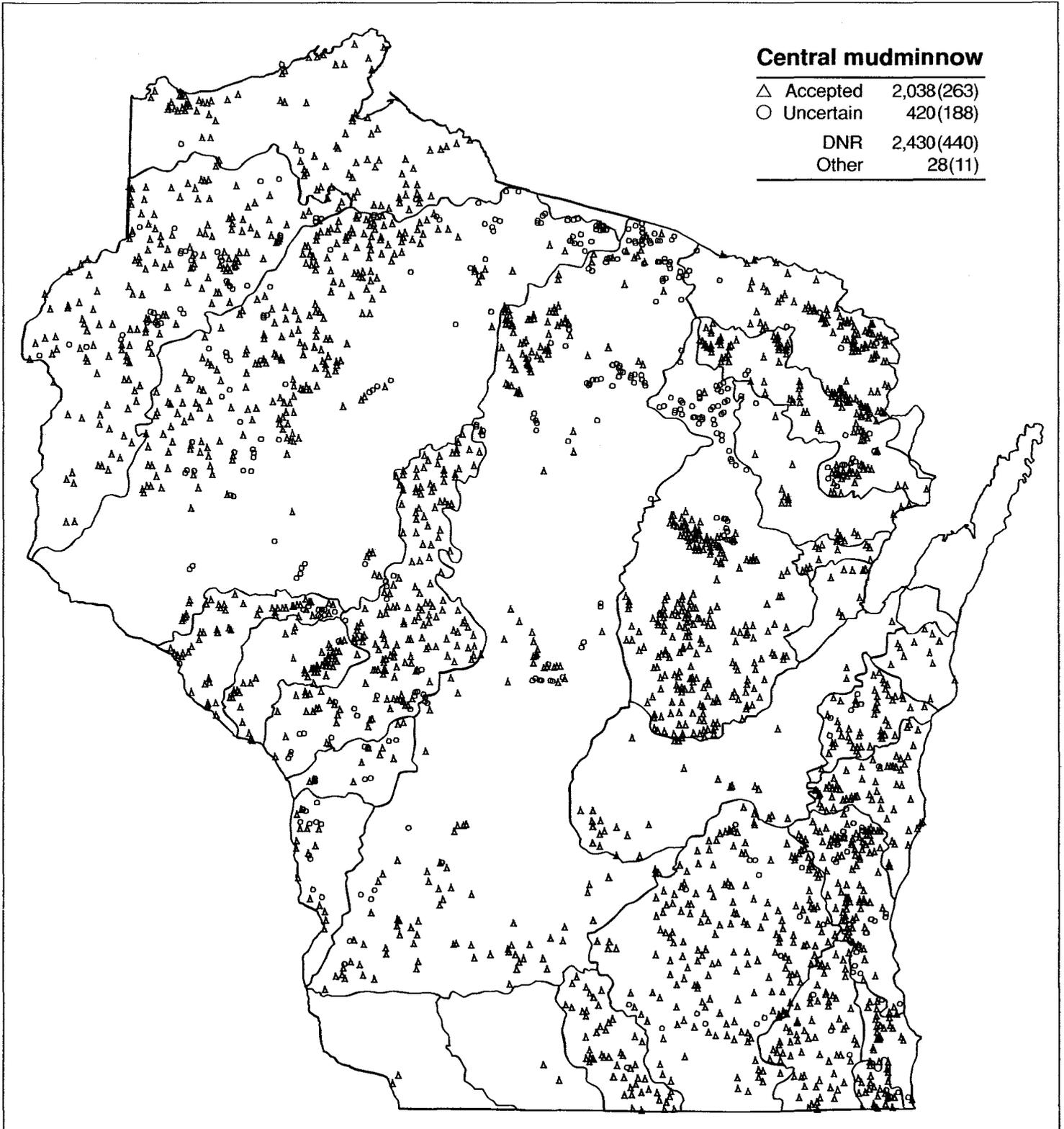


Map 27(L)

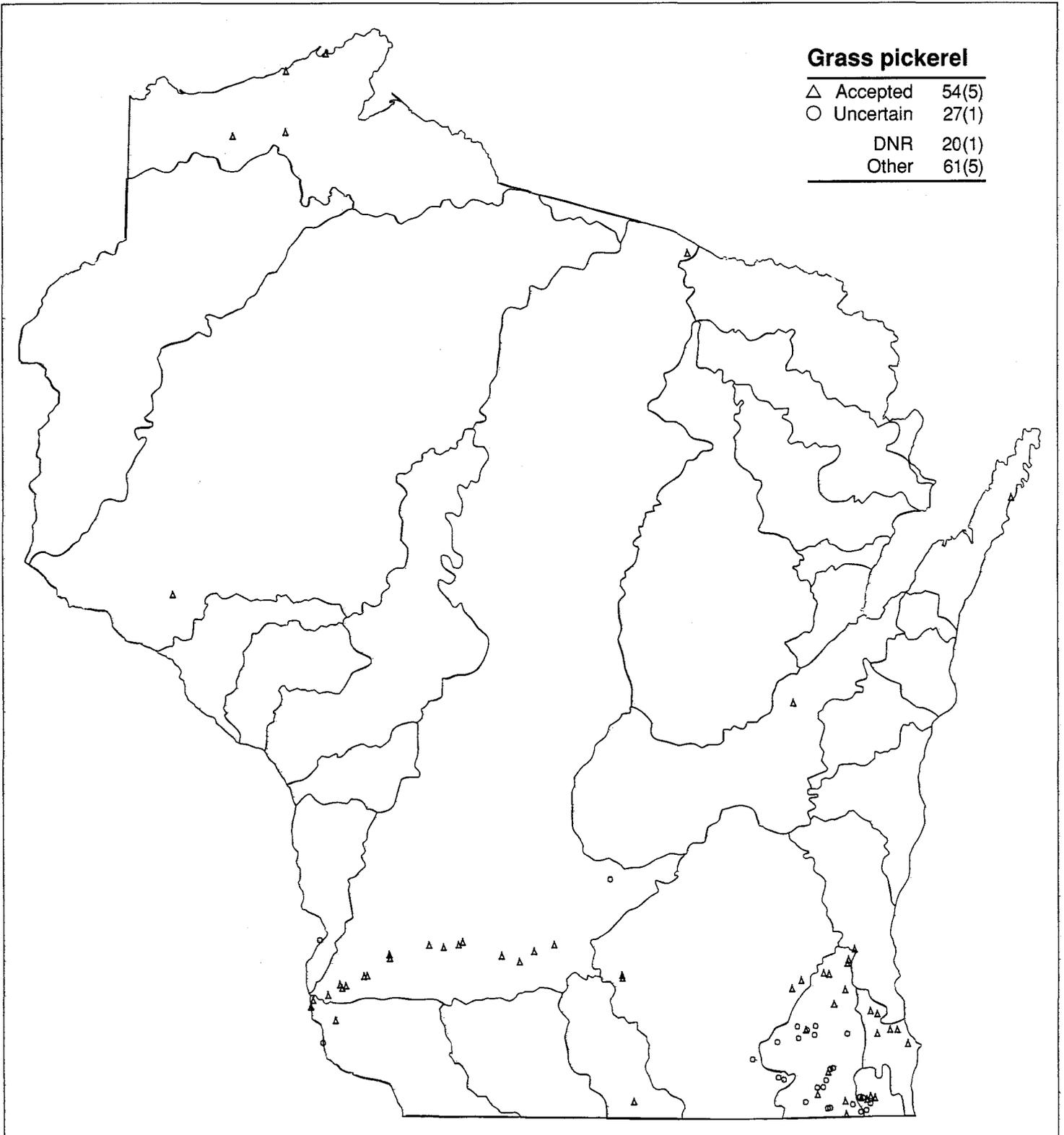


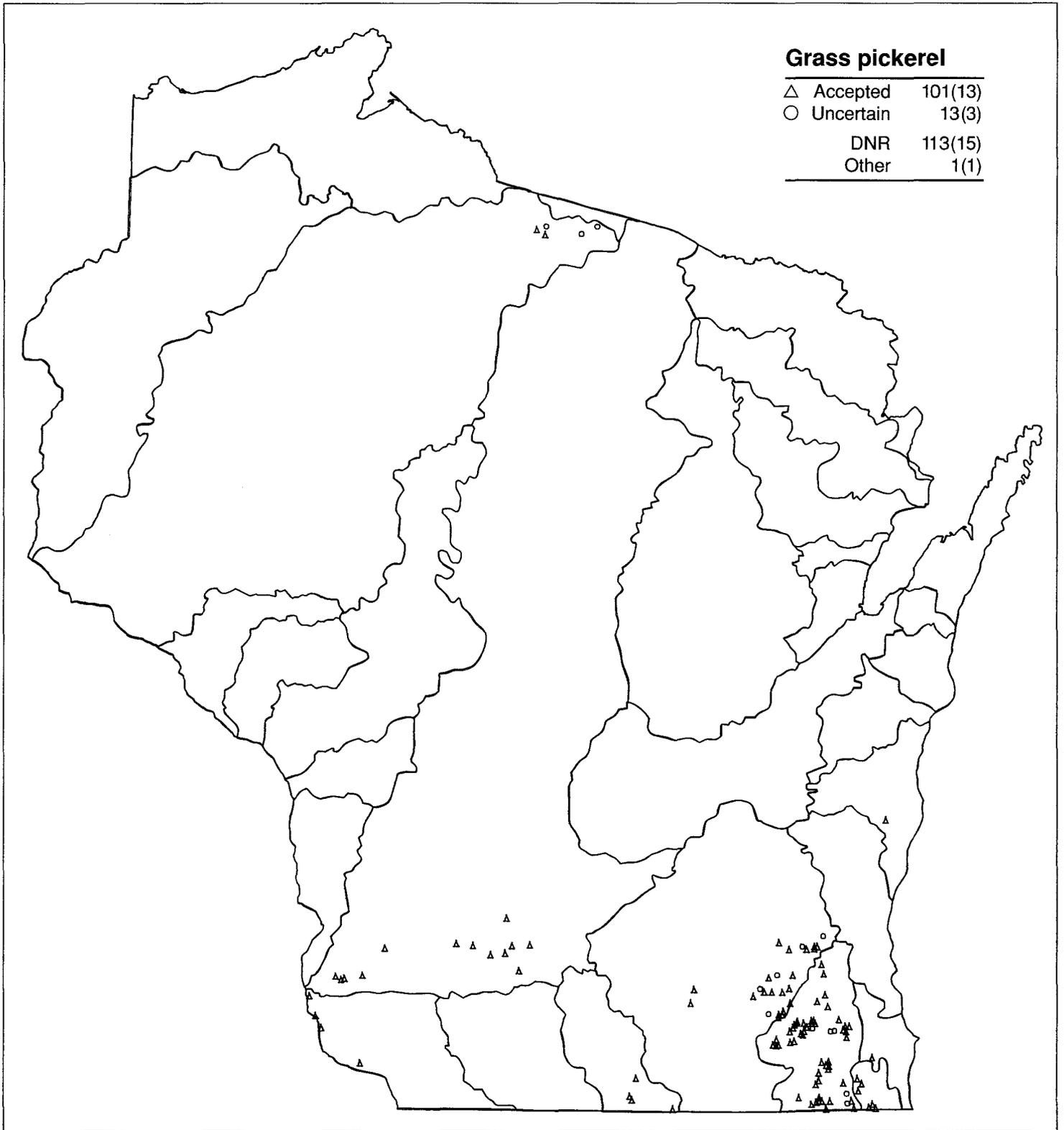
Map 28(E)



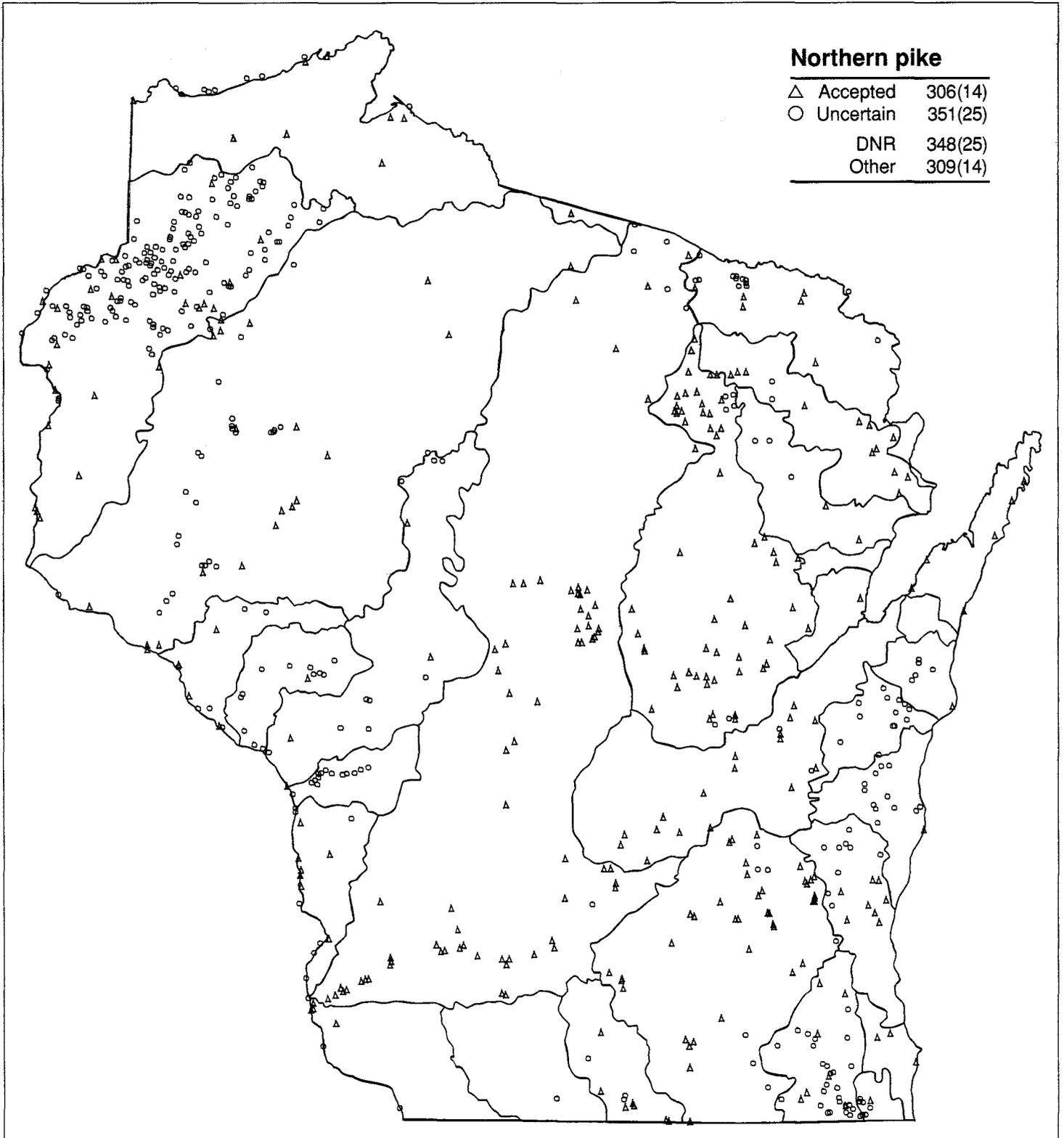


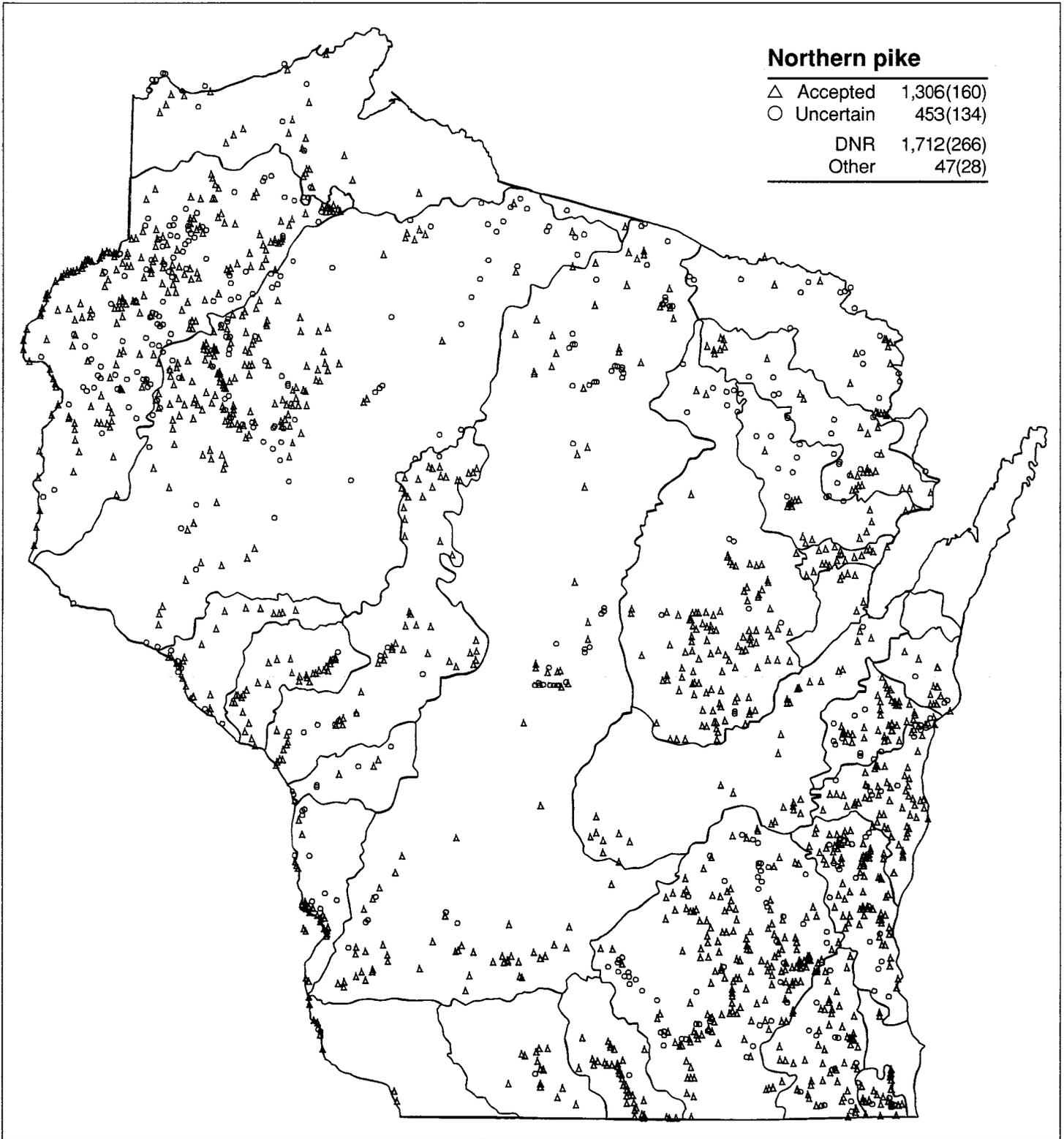
Map 29(E)





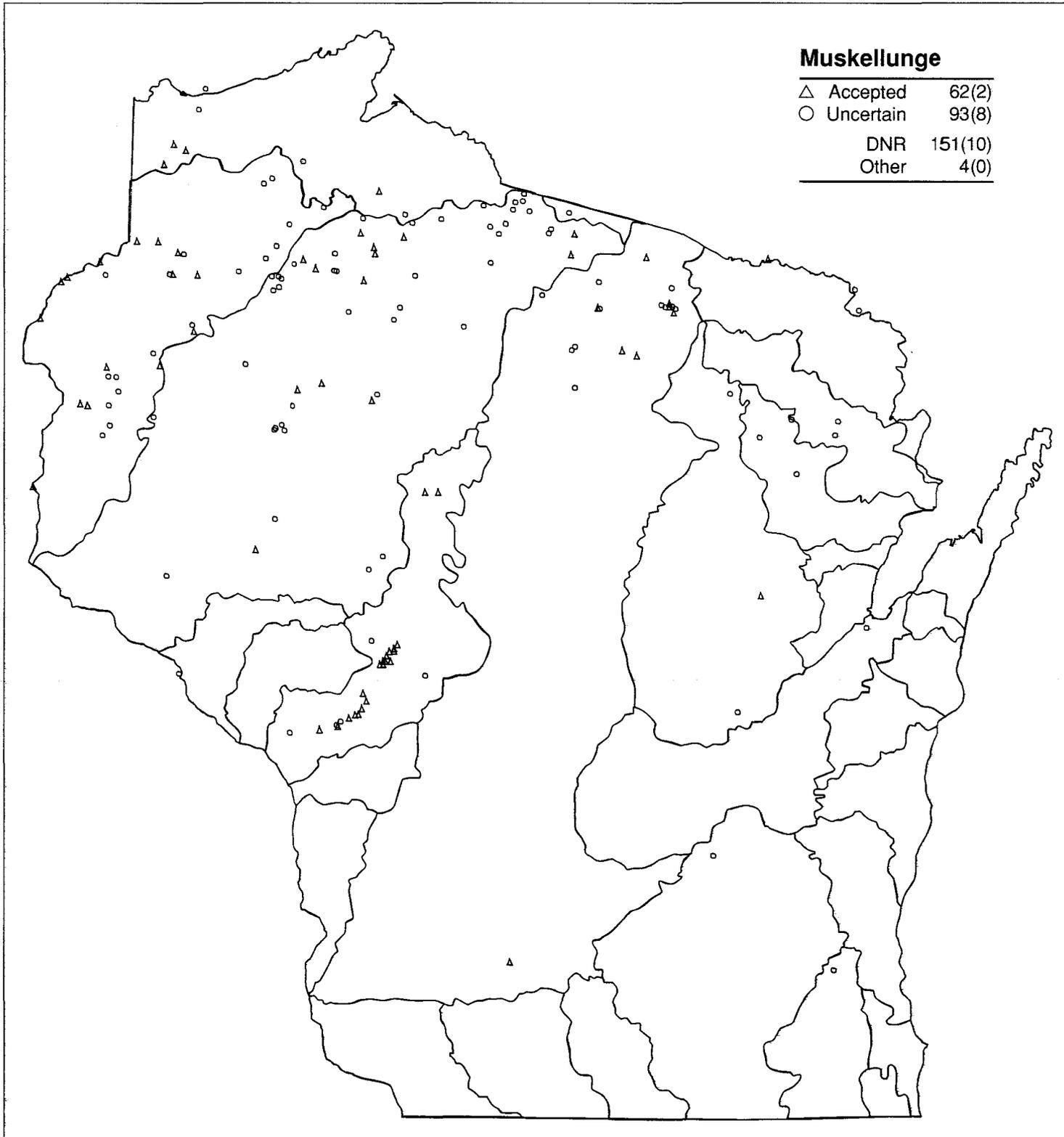
Map 30(E)



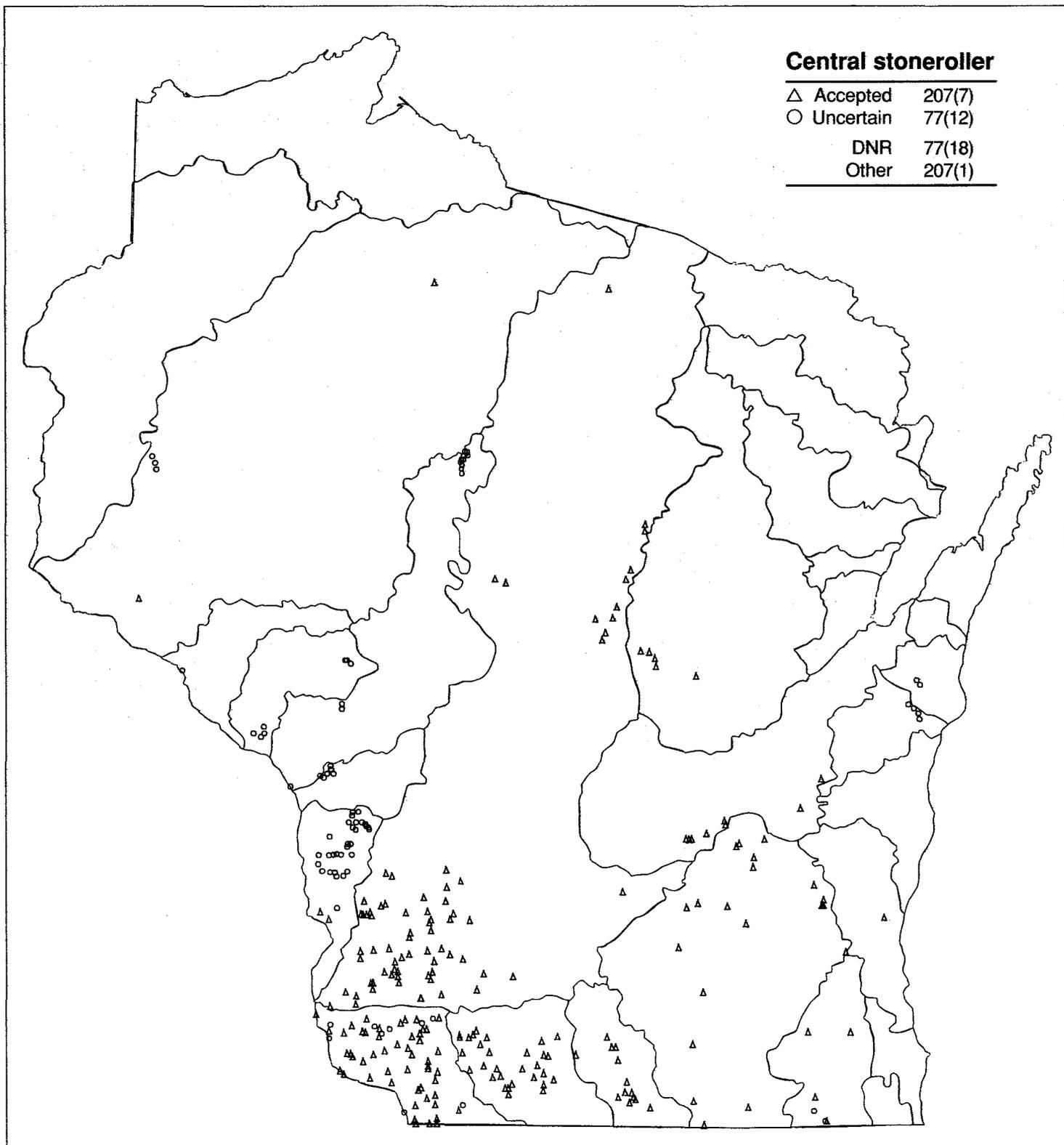


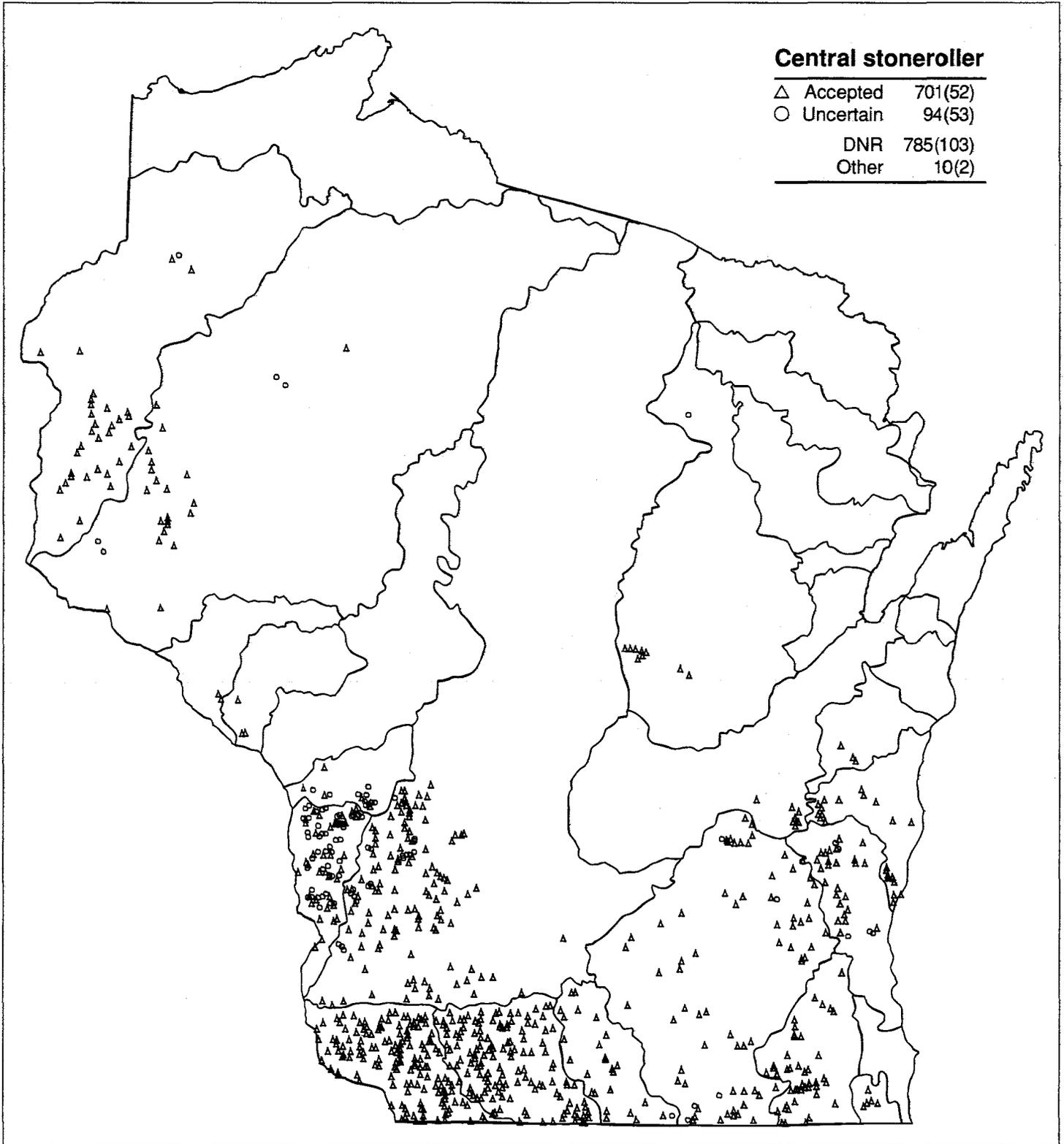
Map 31(E)



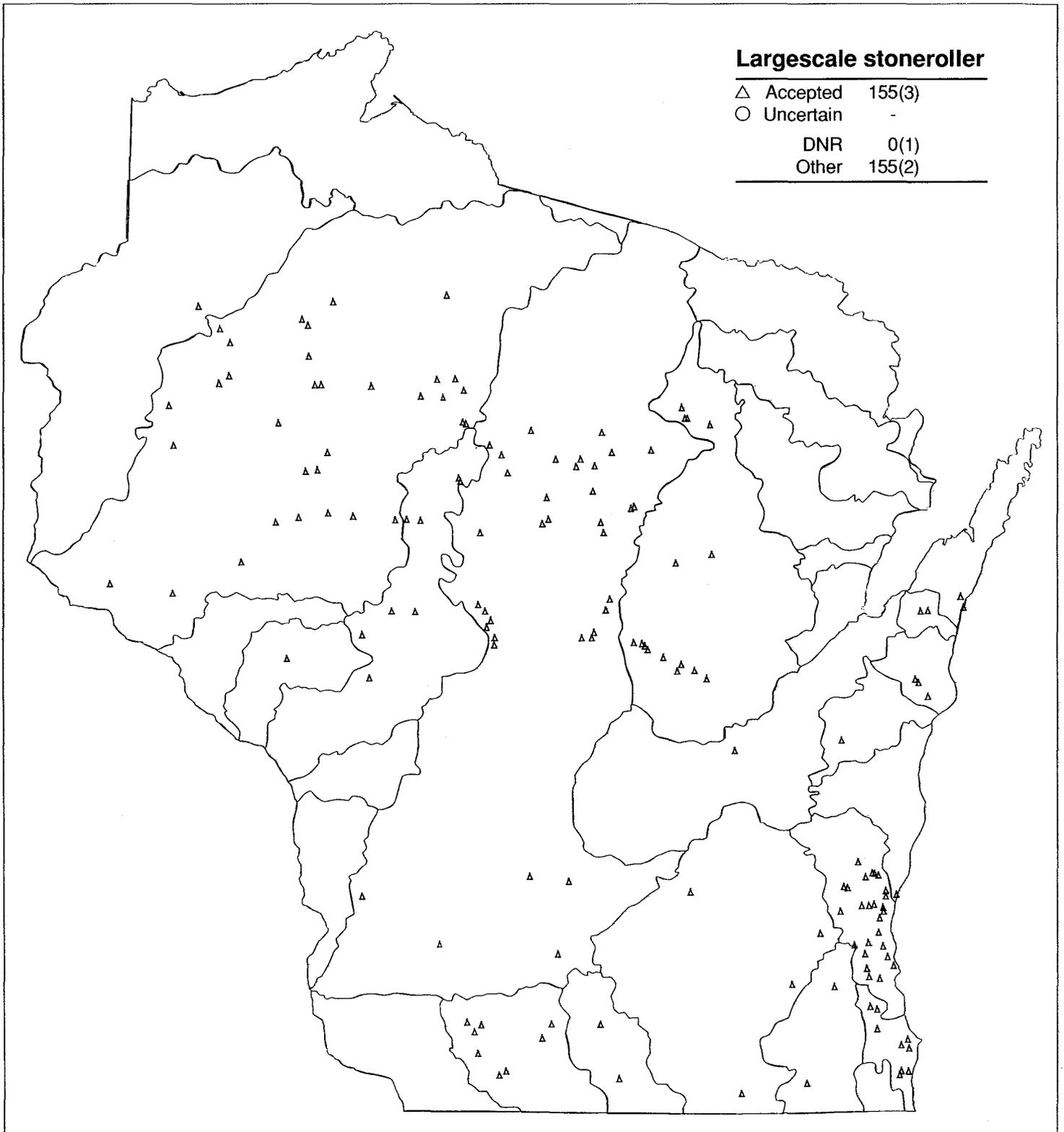


Map 32(E)





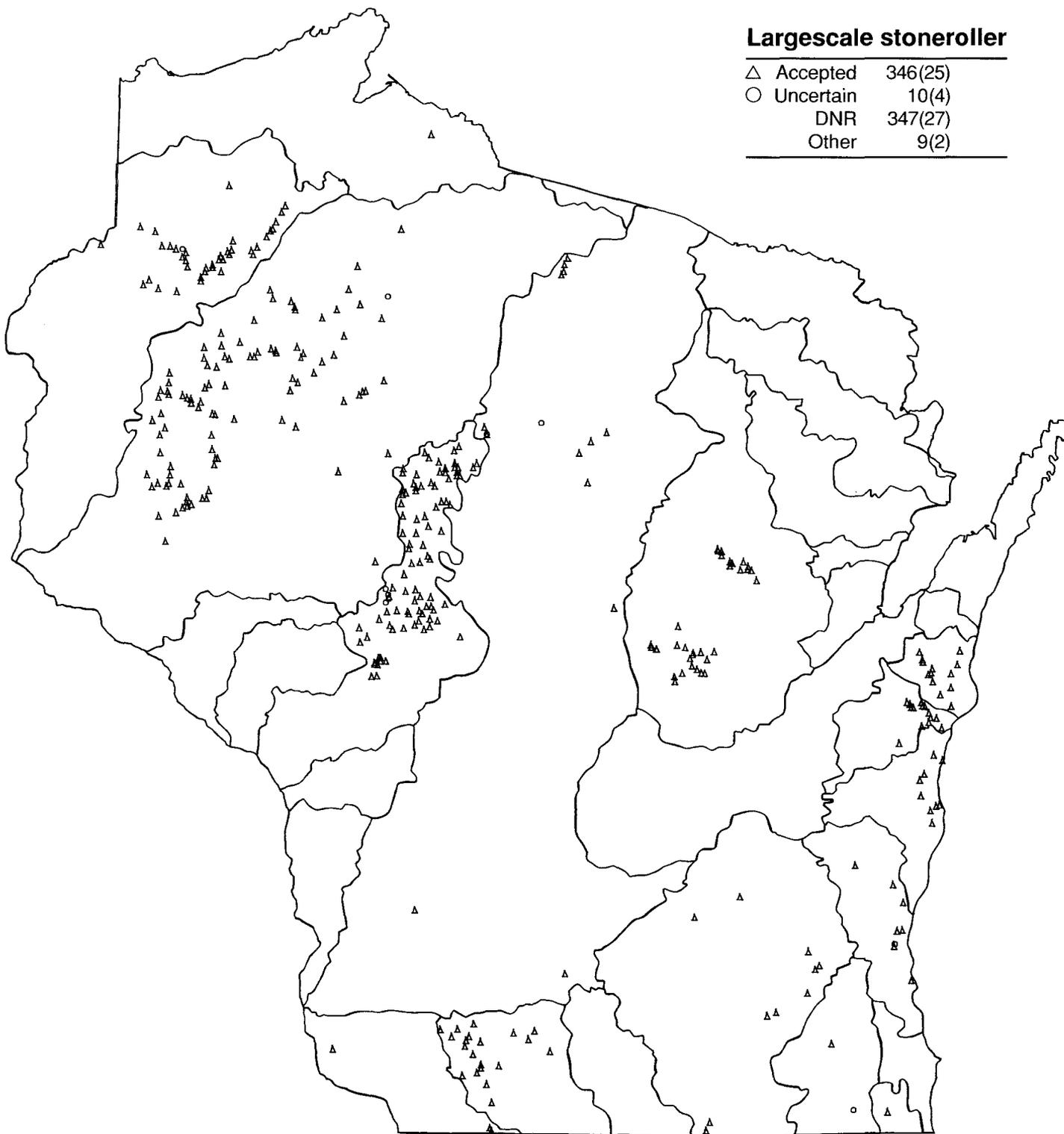
Map 33(E)



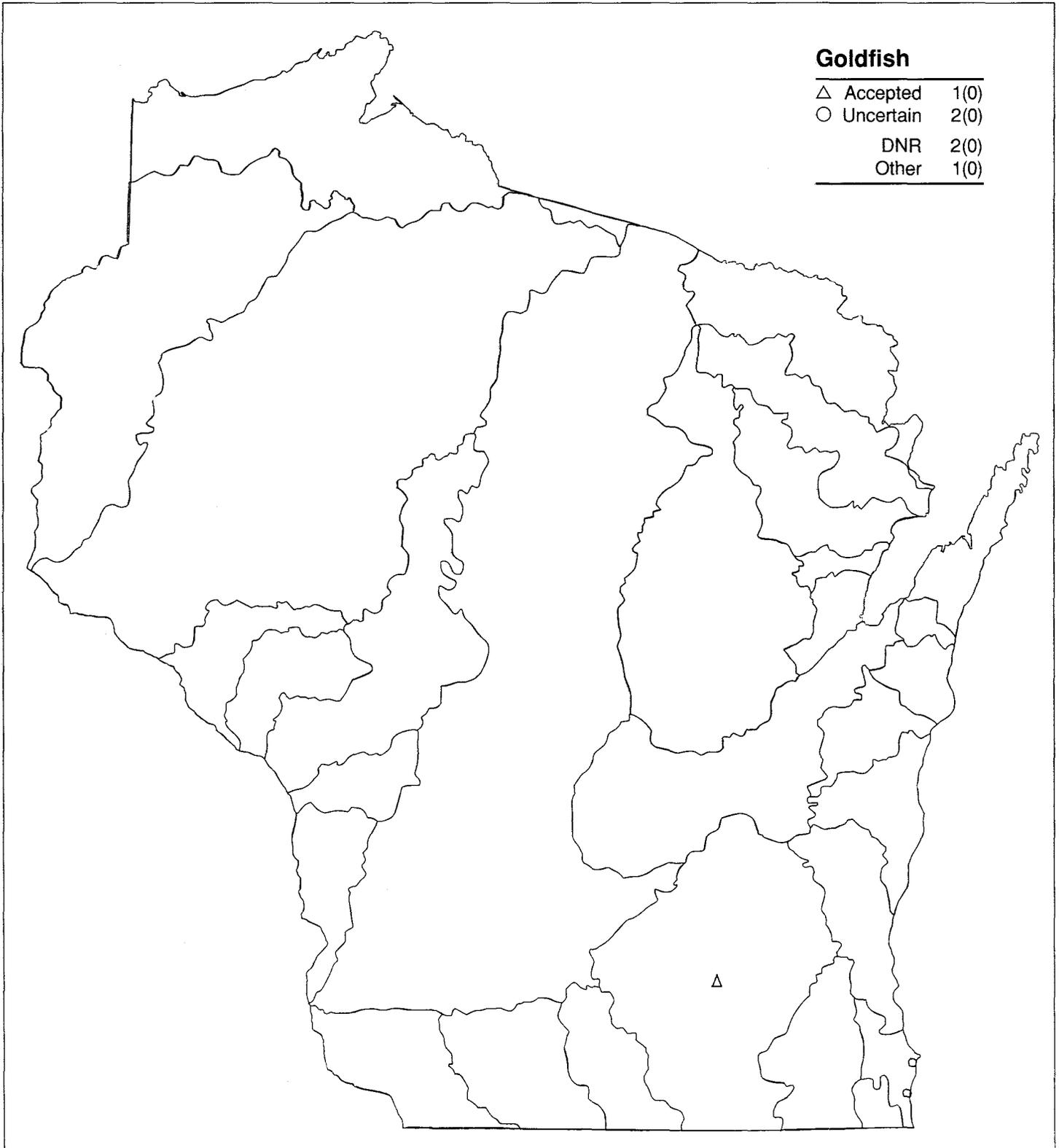
Map 33(L)

Largescale stoneroller

△	Accepted	346(25)
○	Uncertain	10(4)
	DNR	347(27)
	Other	9(2)



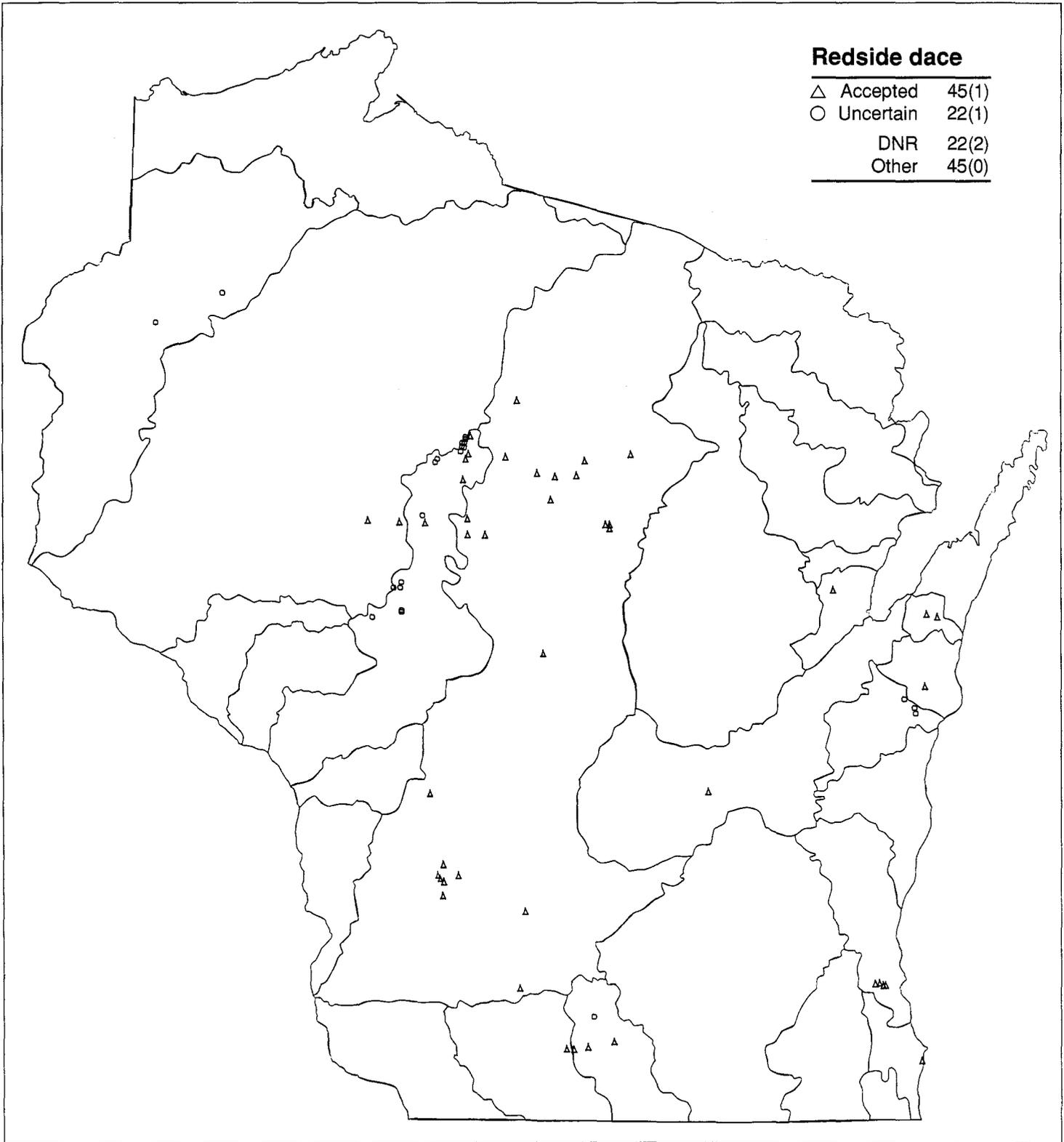
Map 34(E)



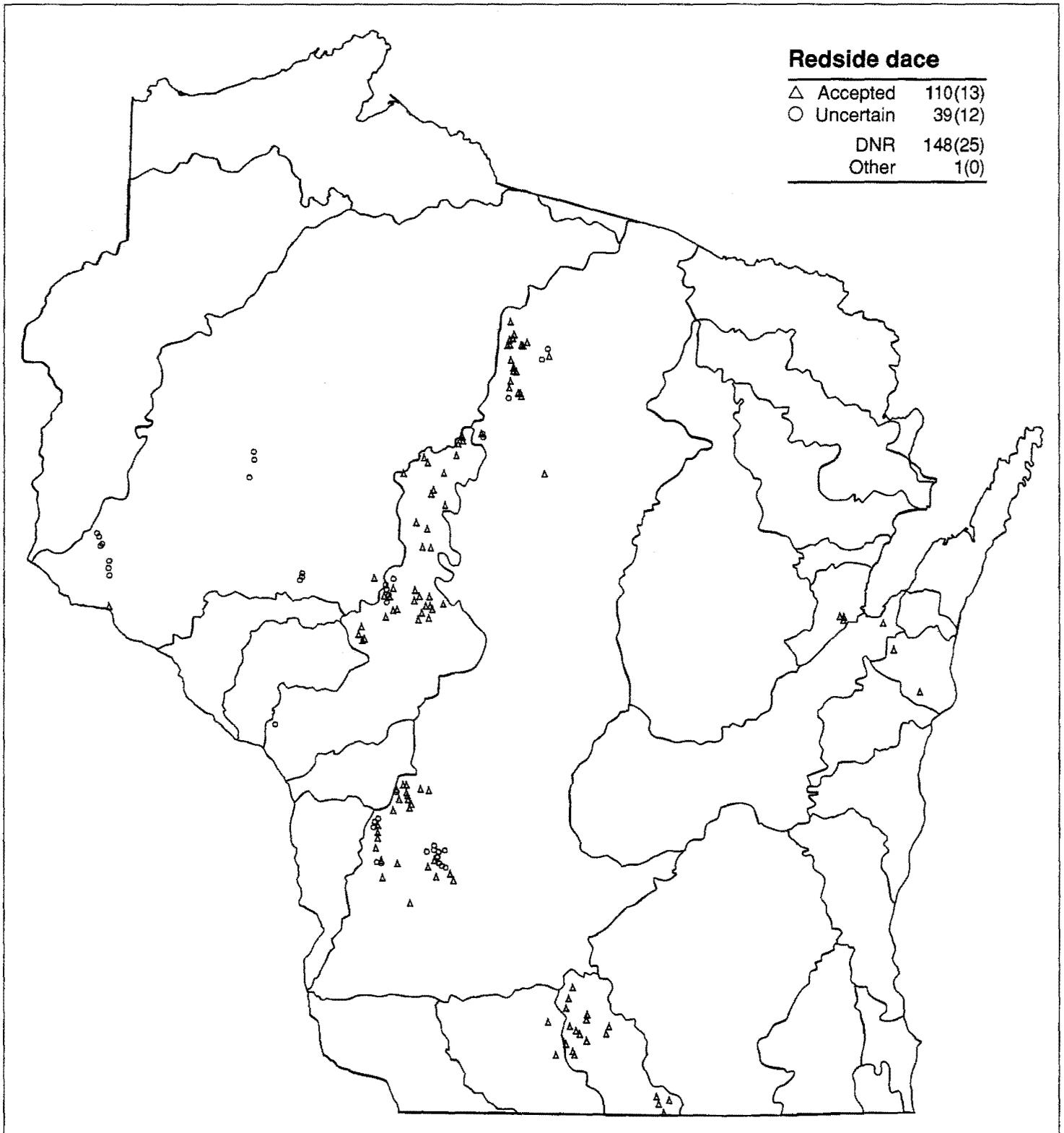
Map 34(L)



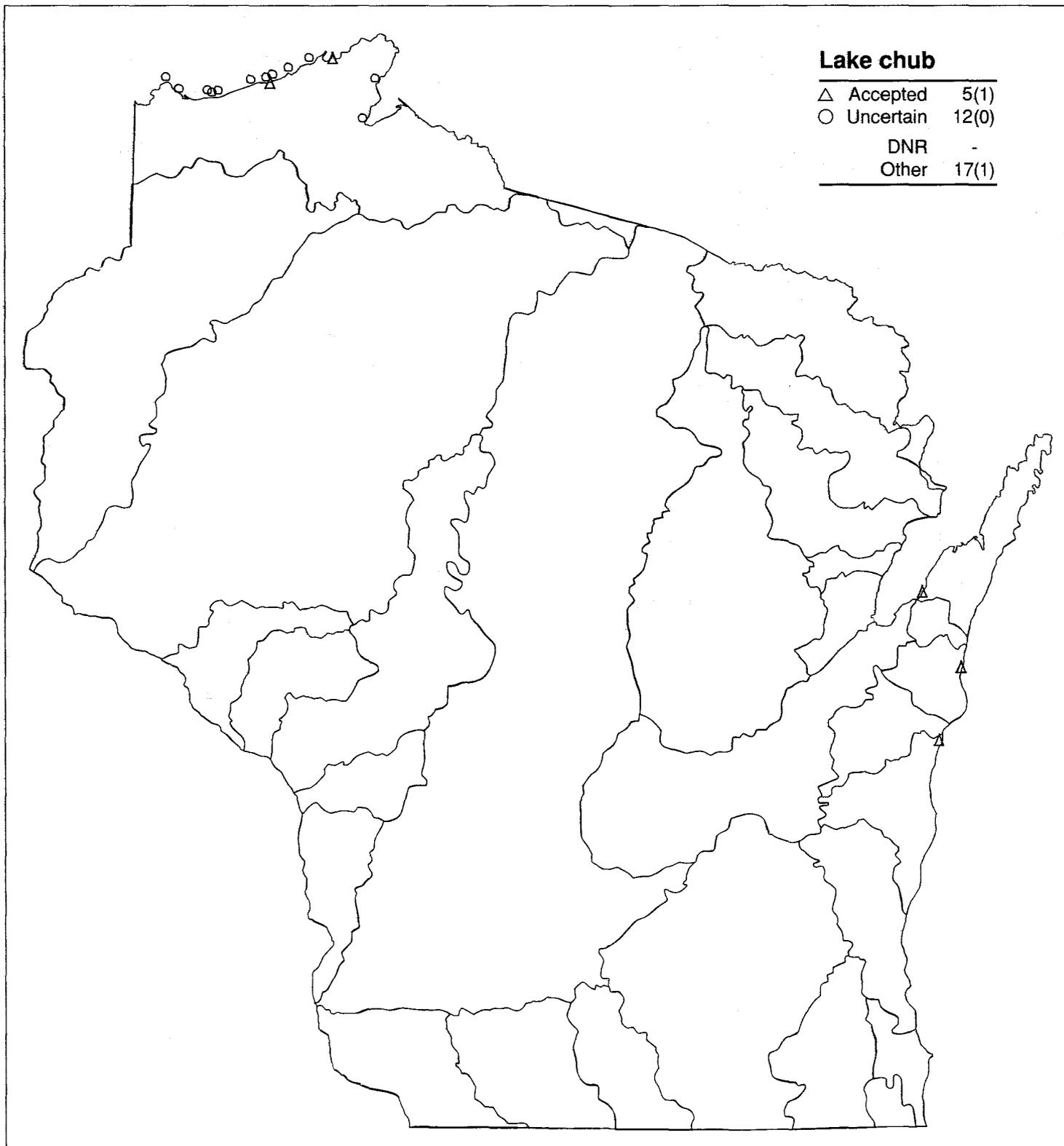
Map 35(E)



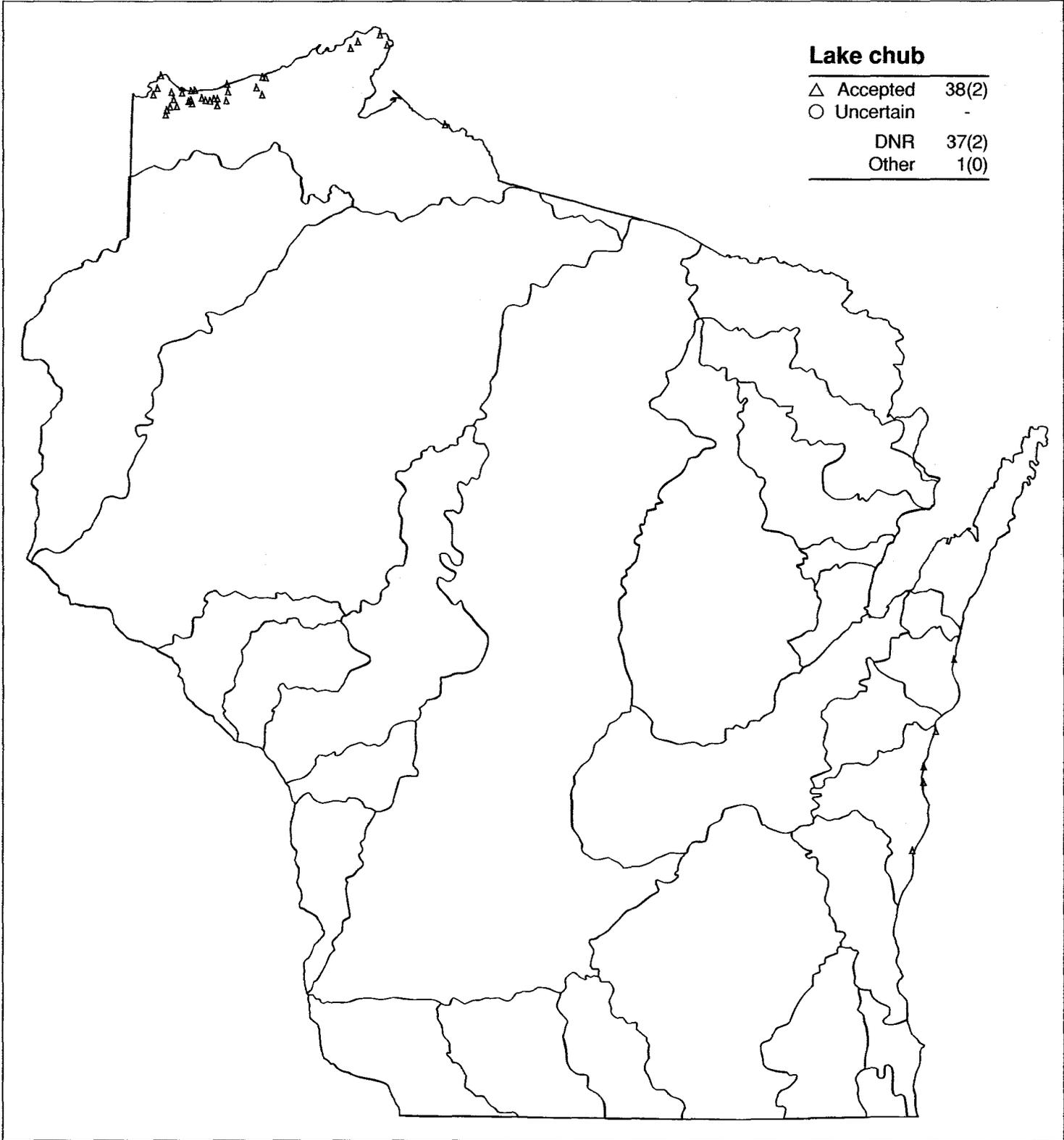
Map 35(L)



Map 36(E)

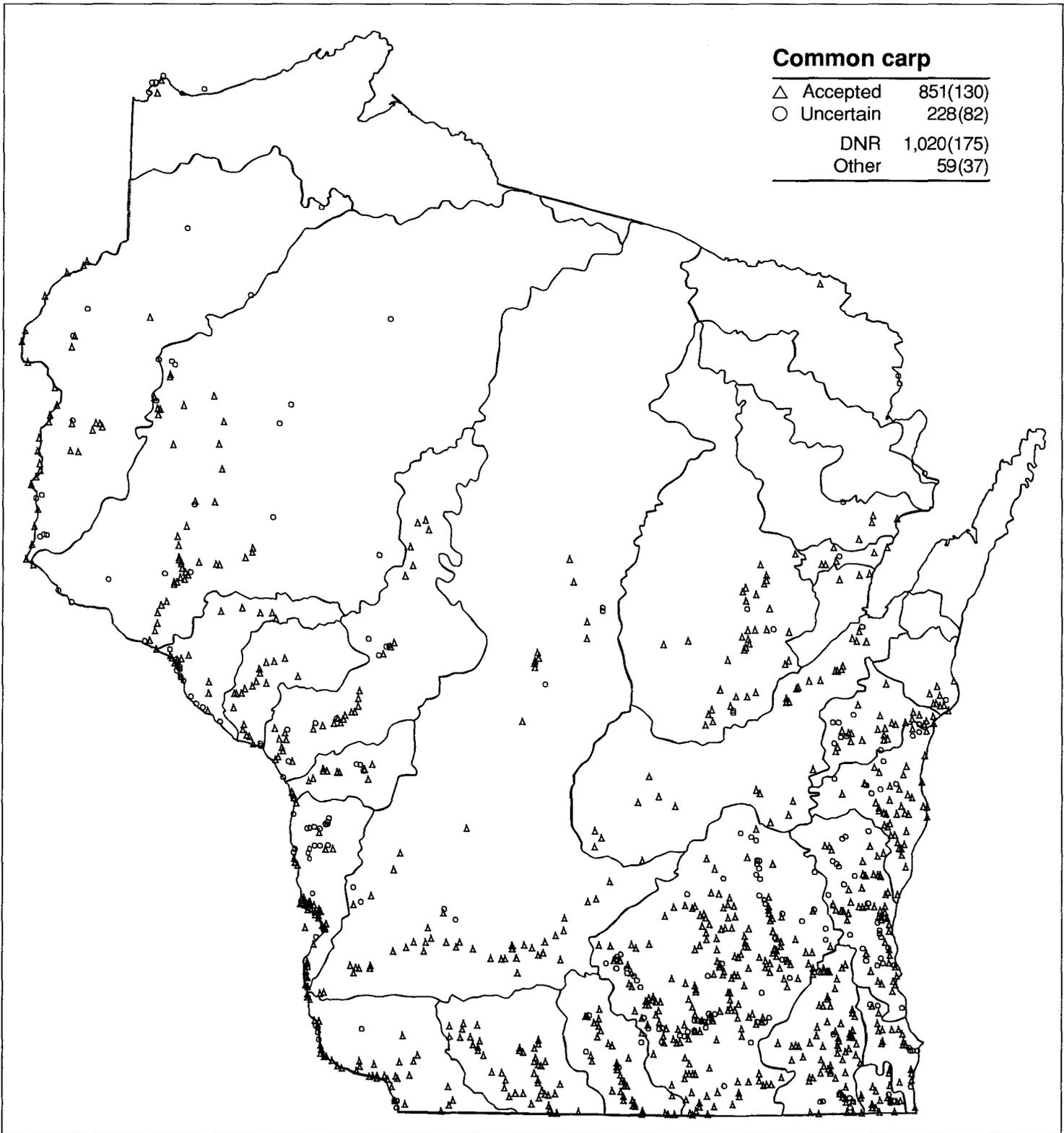


Map 36(L)

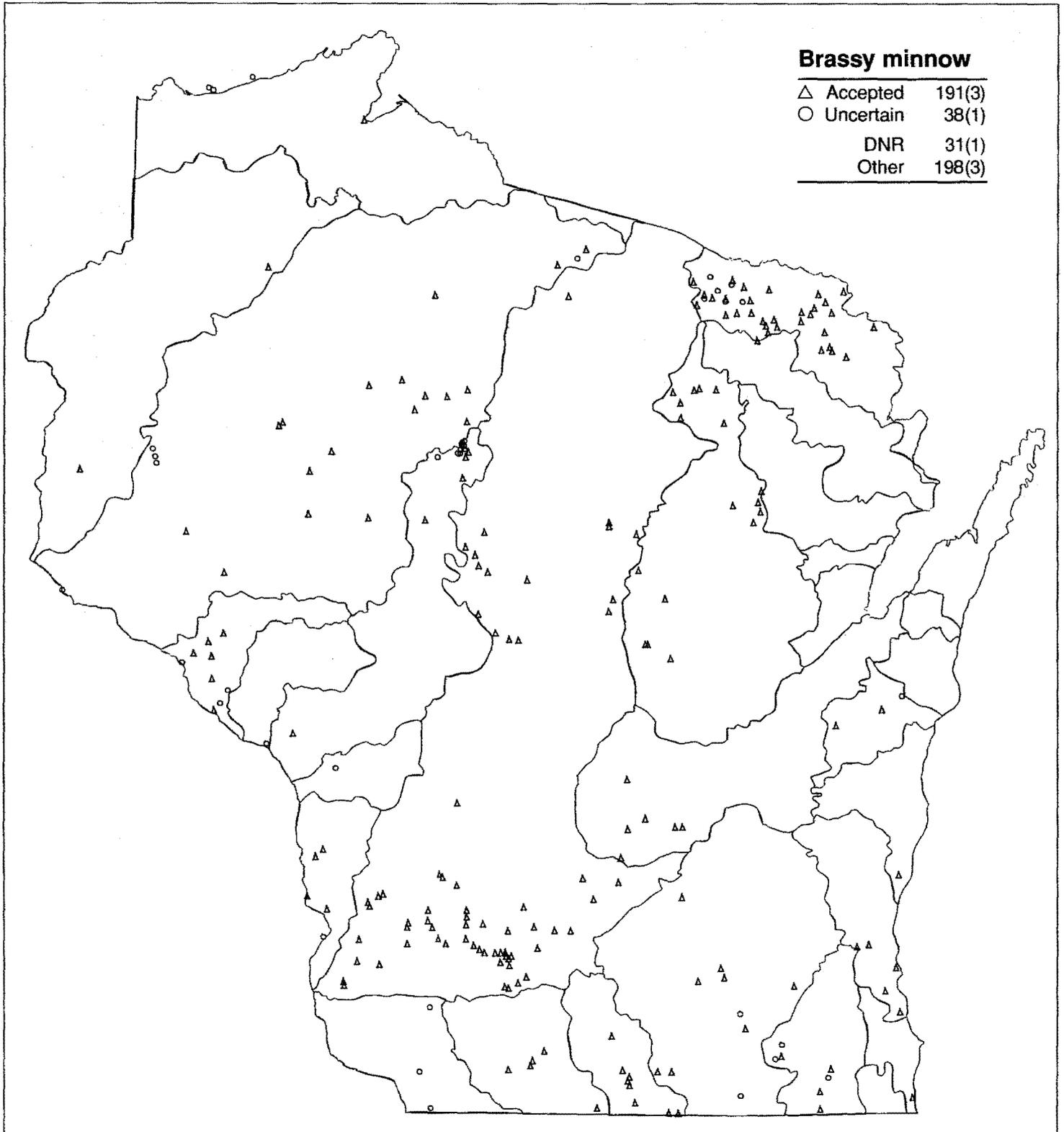


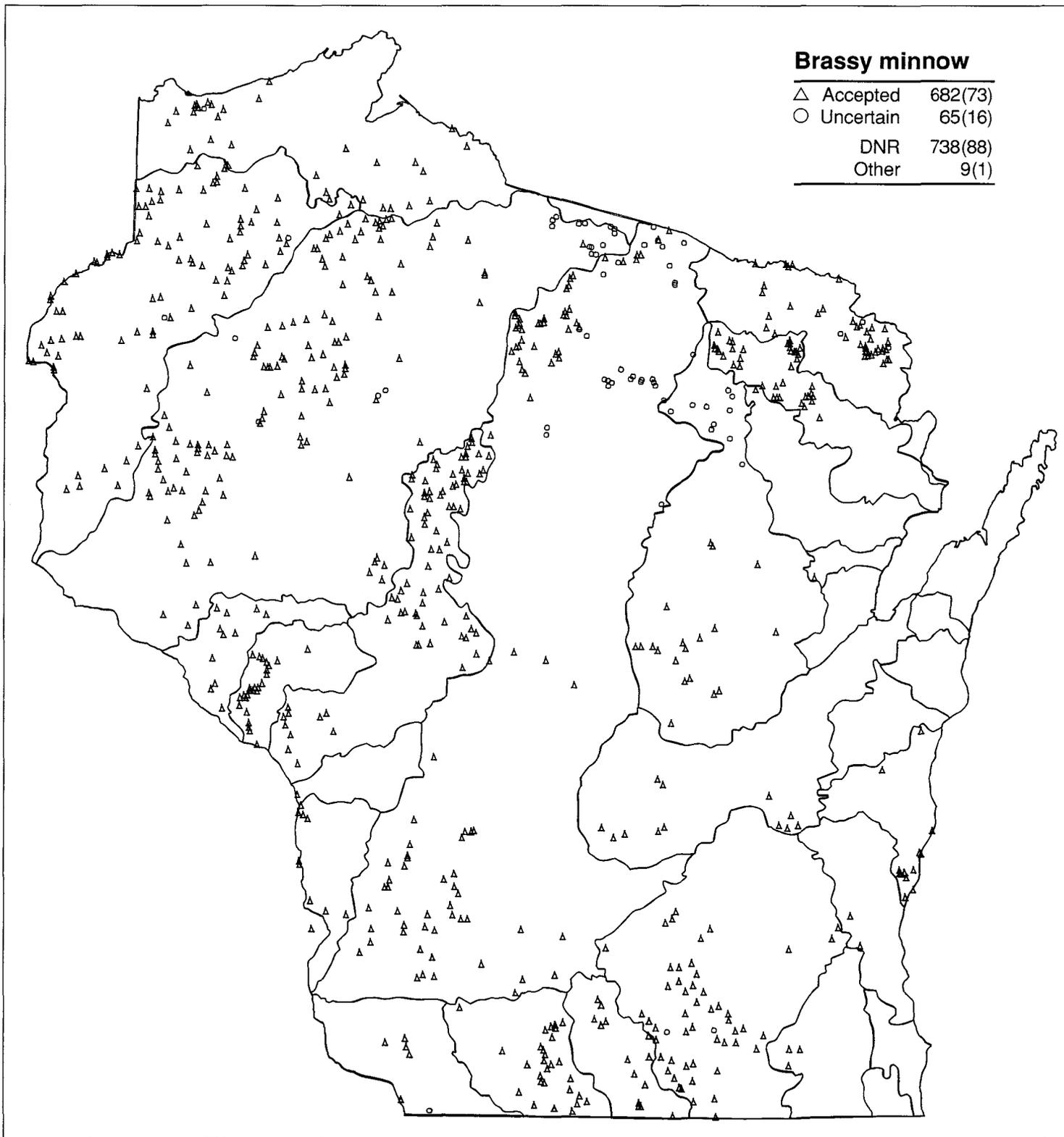
Map 37(E)





Map 38(E)

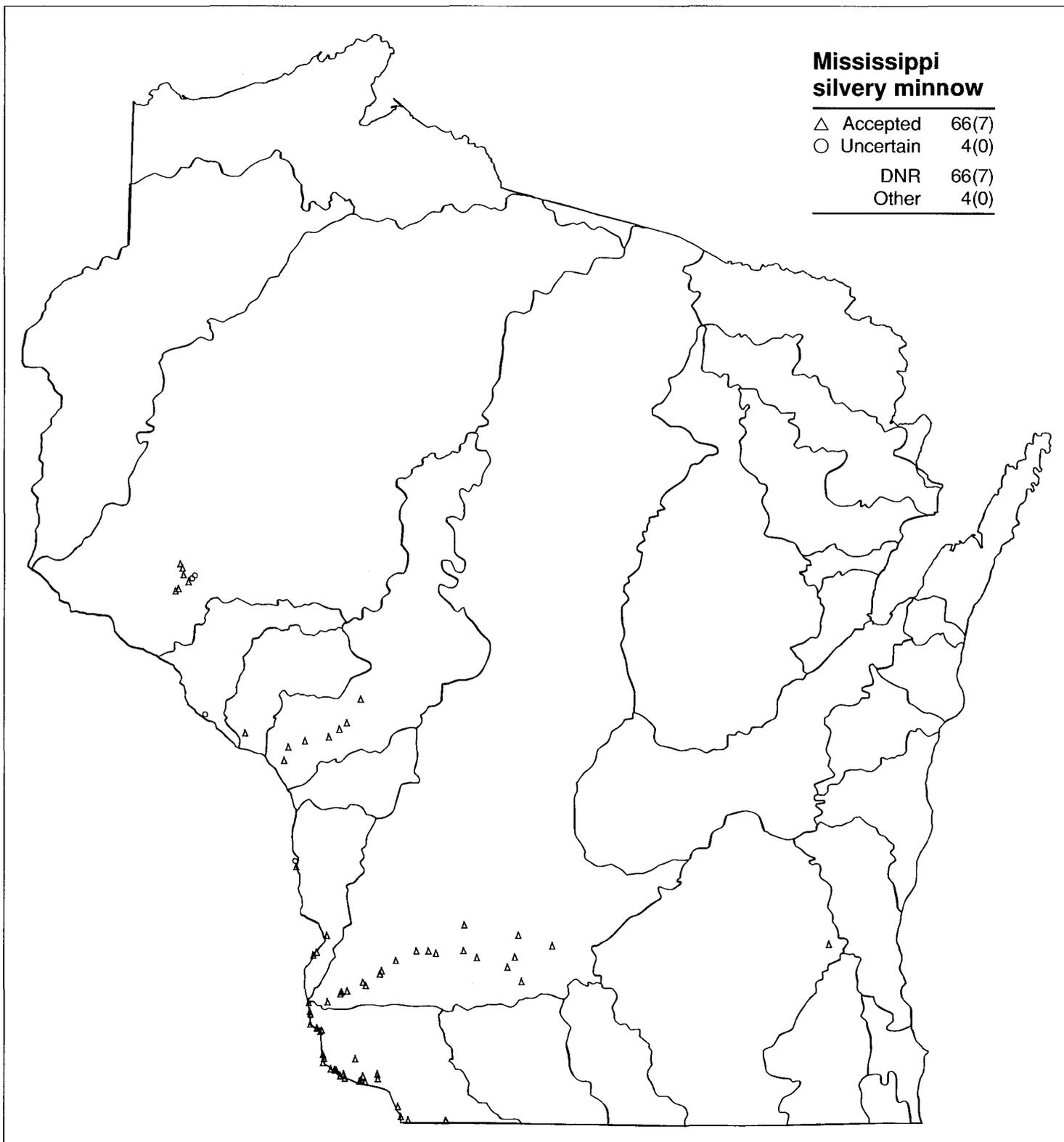




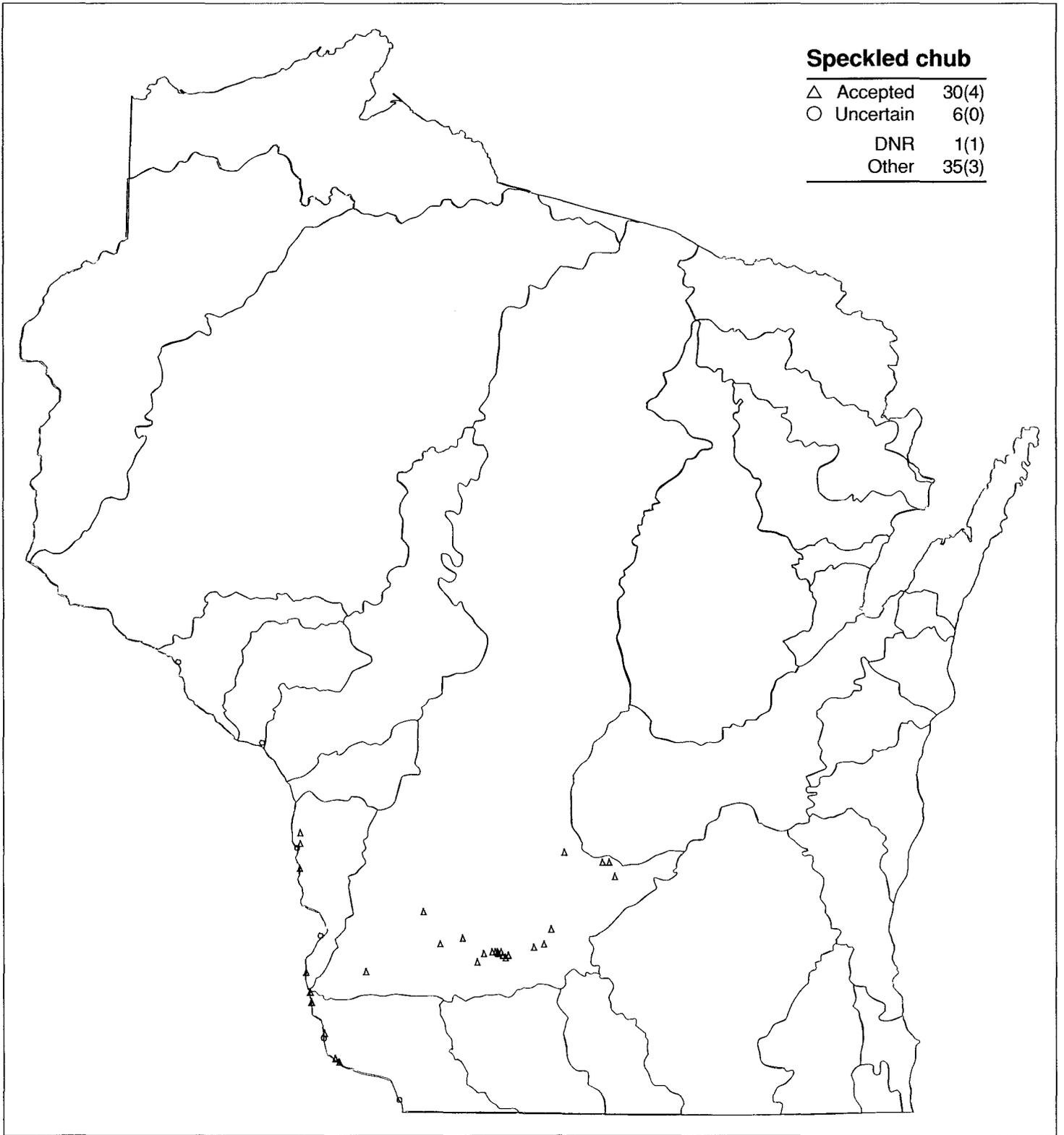
Map 39(E)



Map 39(L)



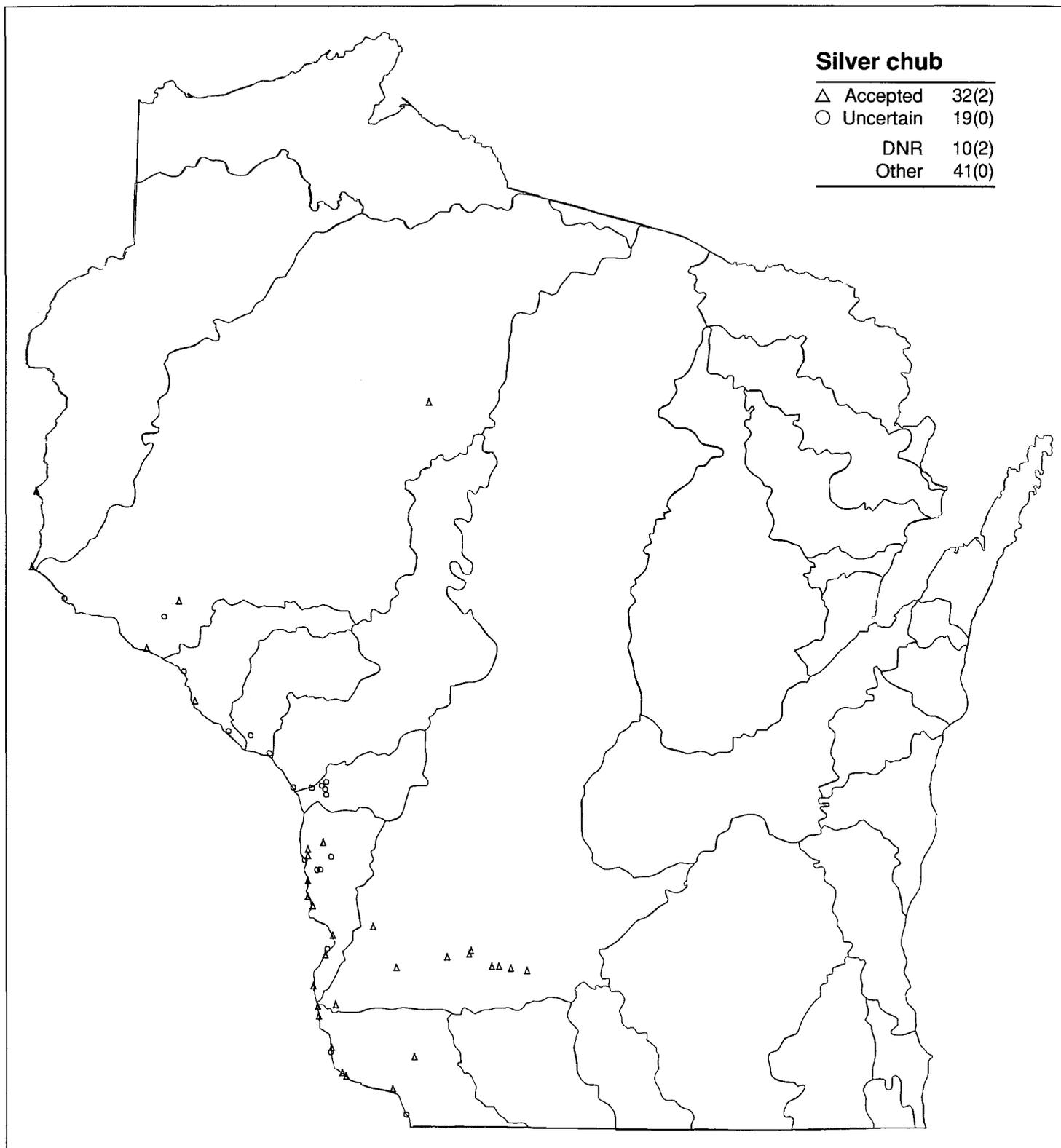
Map 40(E)

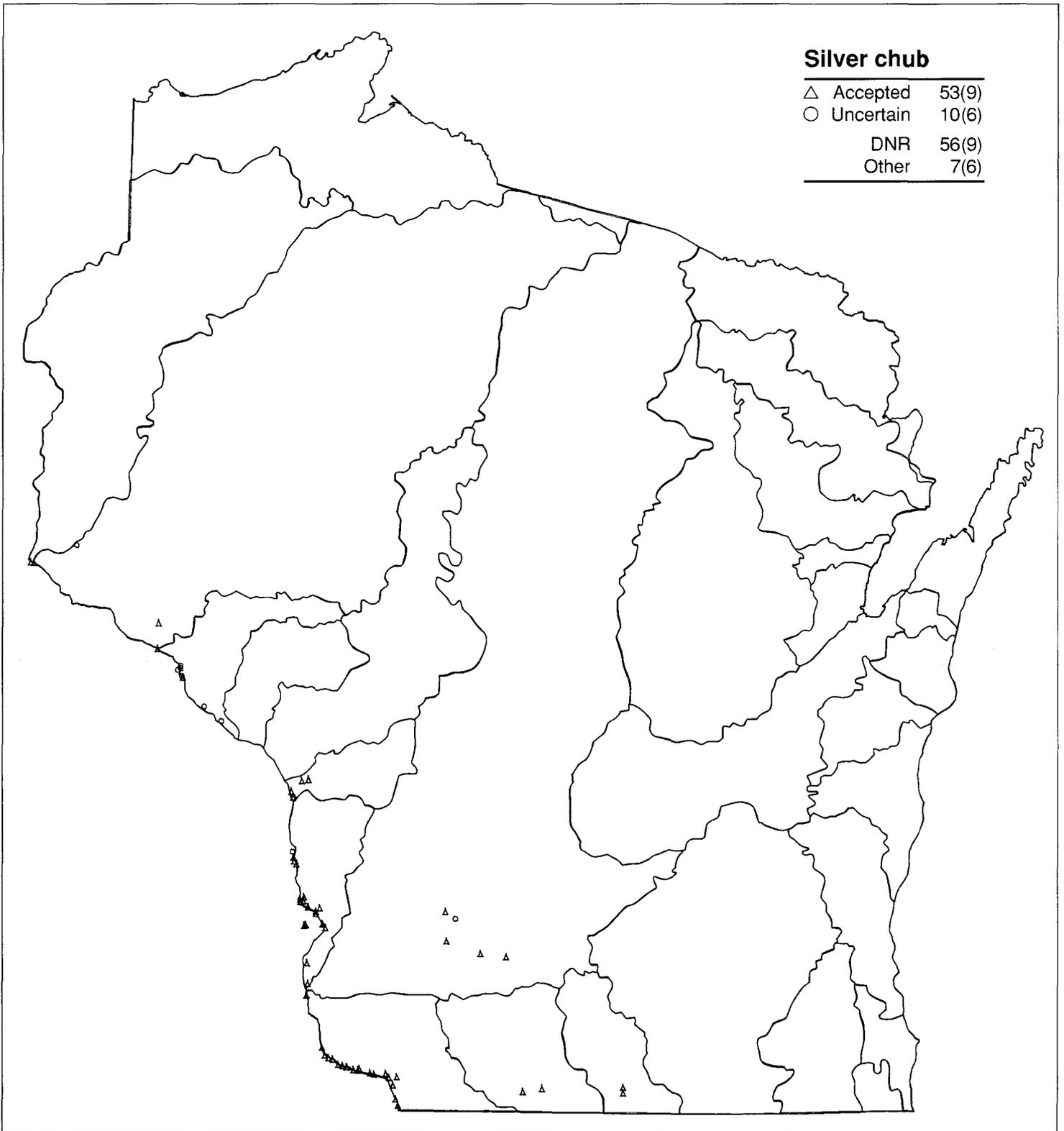


Map 40(L)

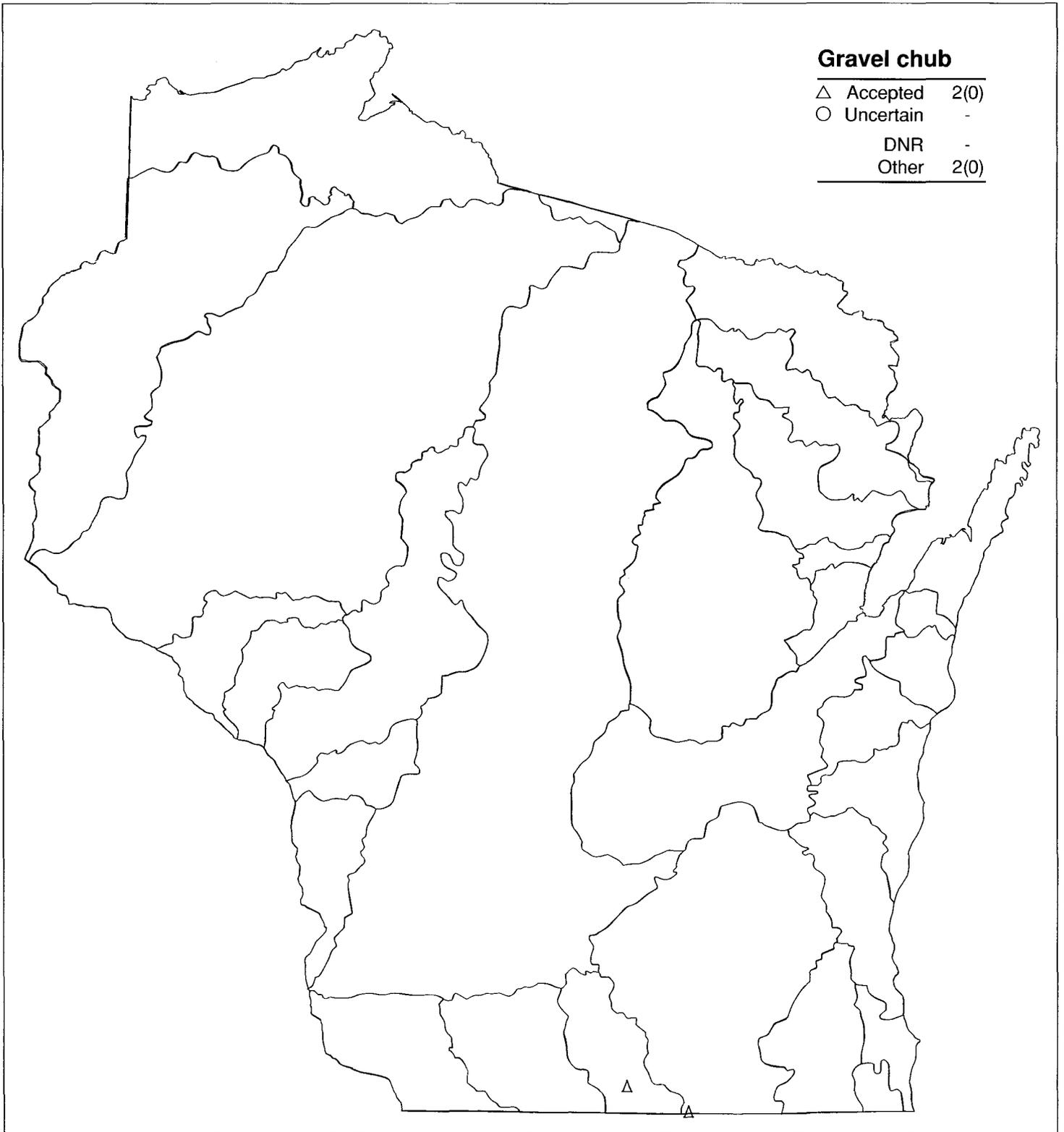


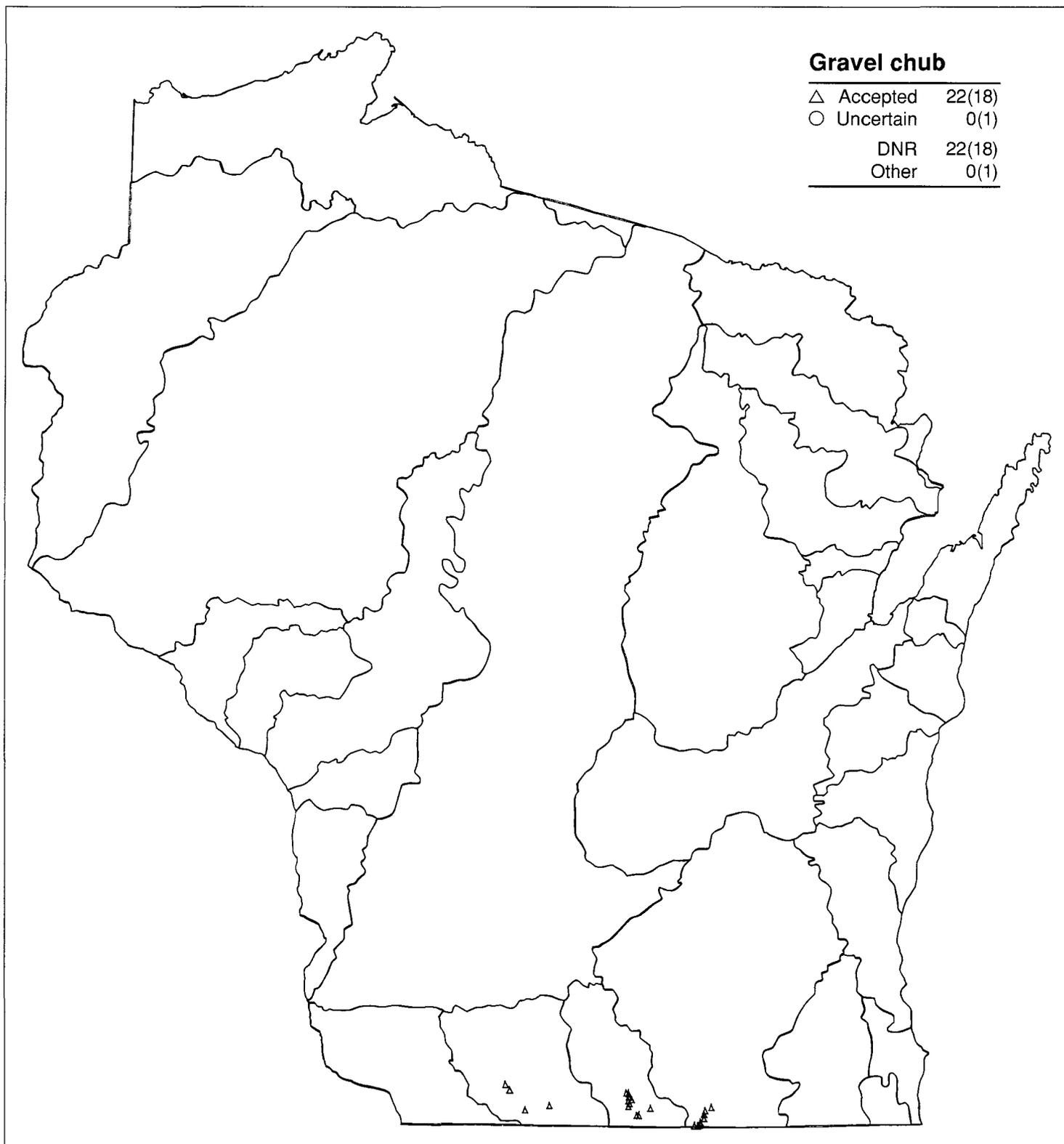
Map 41(E)



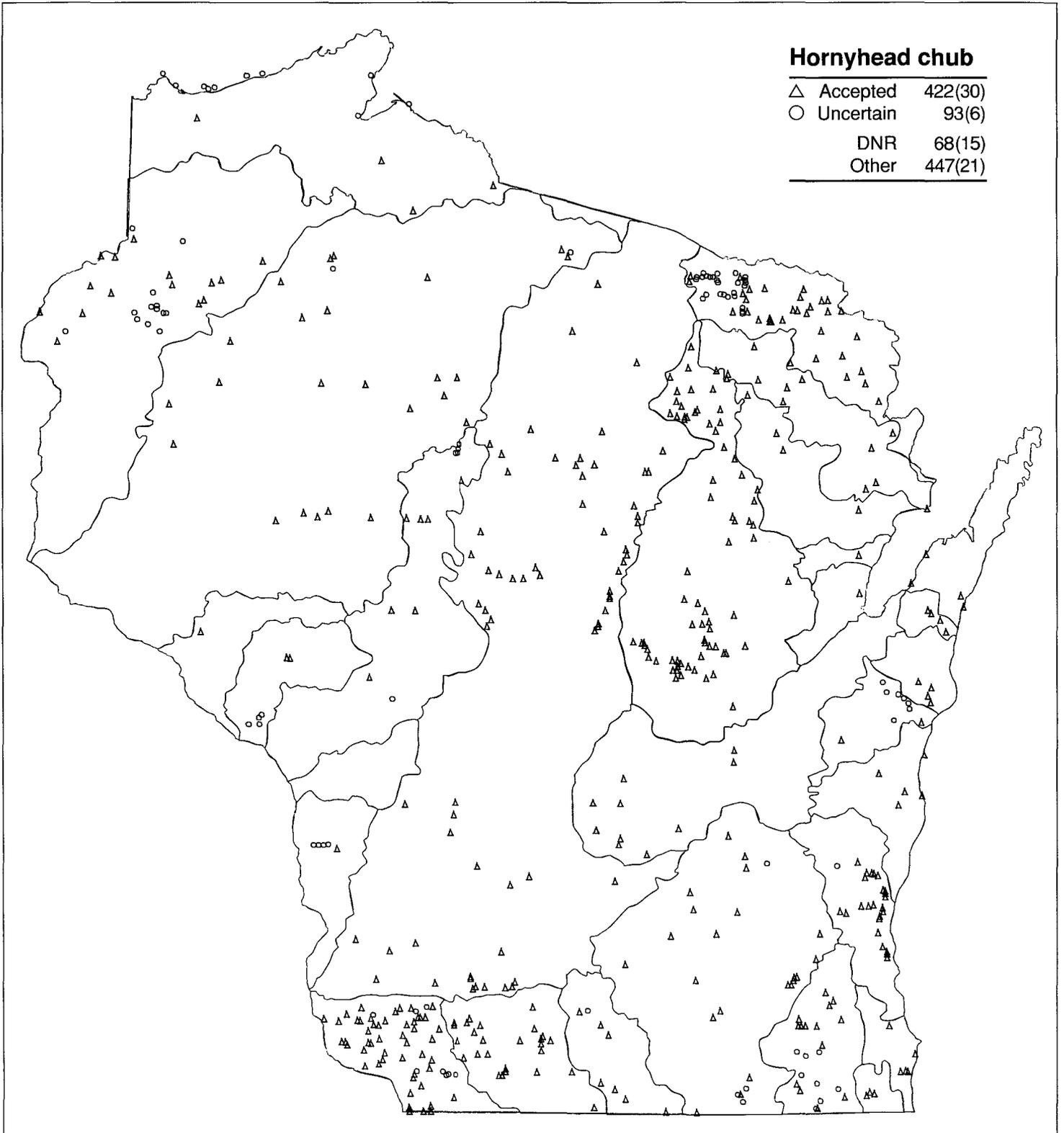


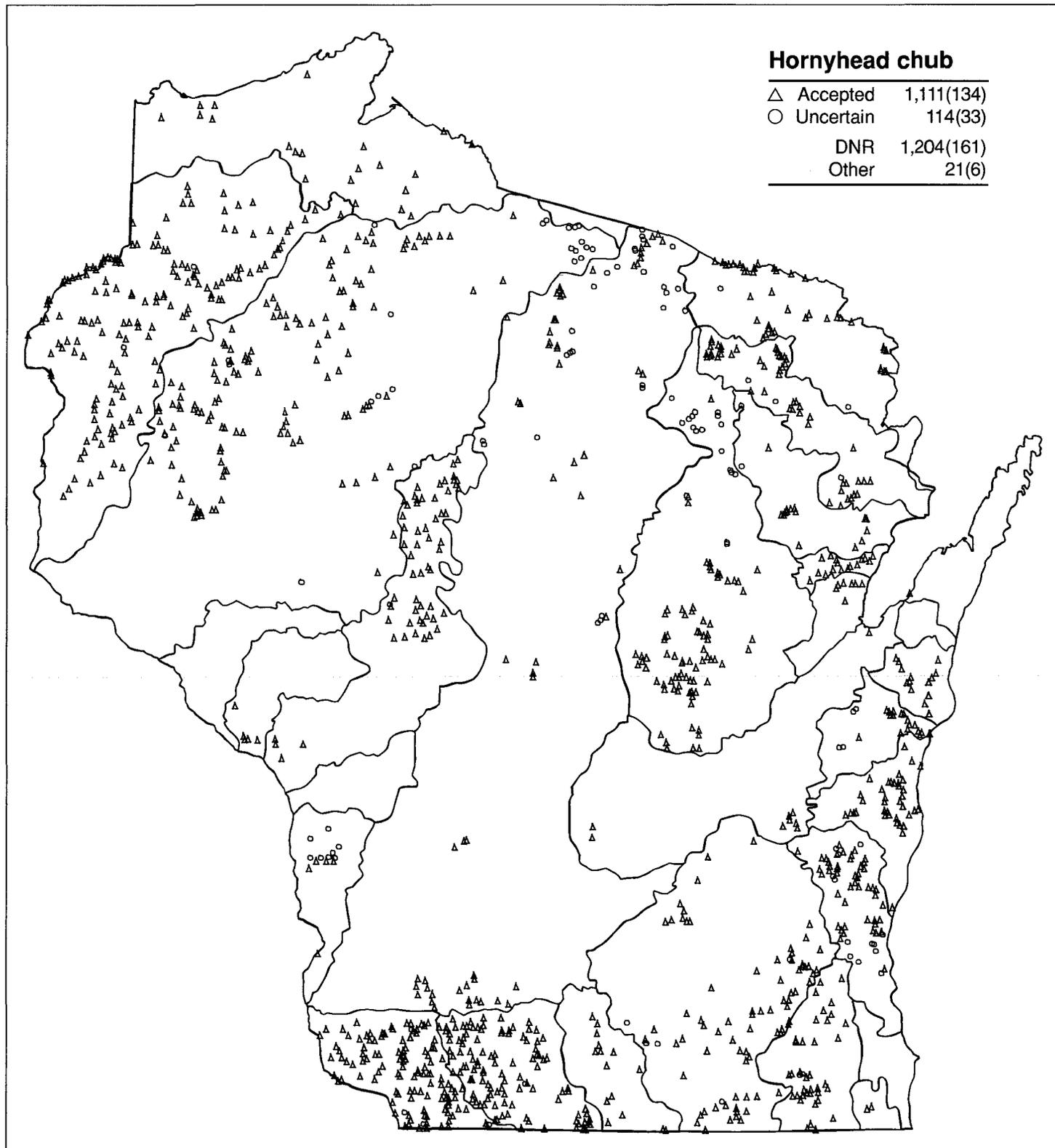
Map 42(E)



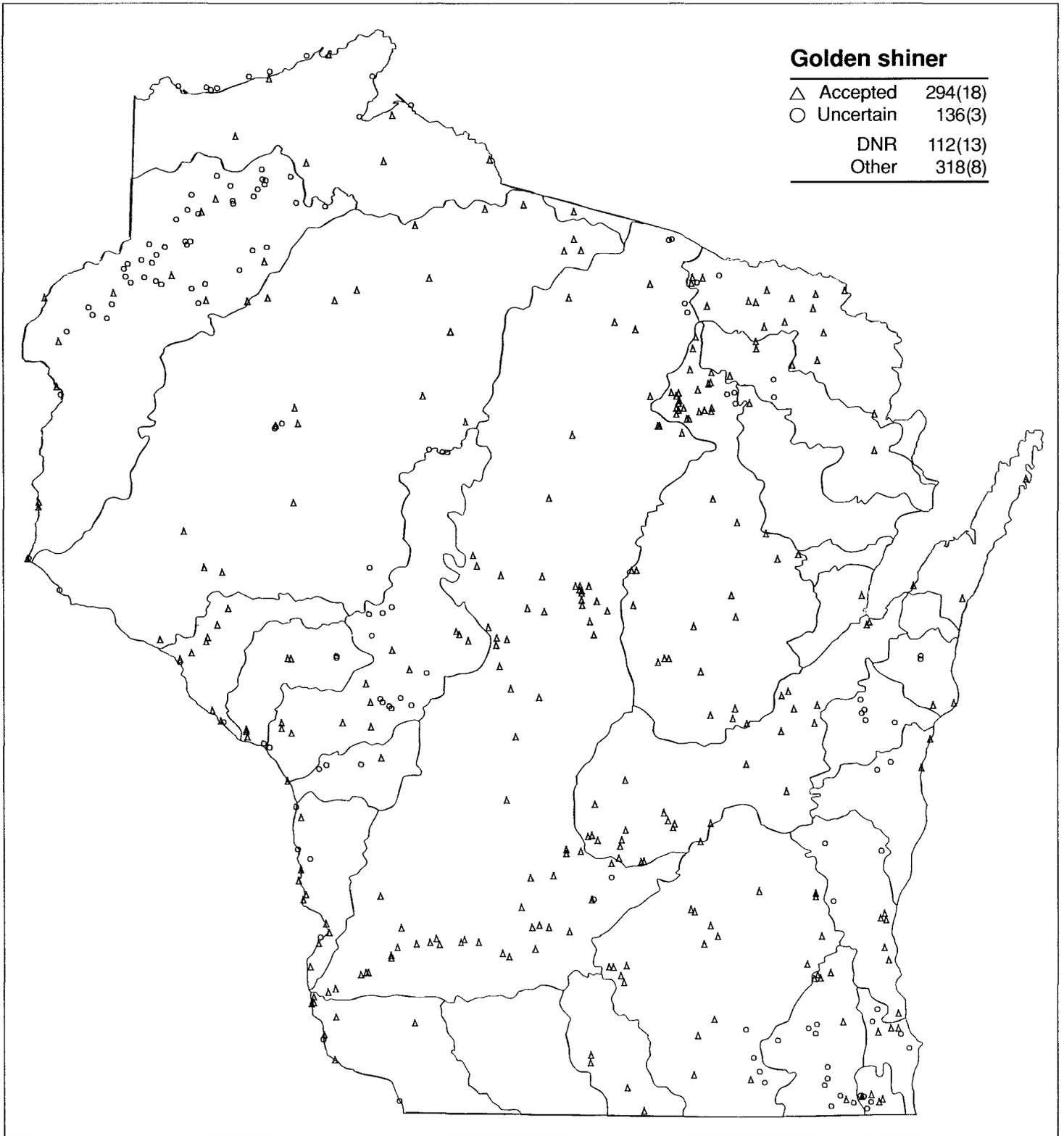


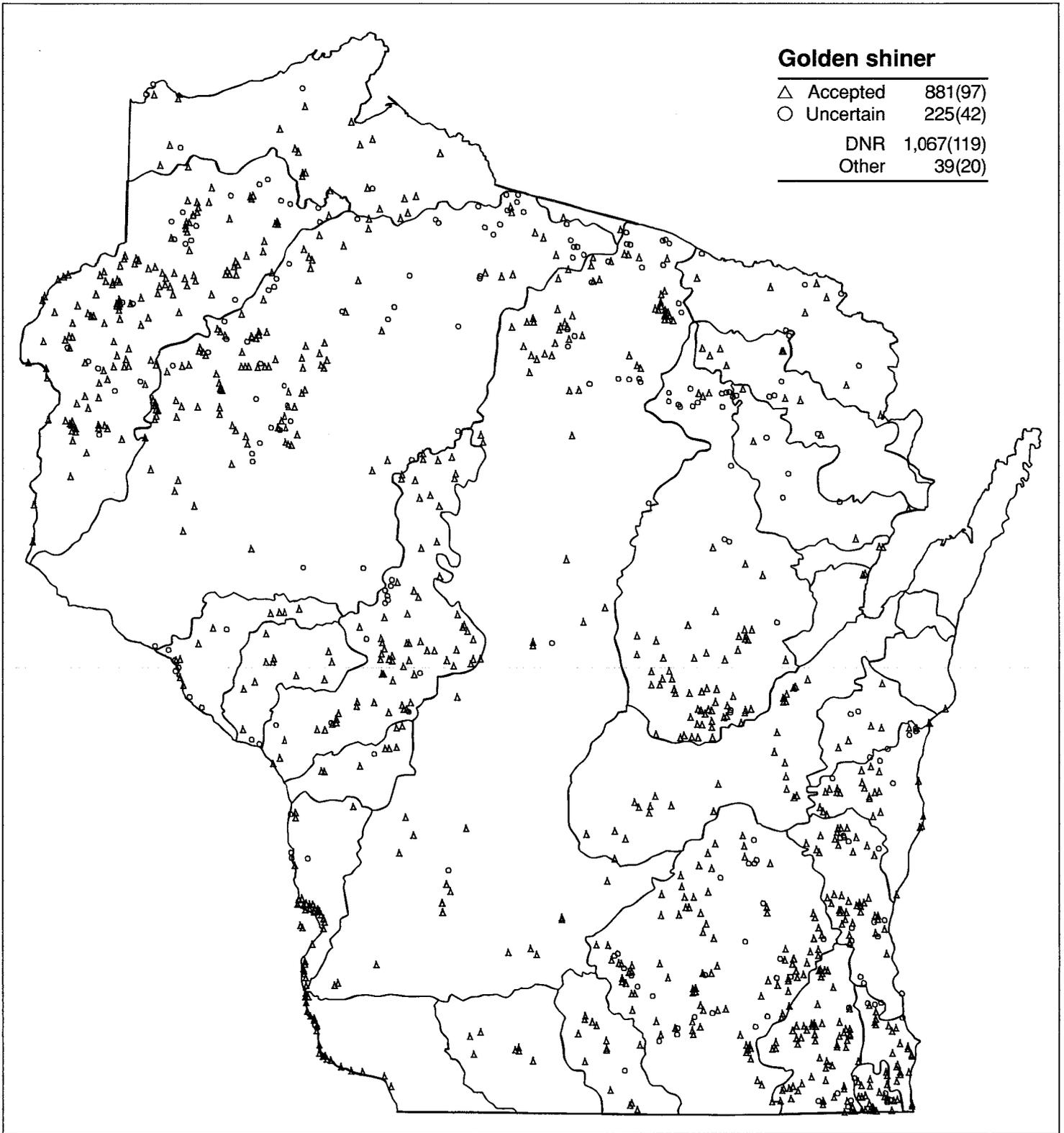
Map 43(E)



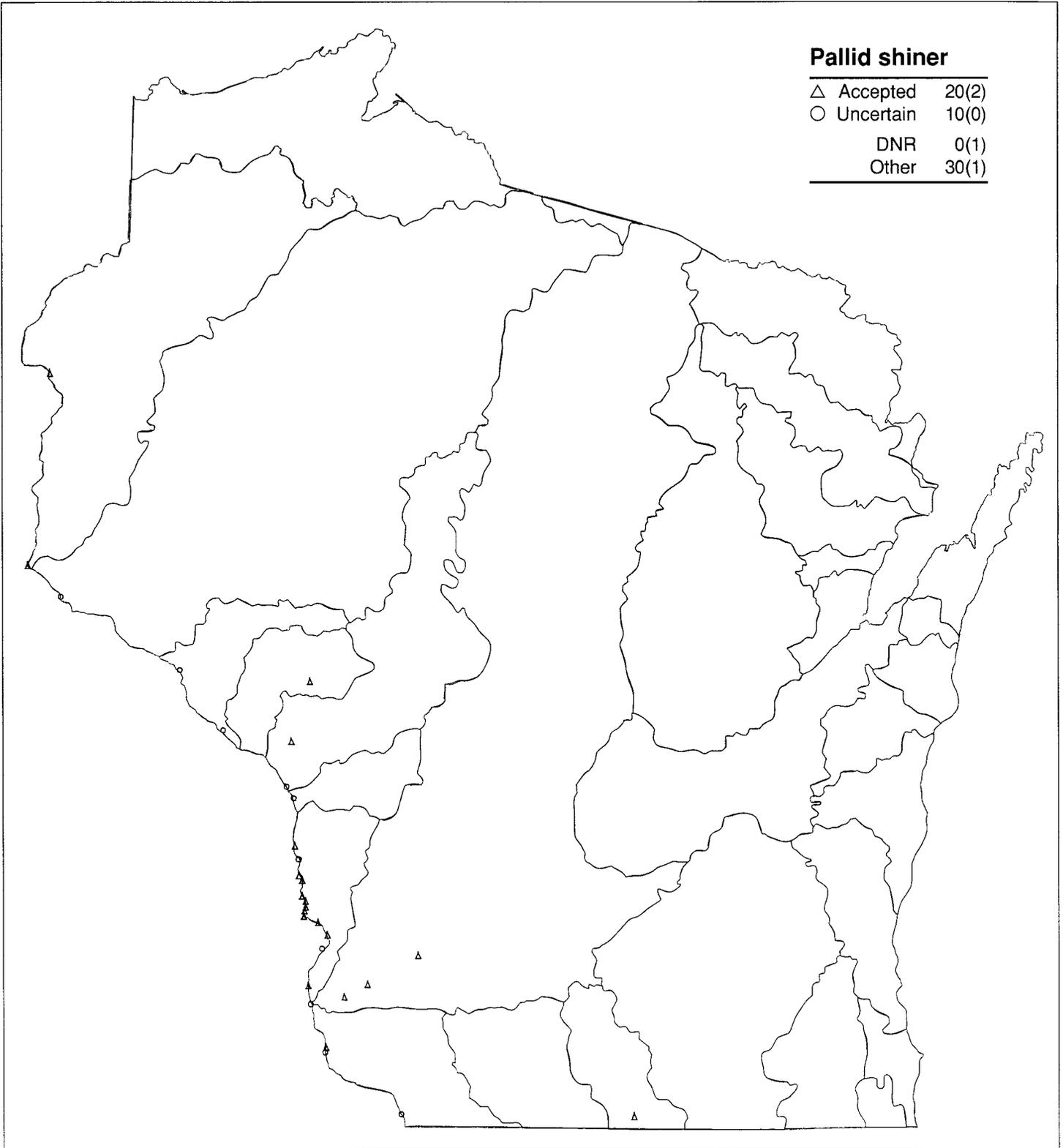


Map 44(E)





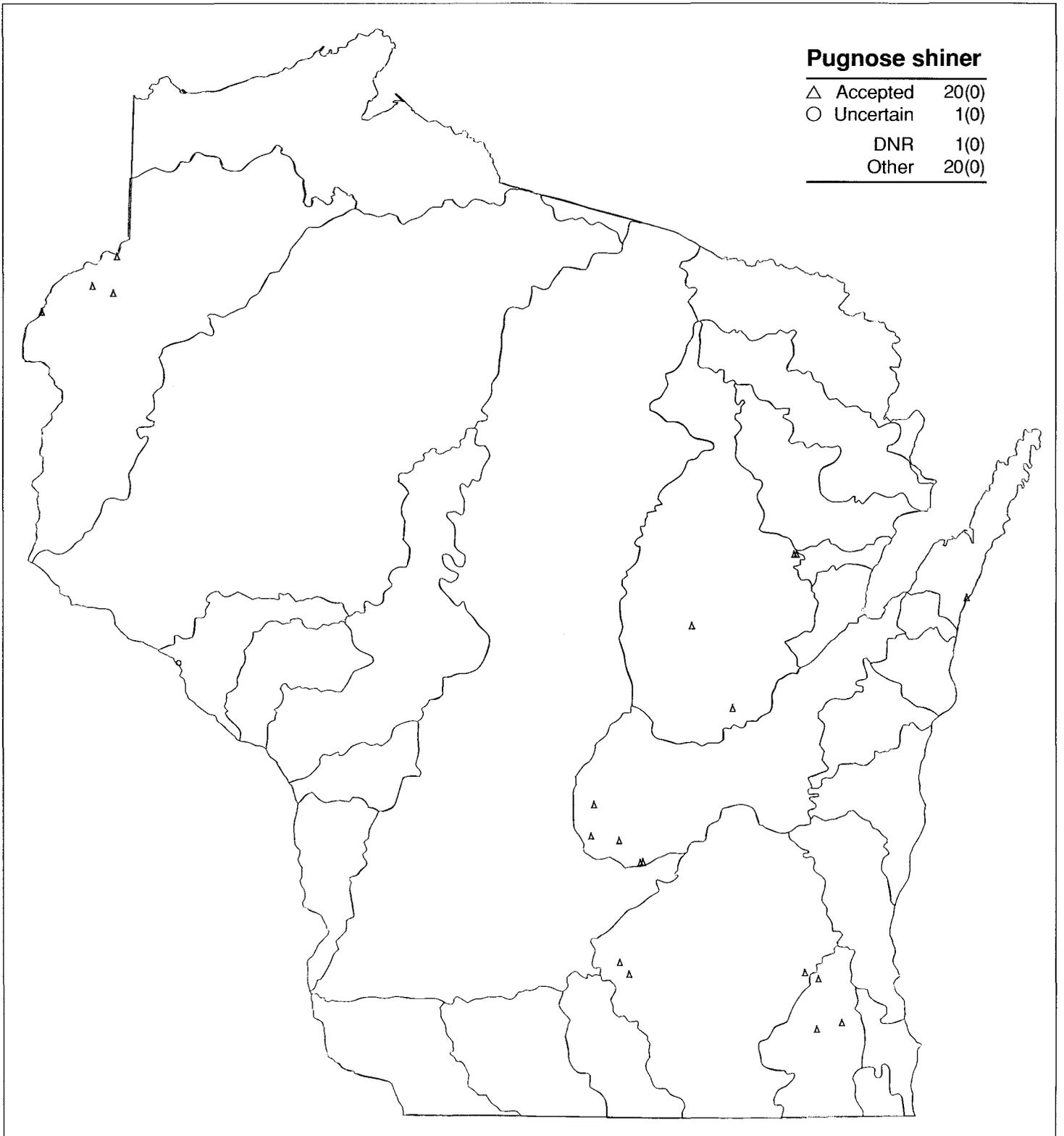
Map 45(E)



Map 45(L)



Map 46(E)



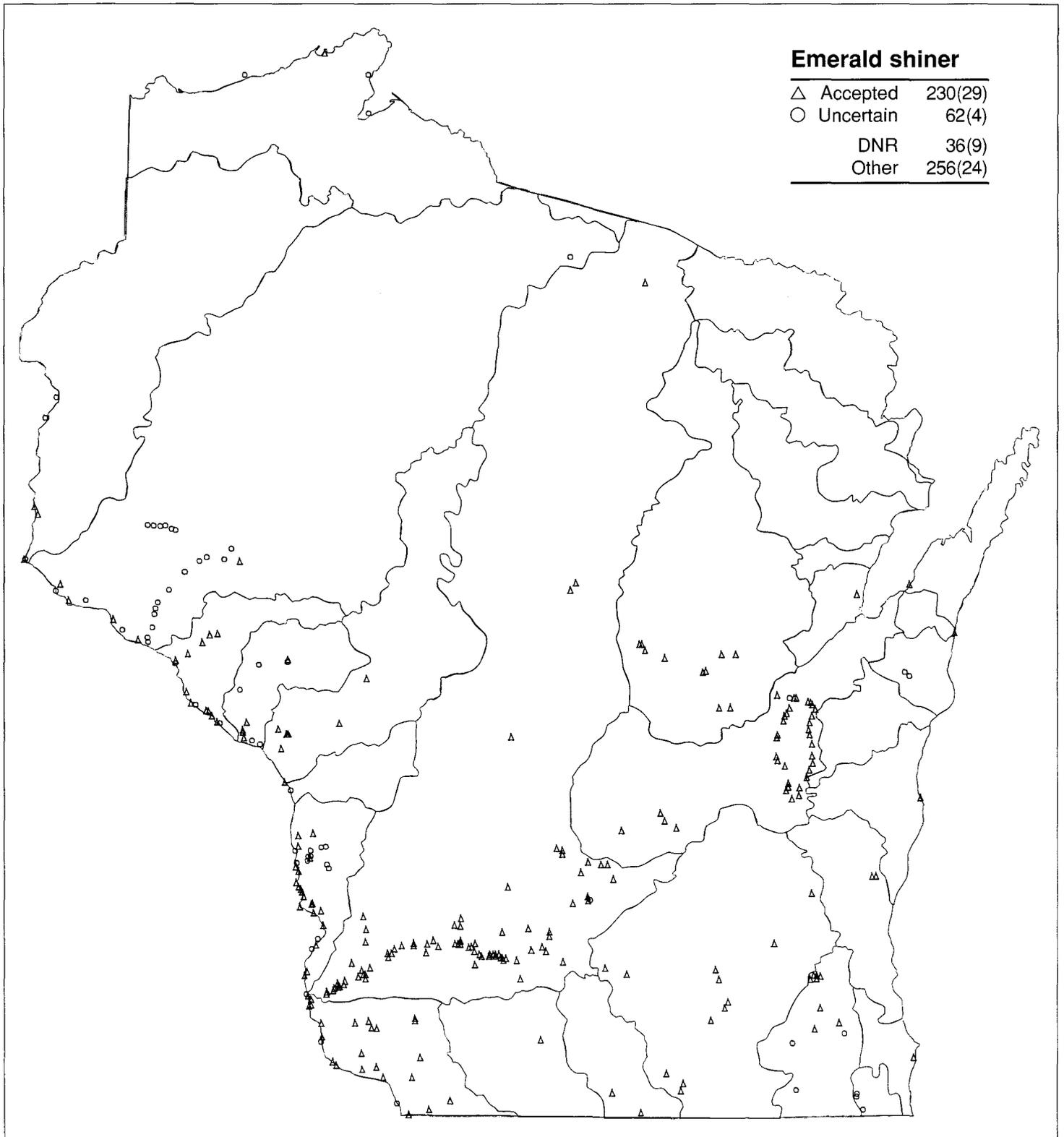
Map 46(L)

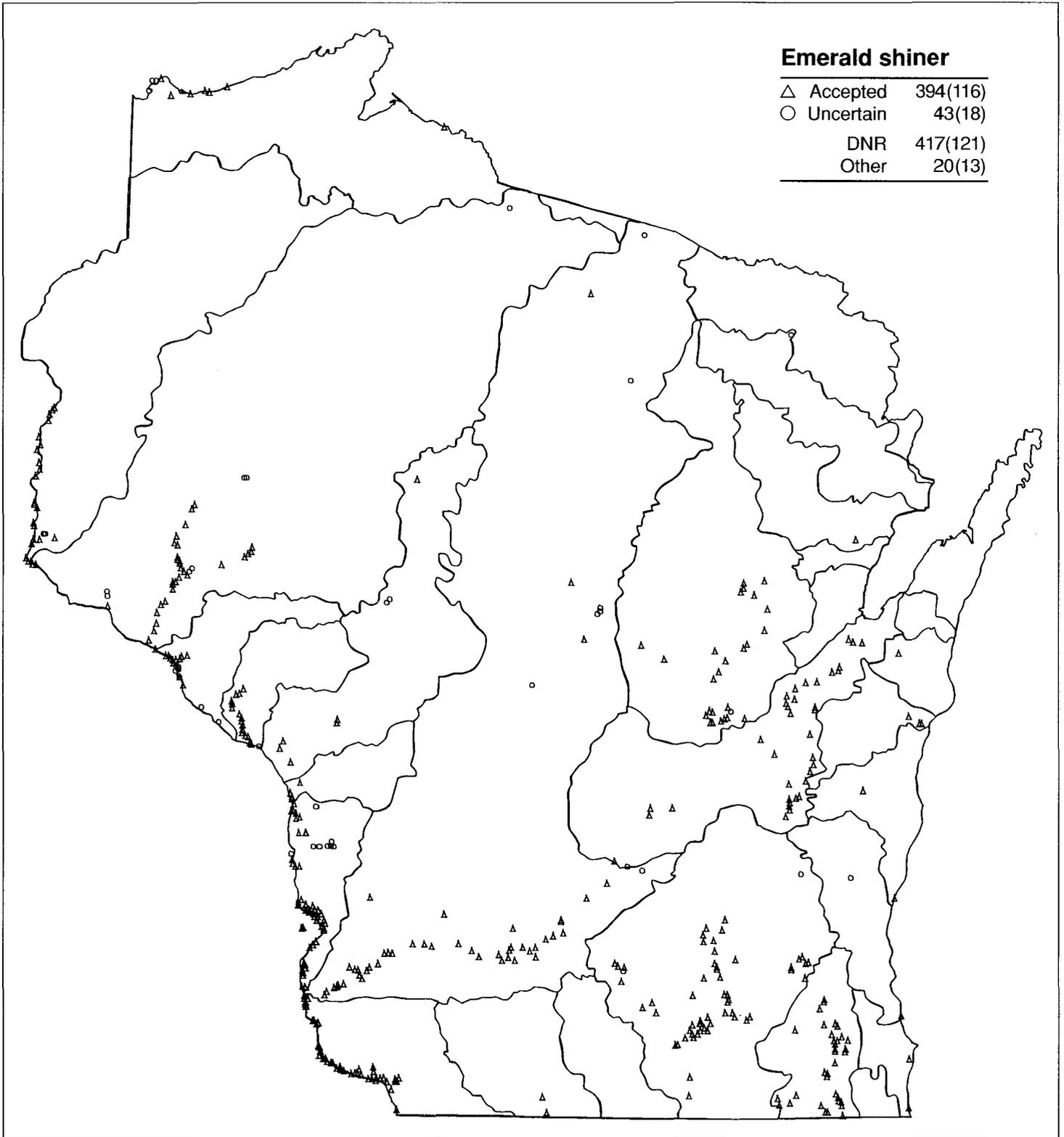
Pugnose shiner

△	Accepted	51(7)
○	Uncertain	-
	DNR	50(7)
	Other	1(0)

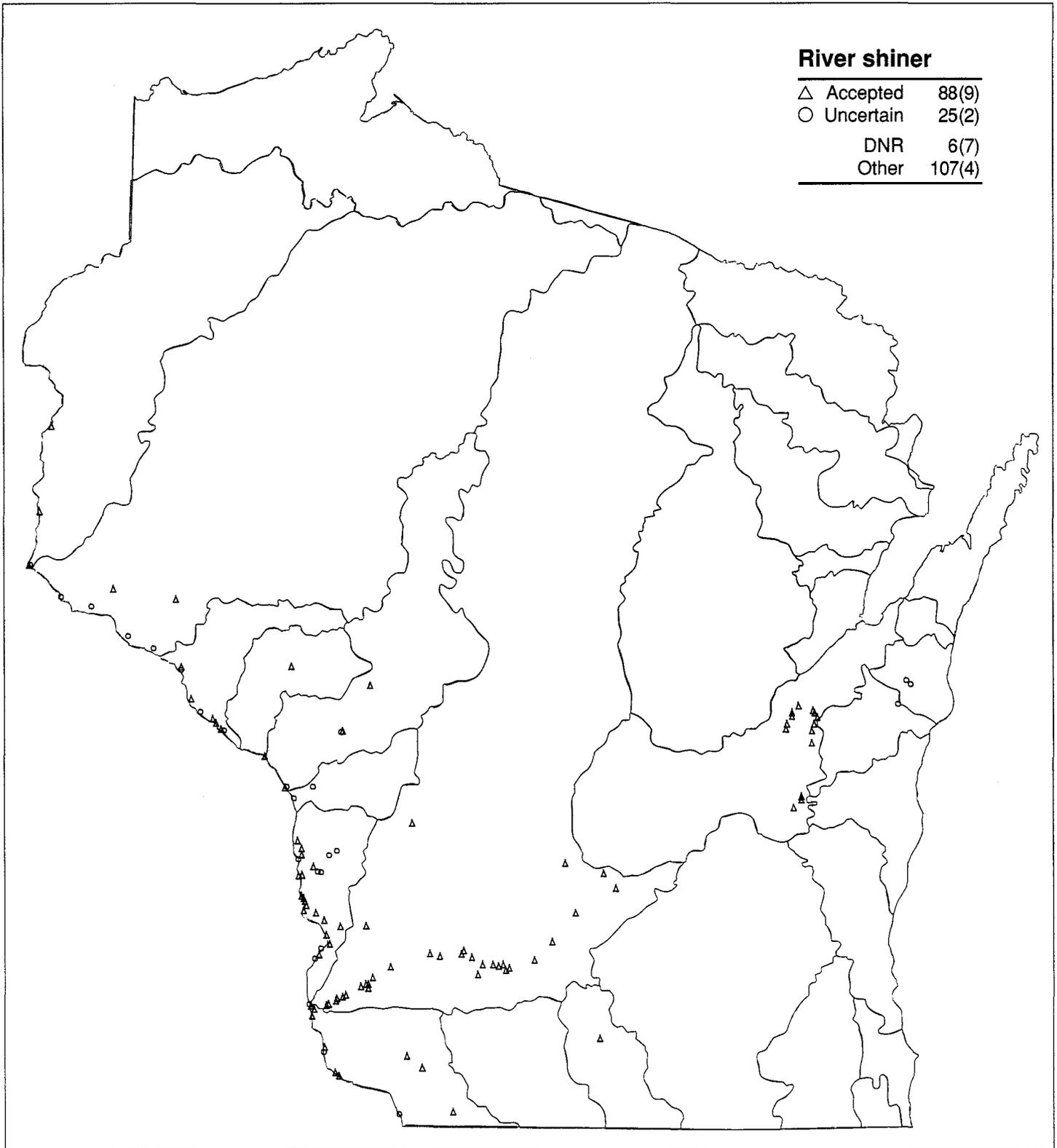


Map 47(E)

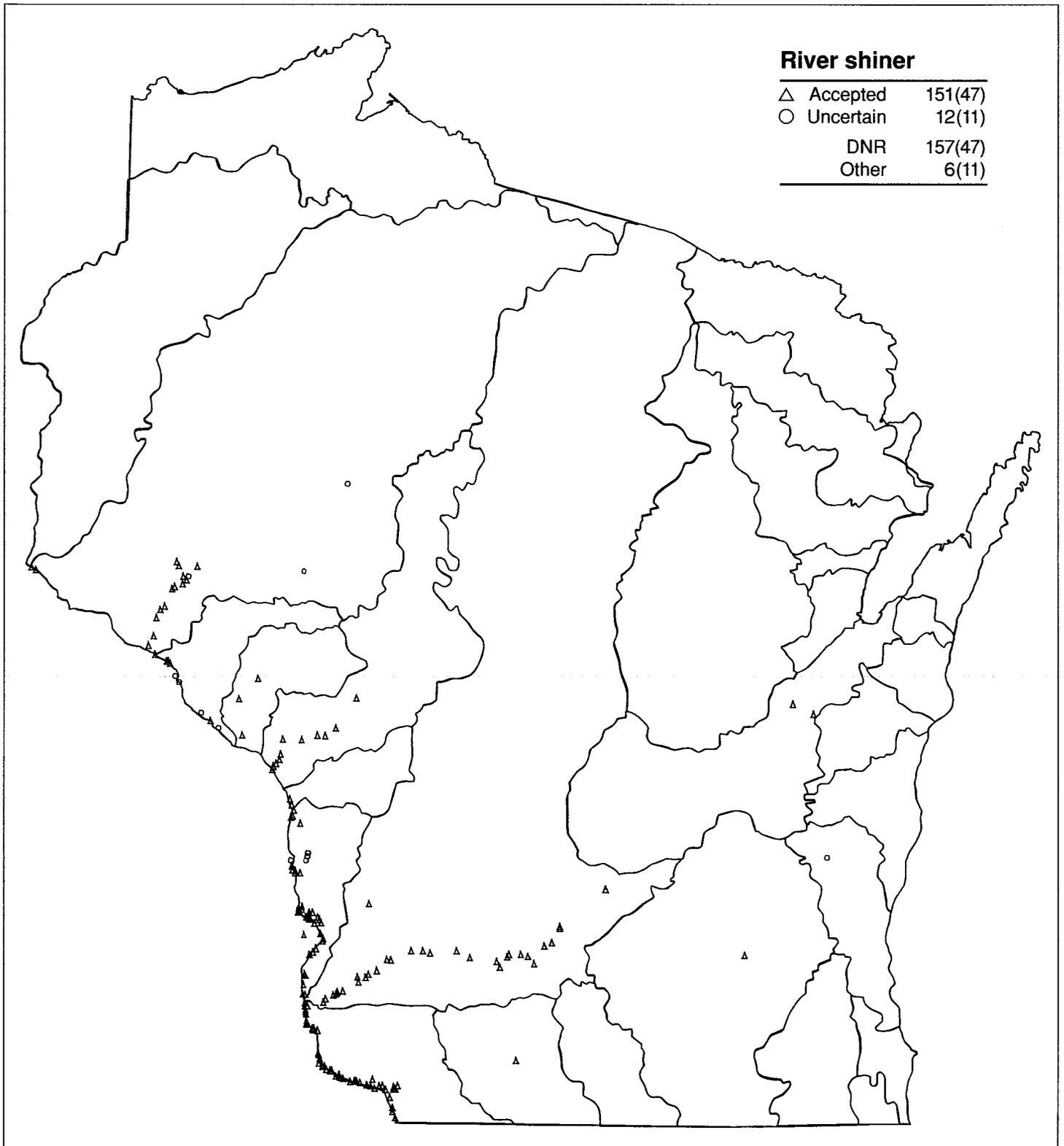




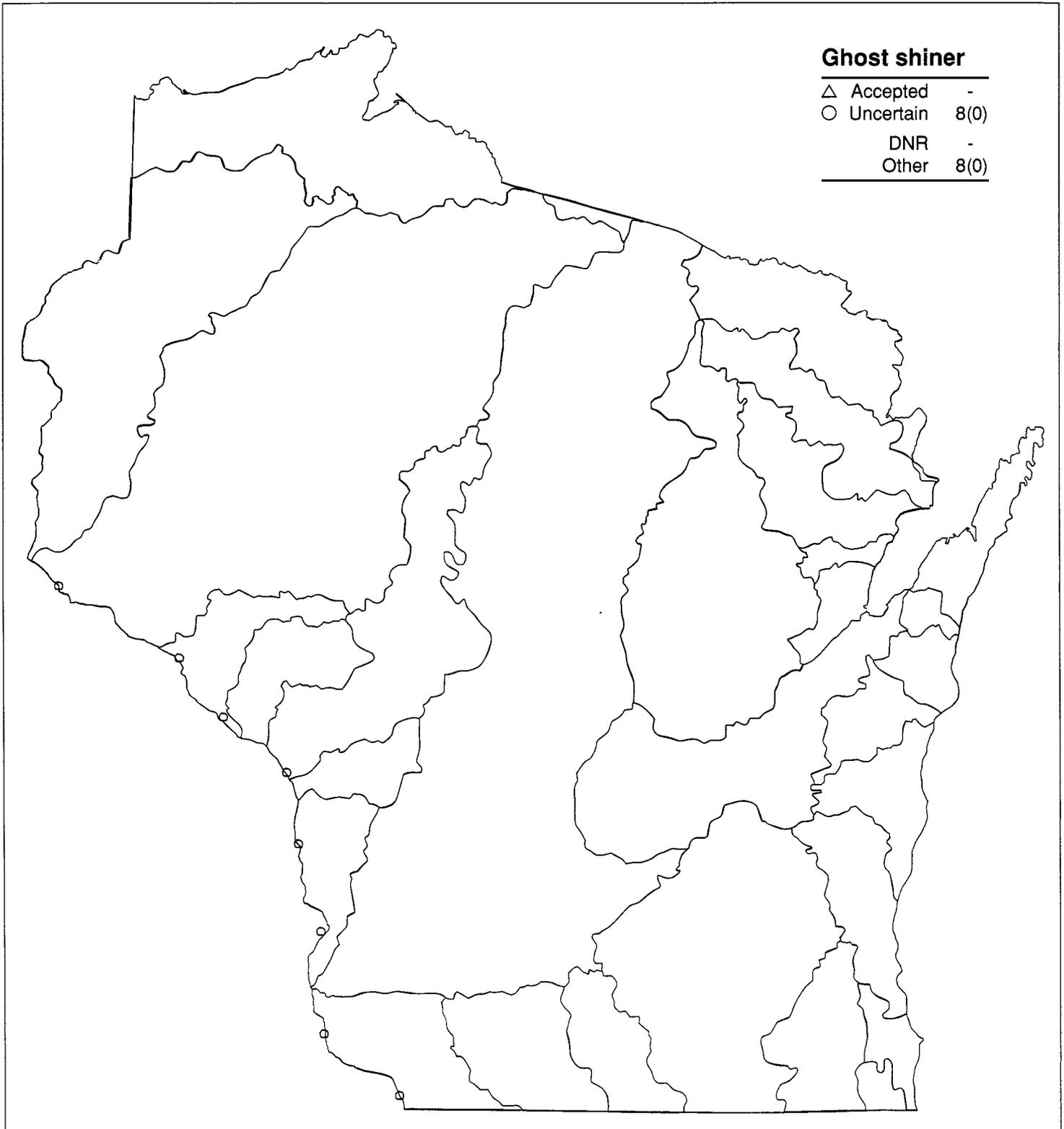
Map 48(E)



Map 48(L)



Map 49(E)

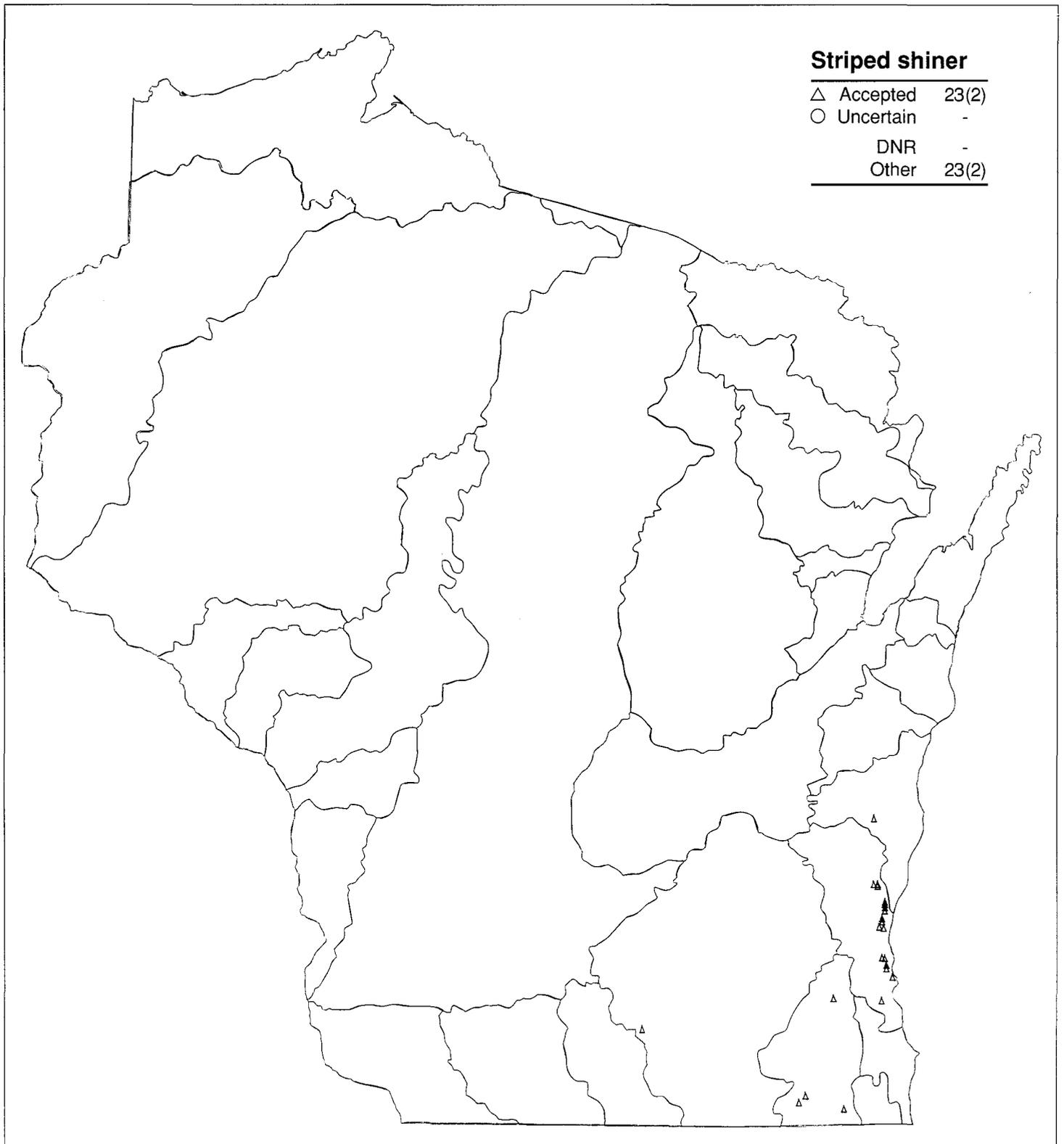


Ghost shiner

The ghost shiner was not recorded during 1974-86. Therefore no information appears on the distribution map for this species for this period.



Map 50(E)

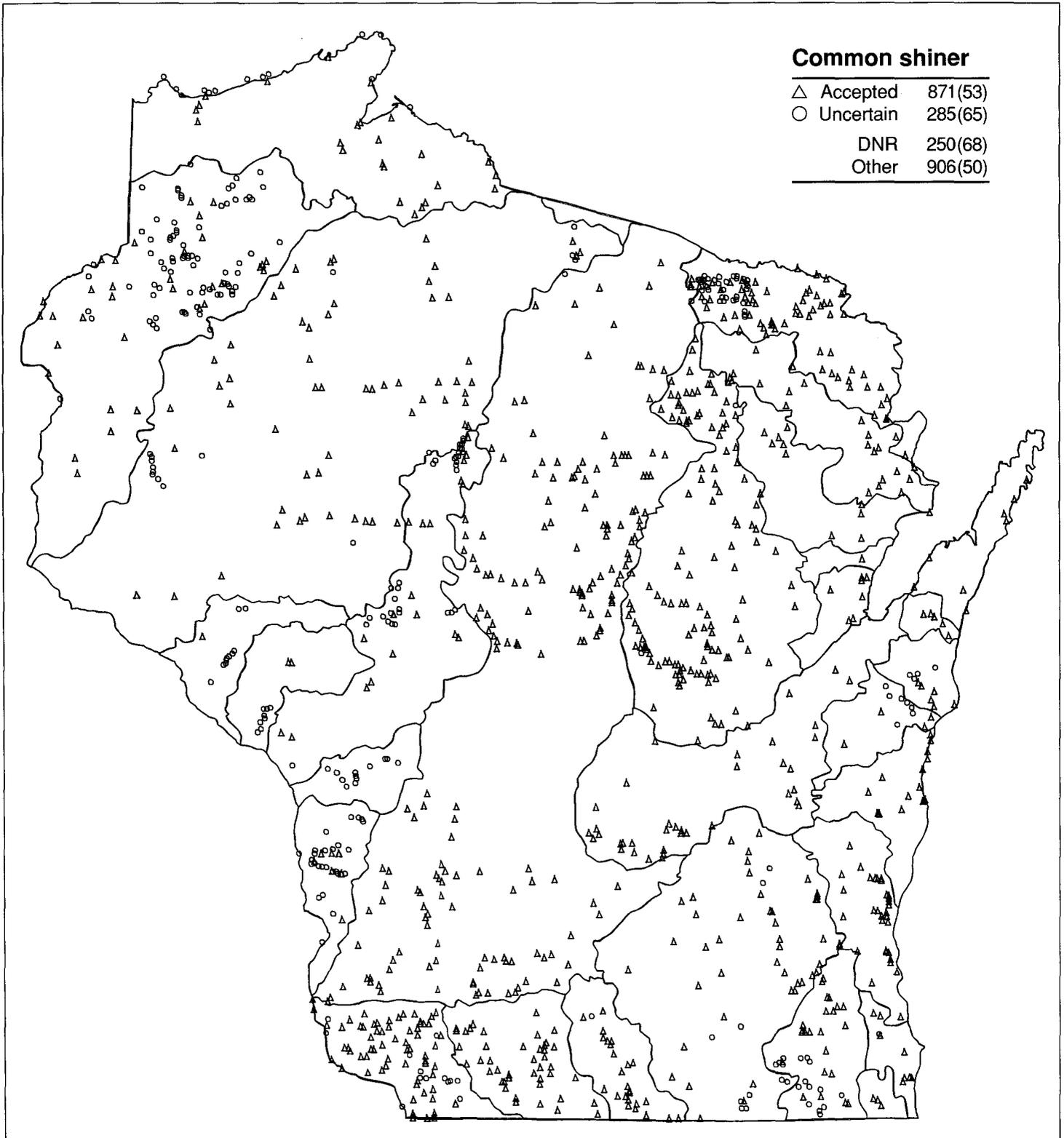


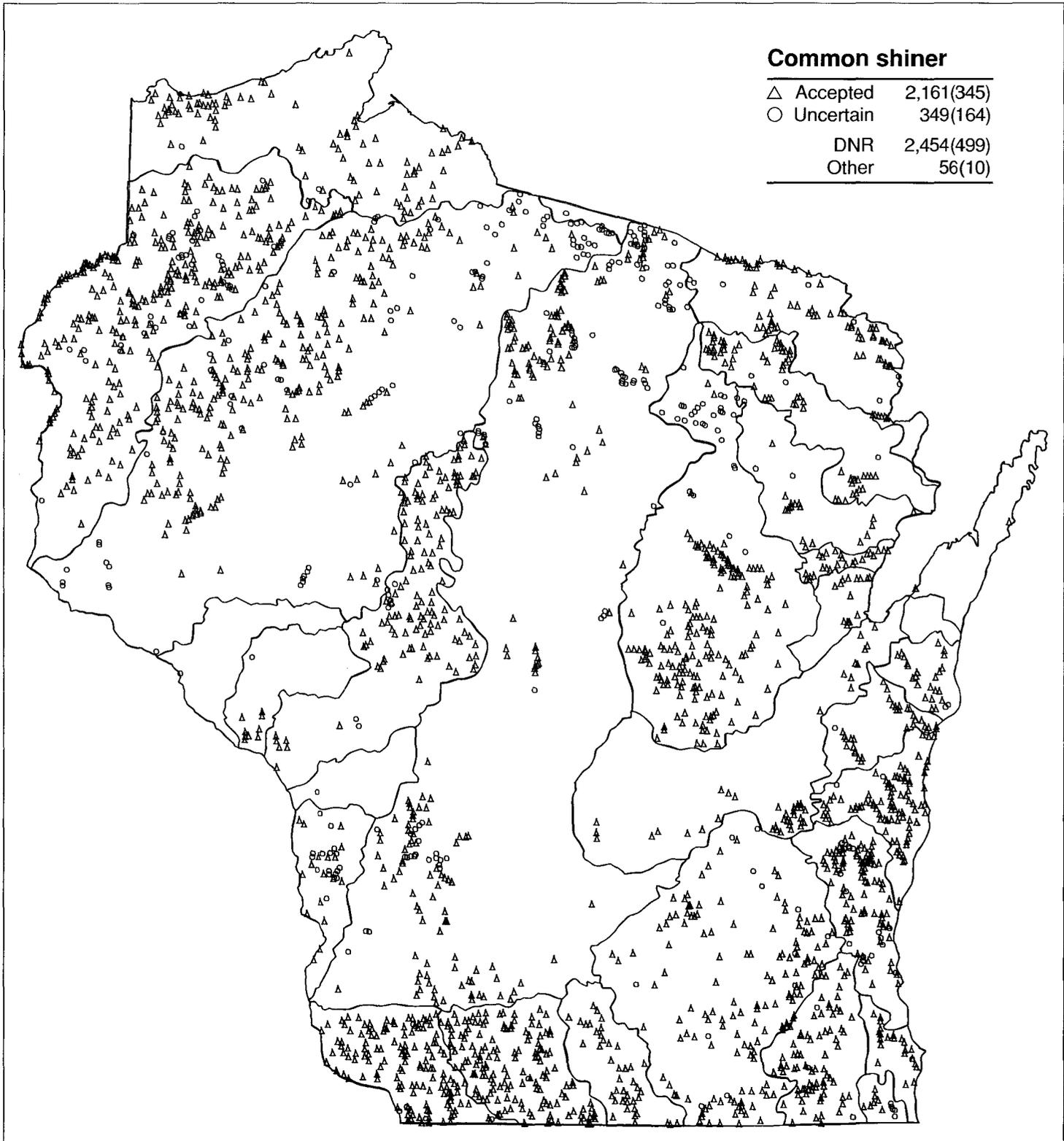
Striped shiner

△	Accepted	13(0)
○	Uncertain	1(1)
	DNR	14(1)
	Other	-

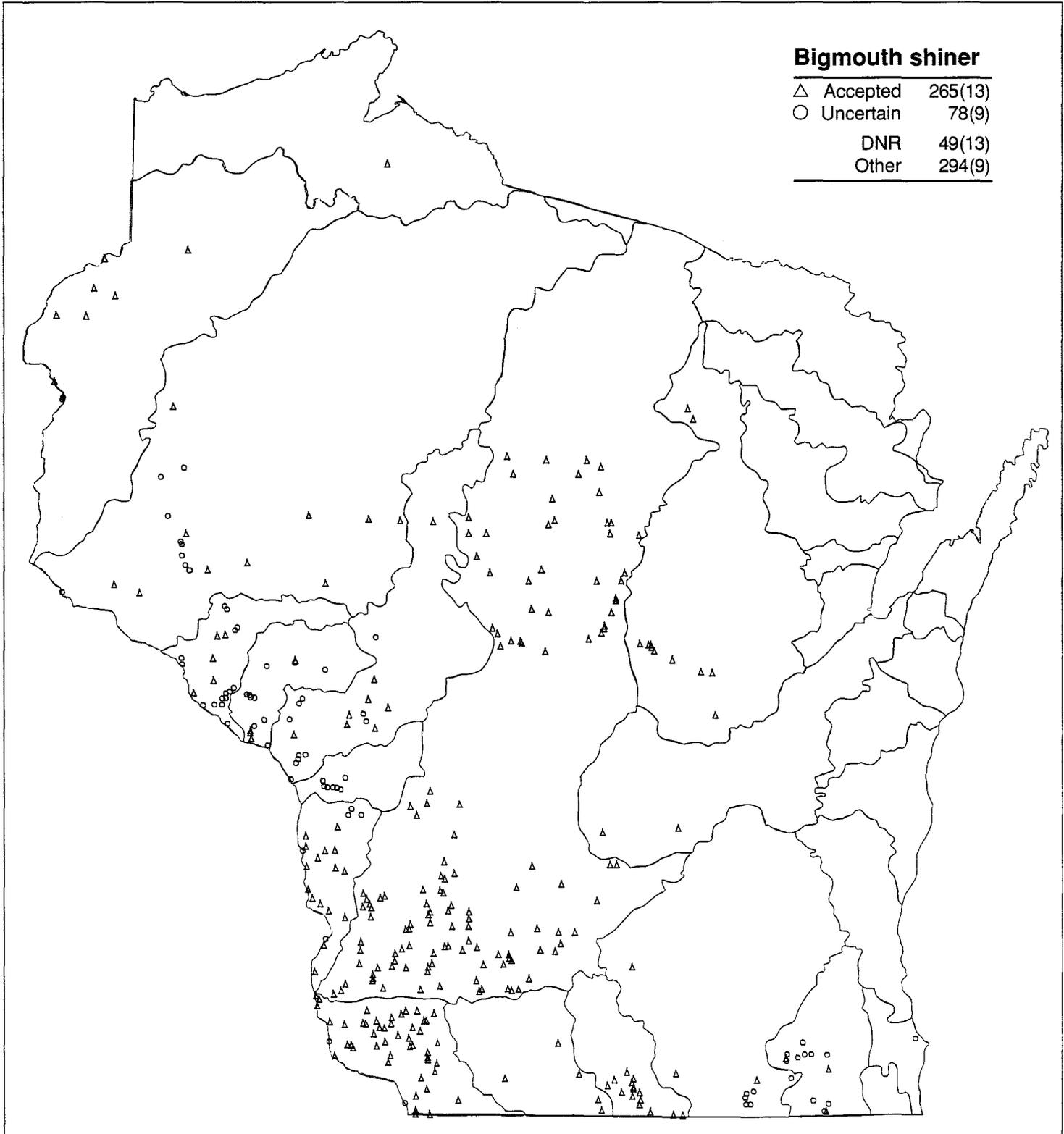


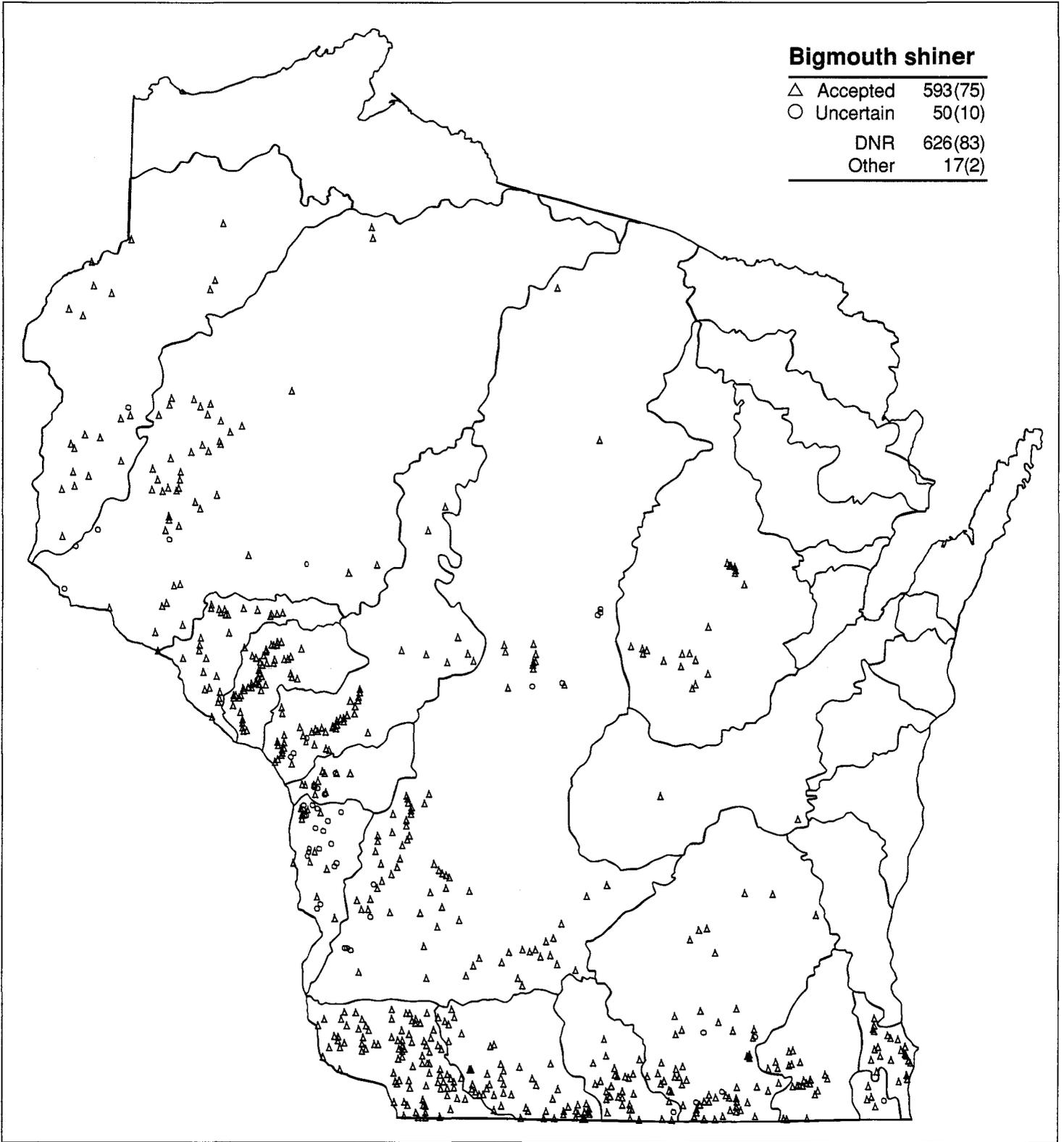
Map 51(E)



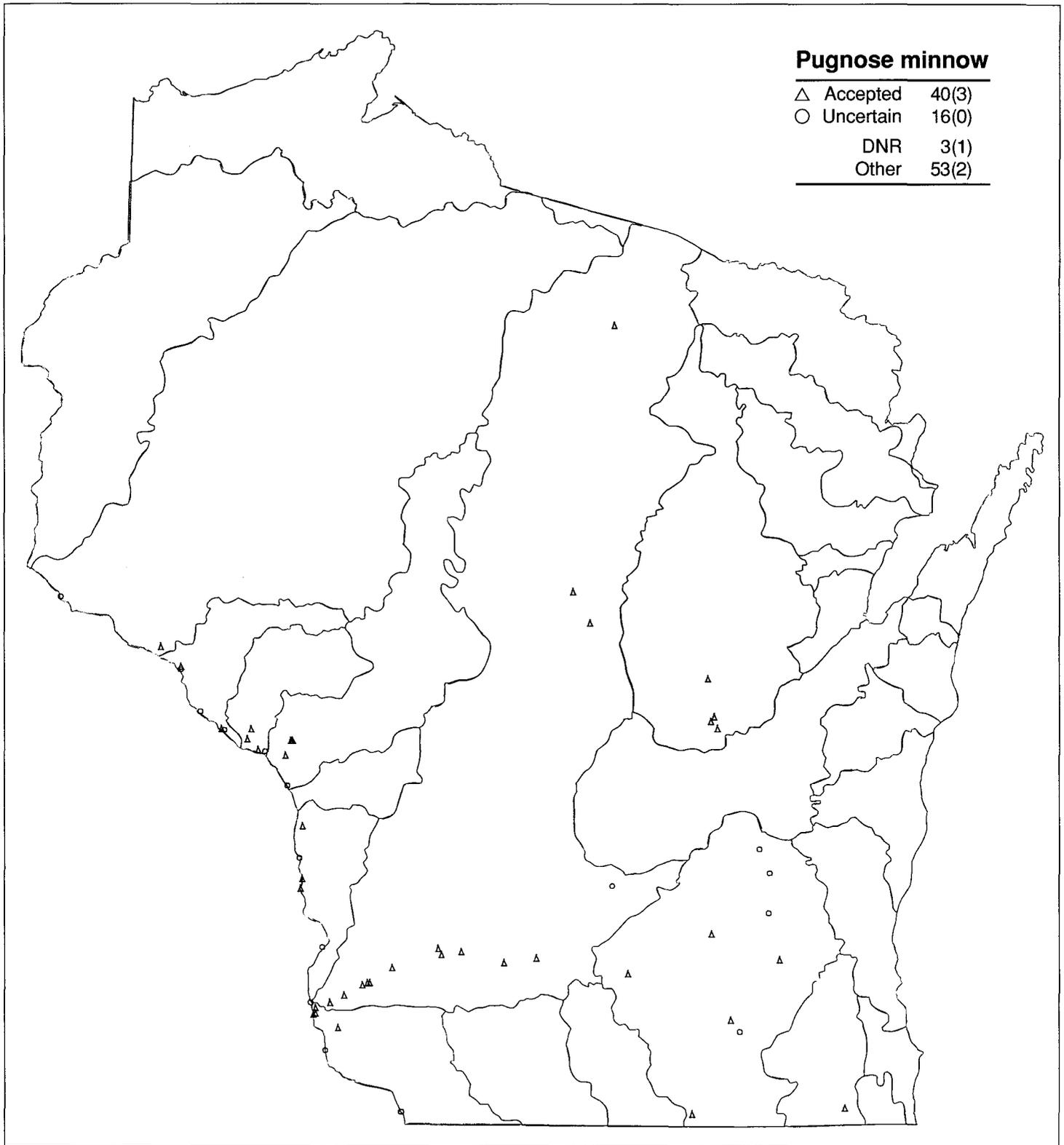


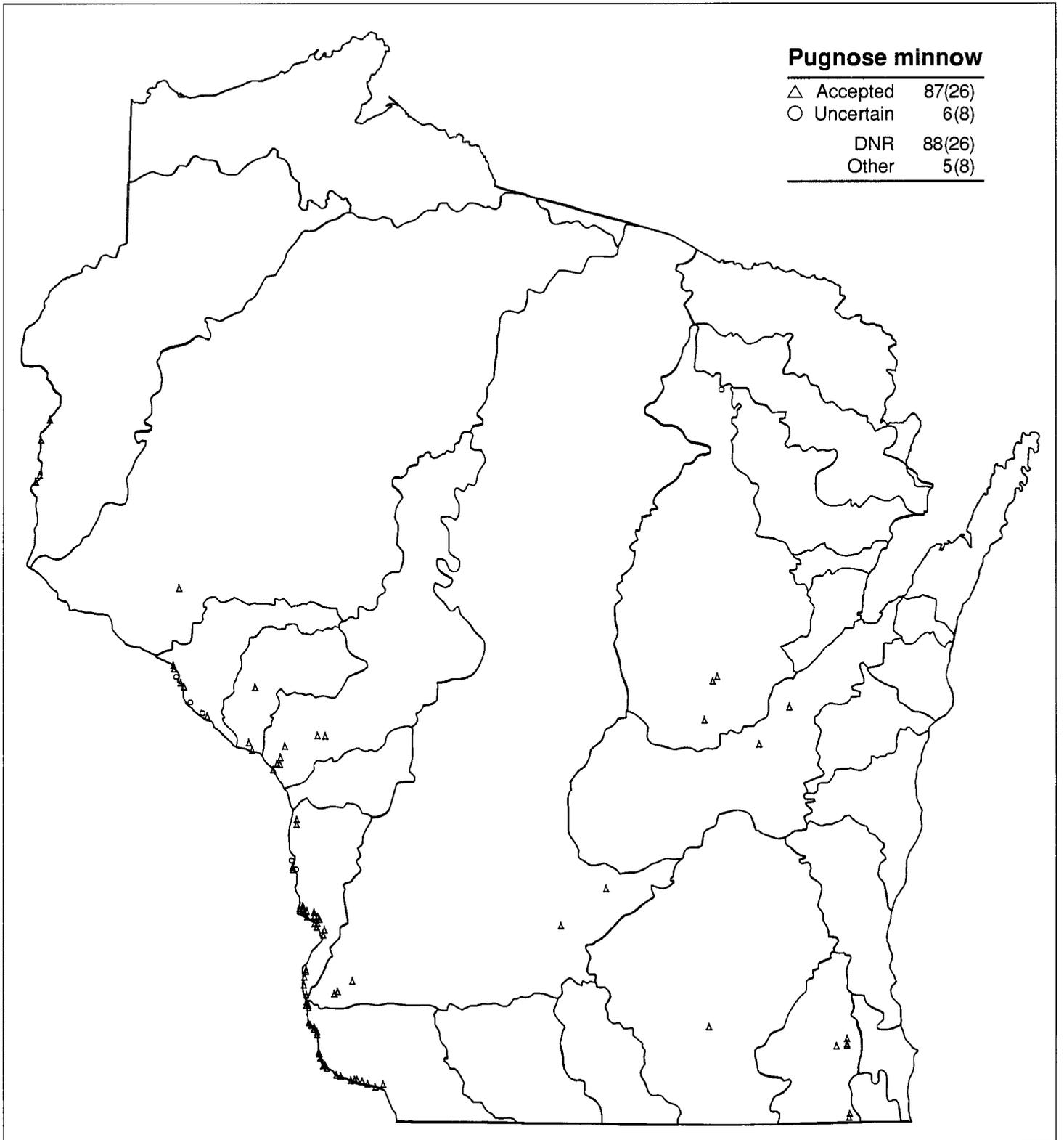
Map 52(E)





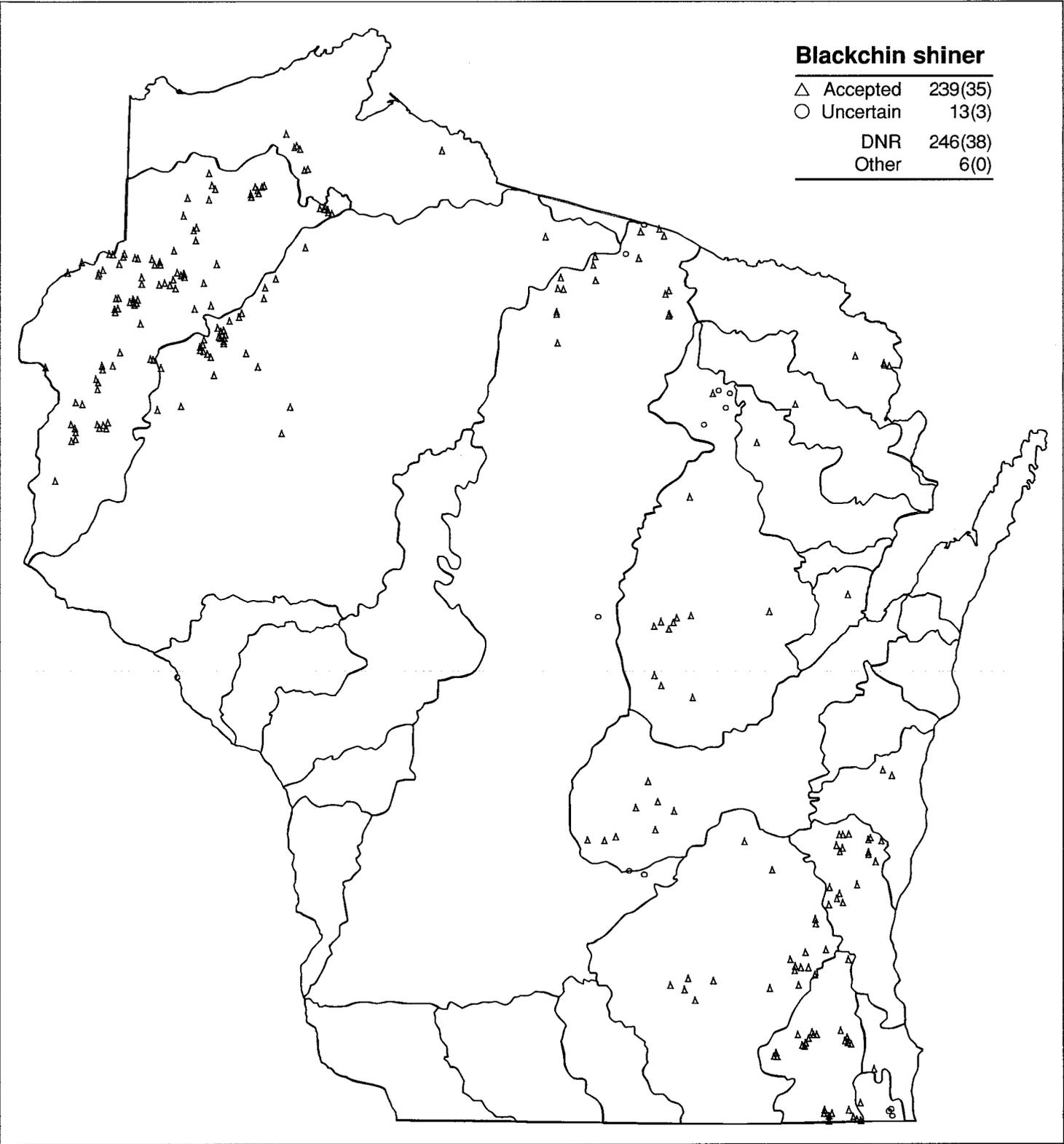
Map 53(E)



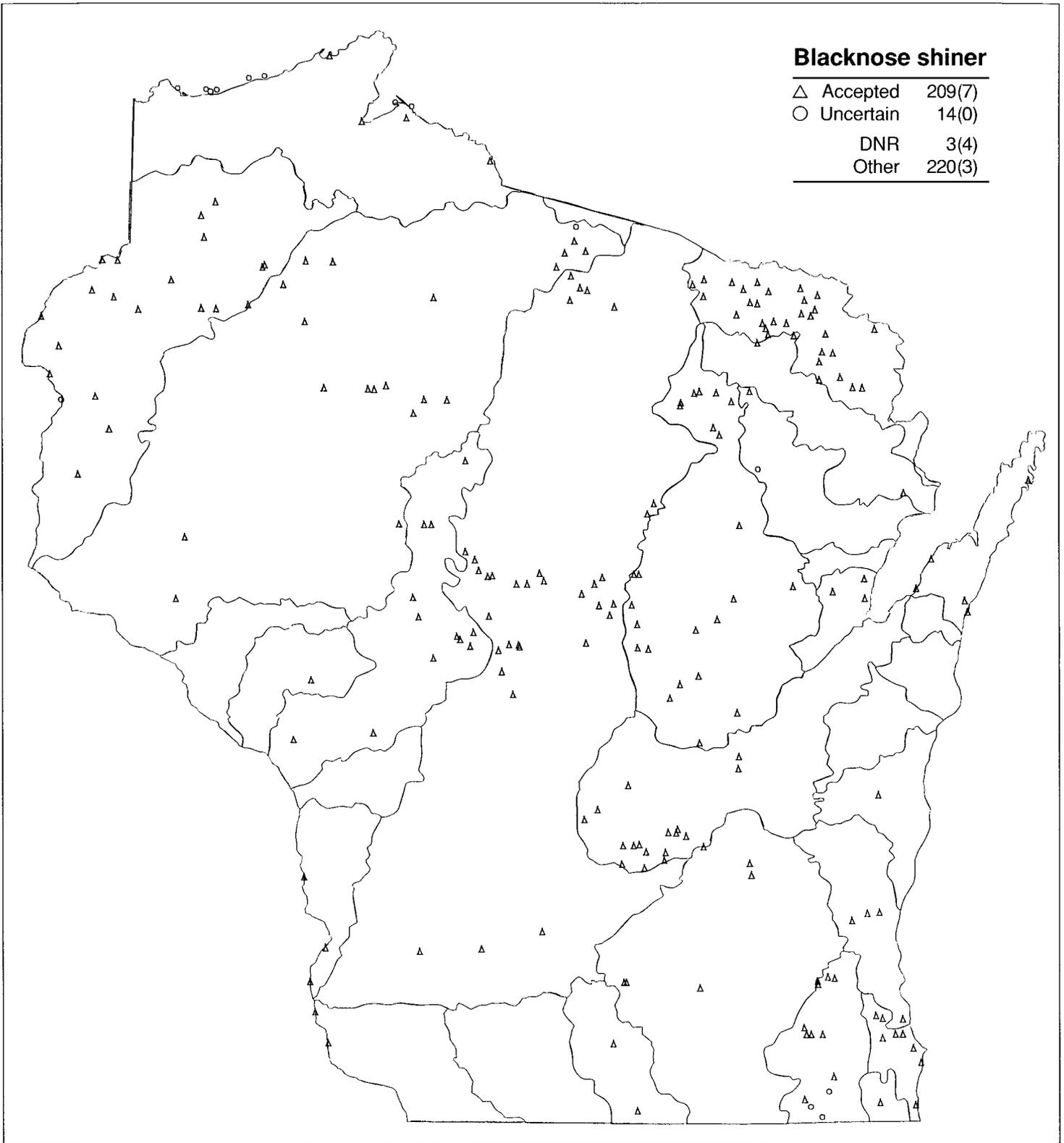


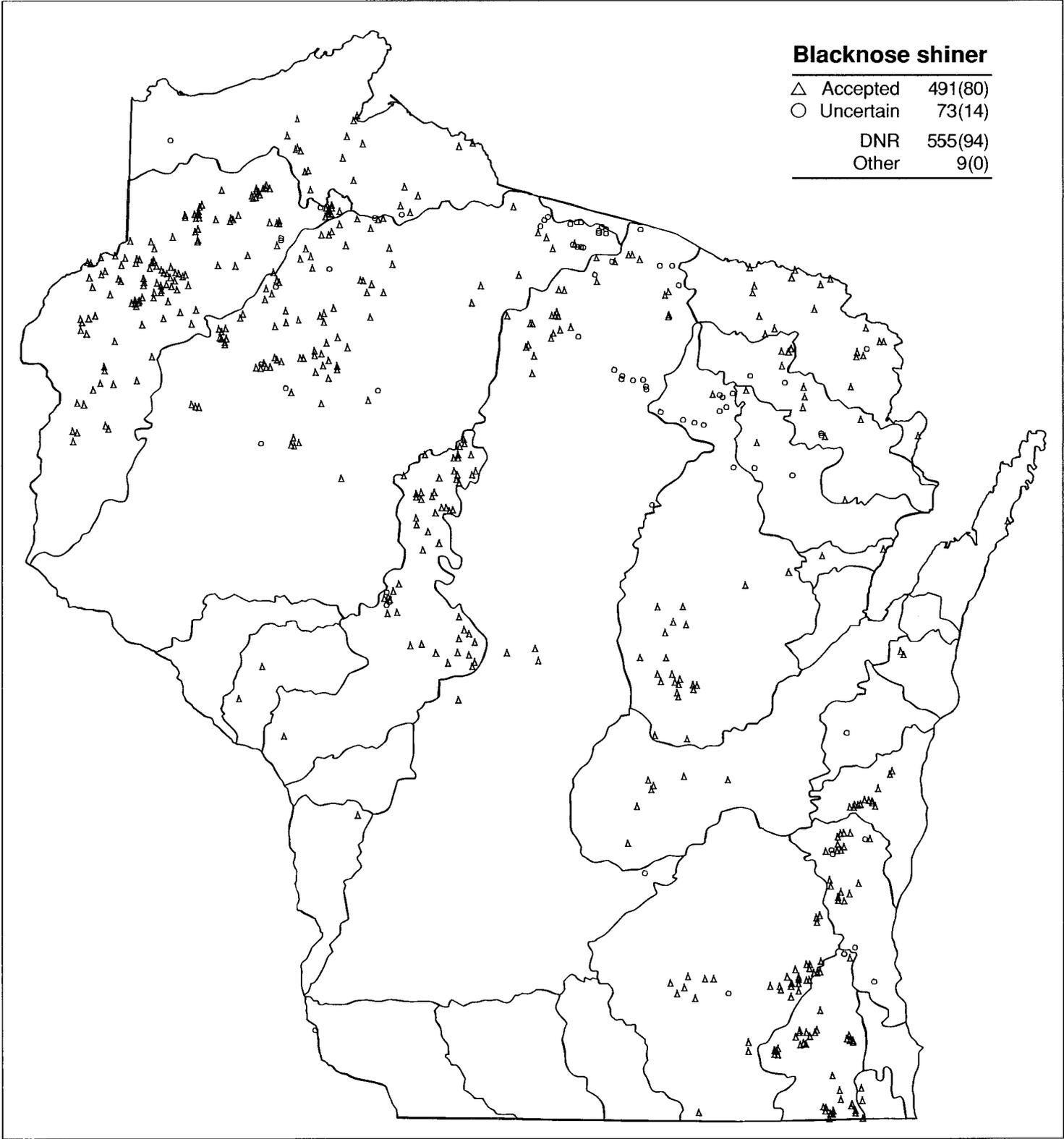
Map 54(E)



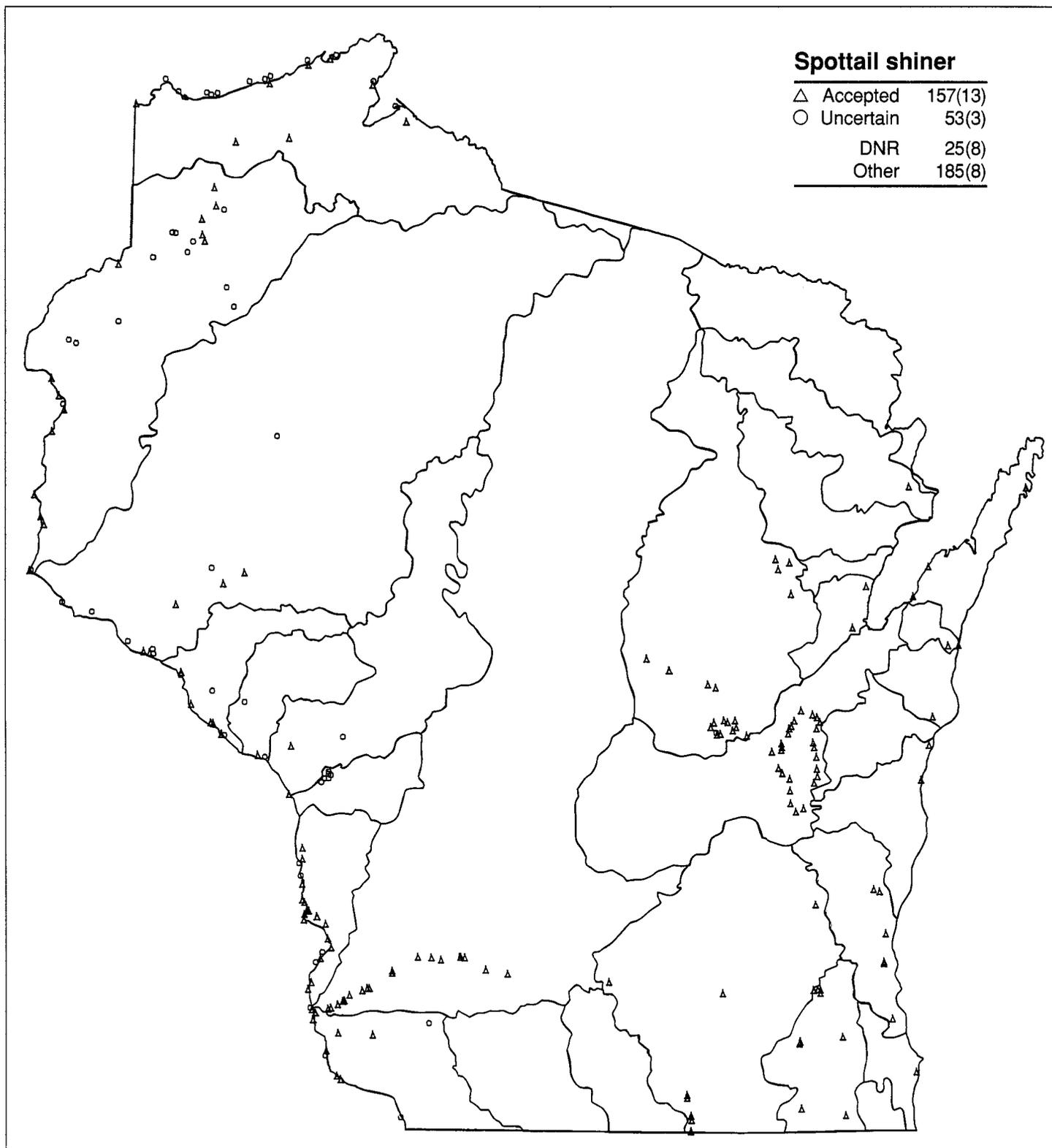


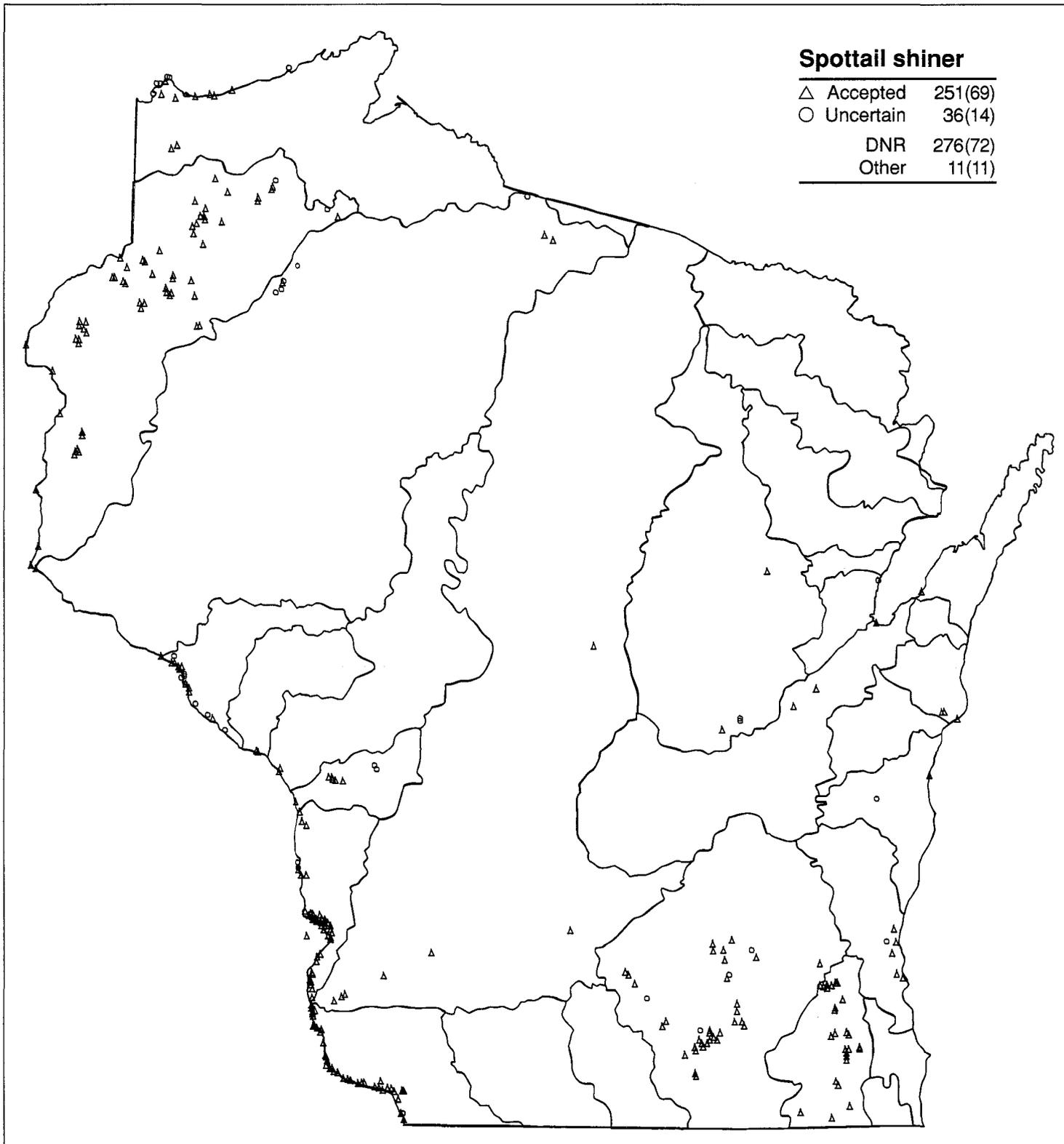
Map 55(E)



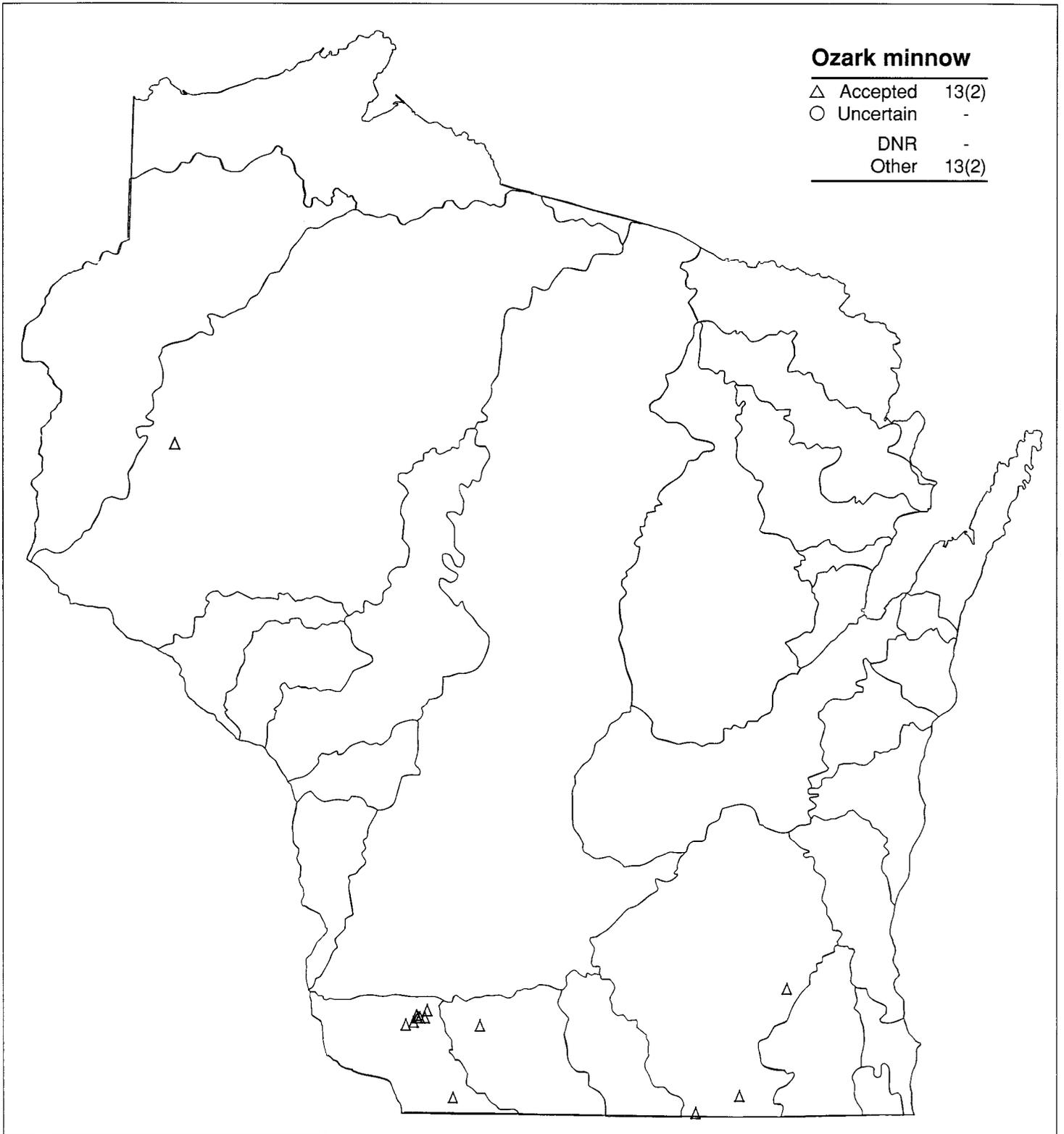


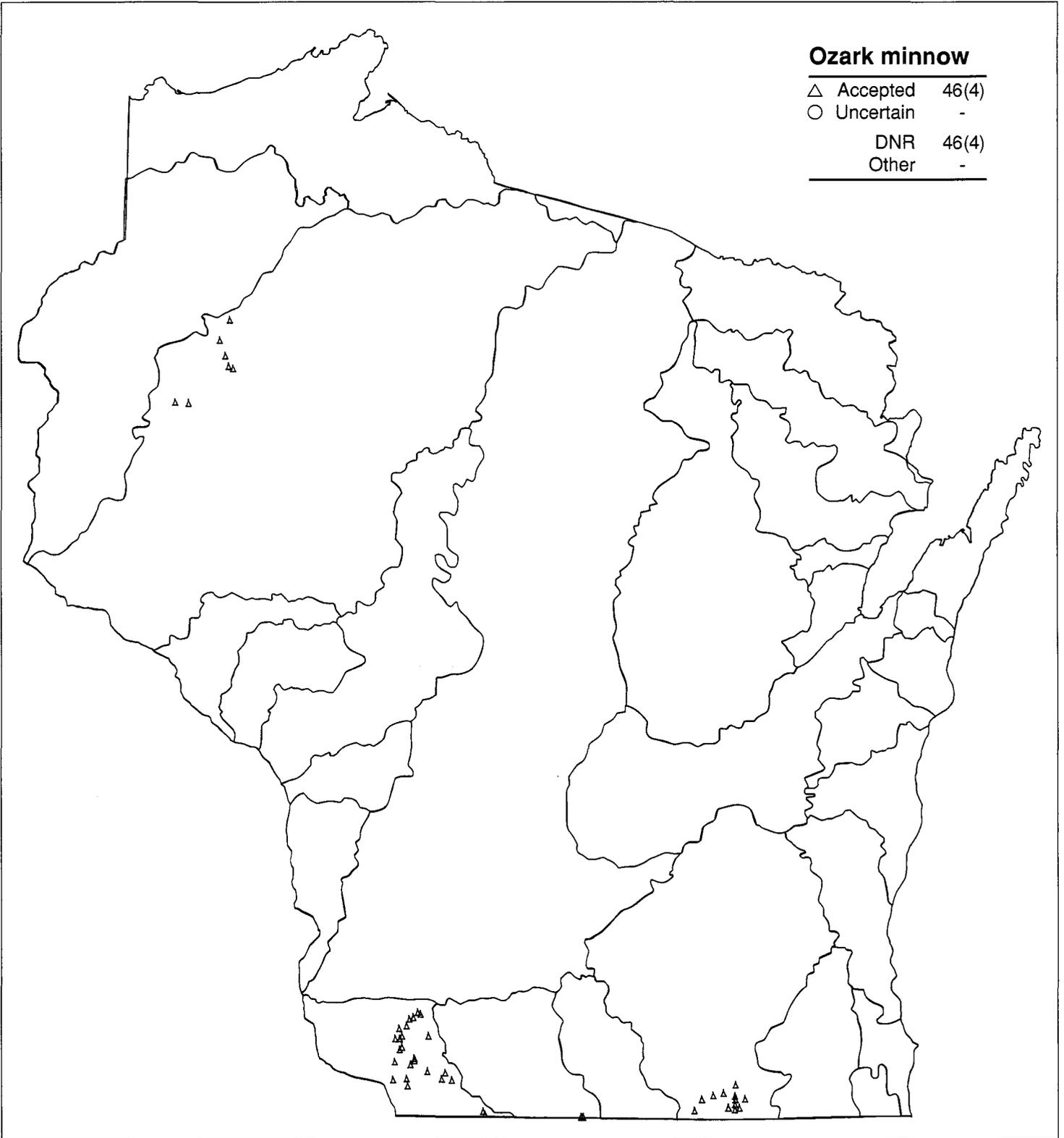
Map 56(E)



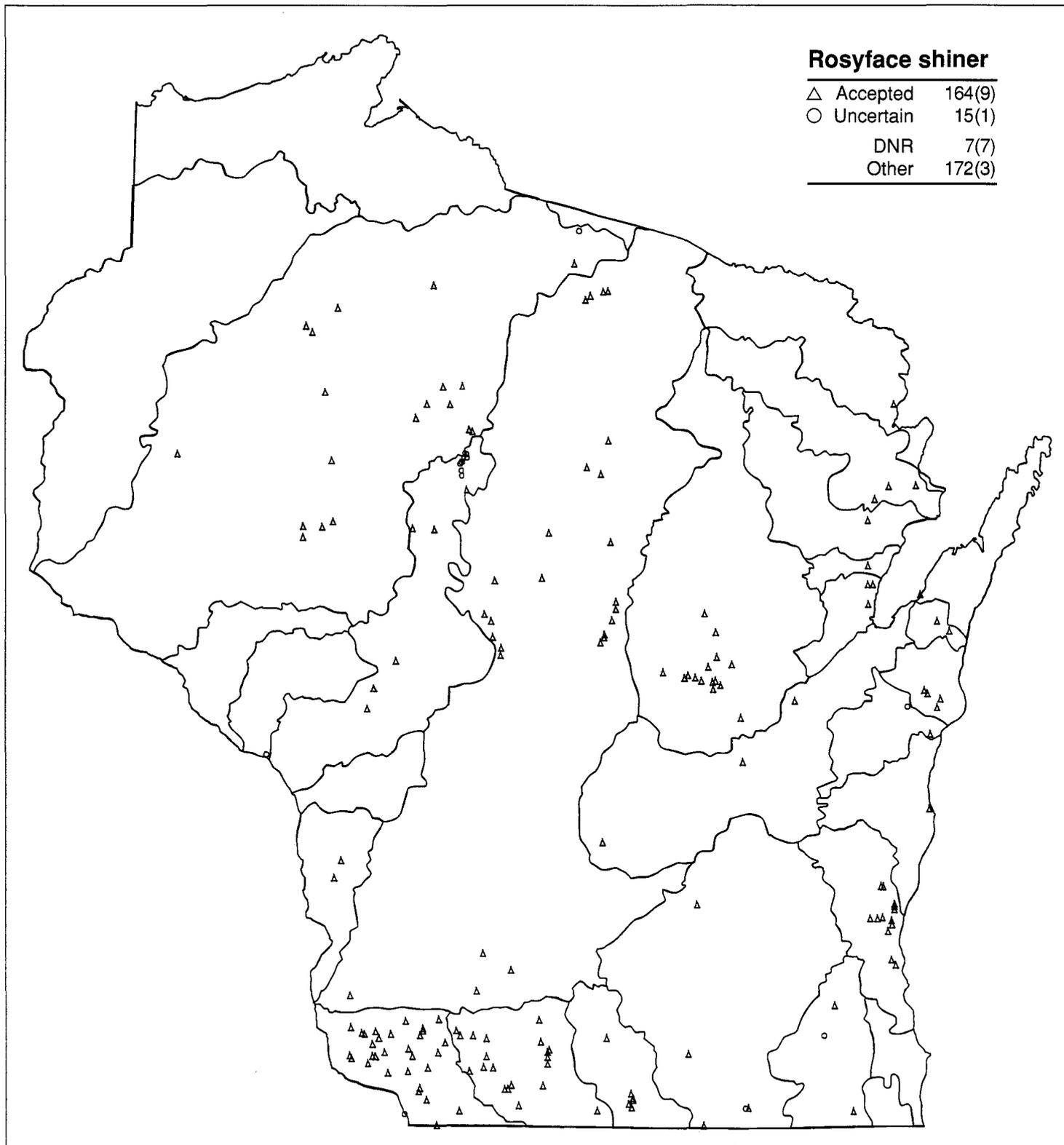


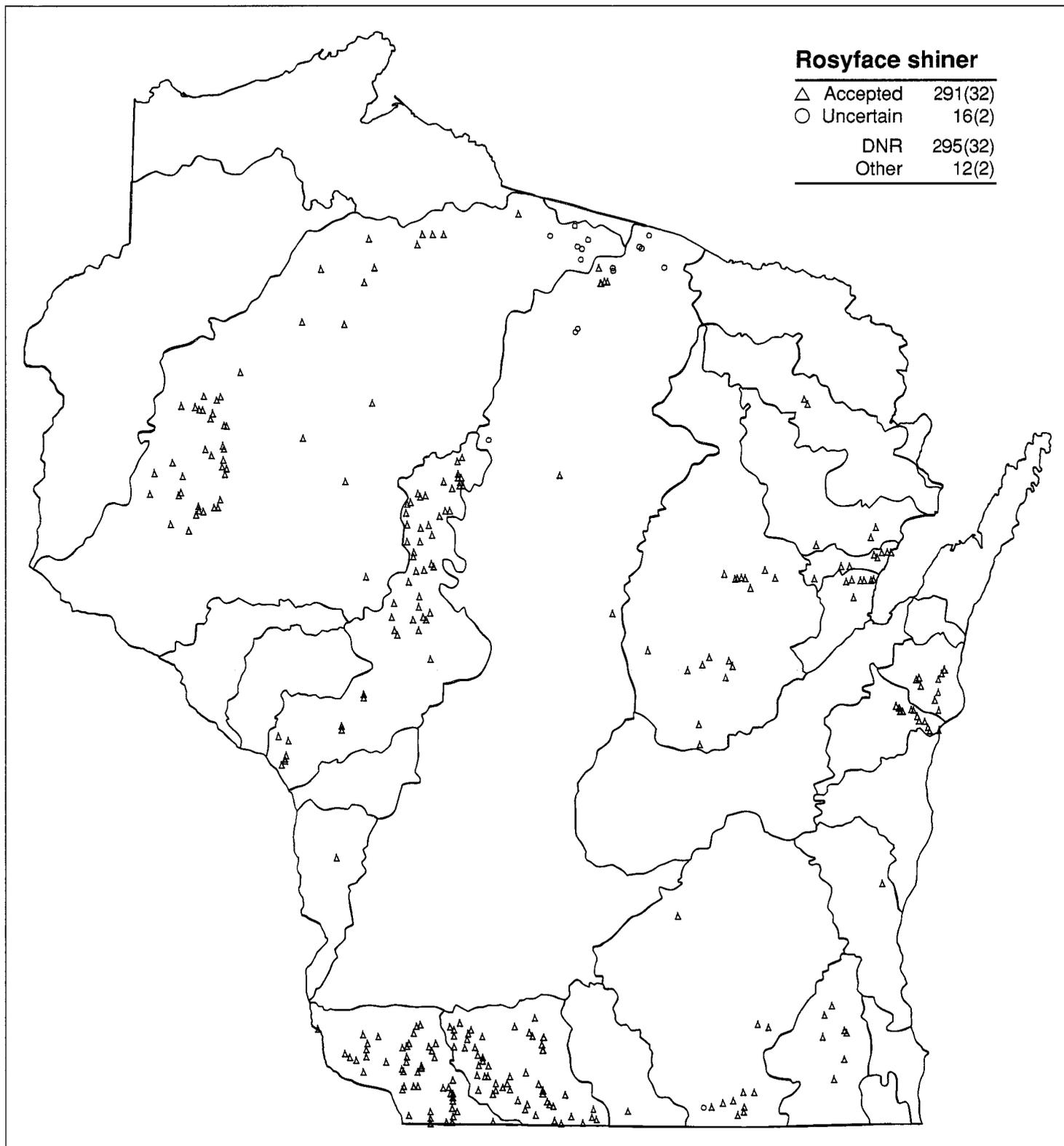
Map 57(E)



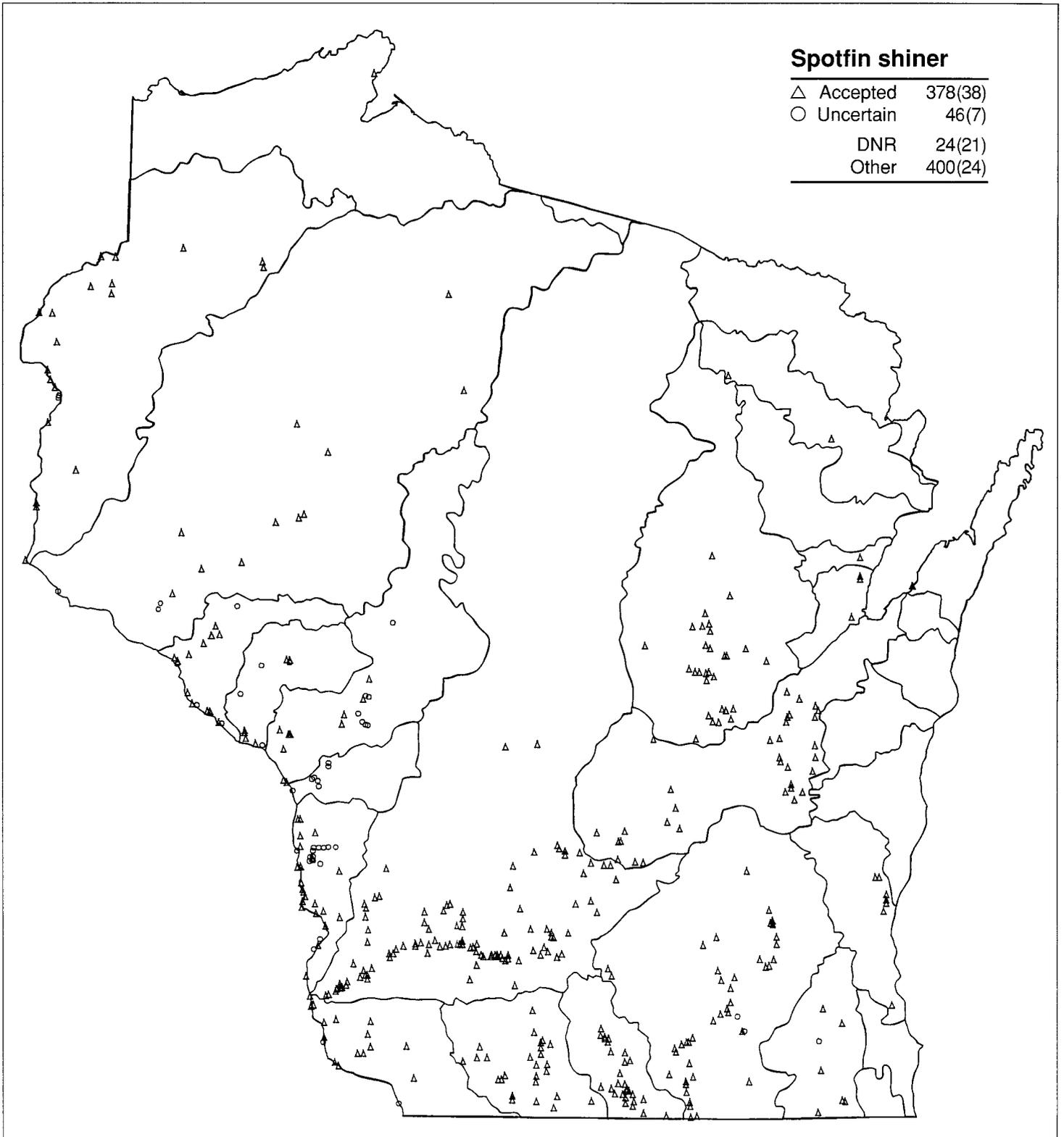


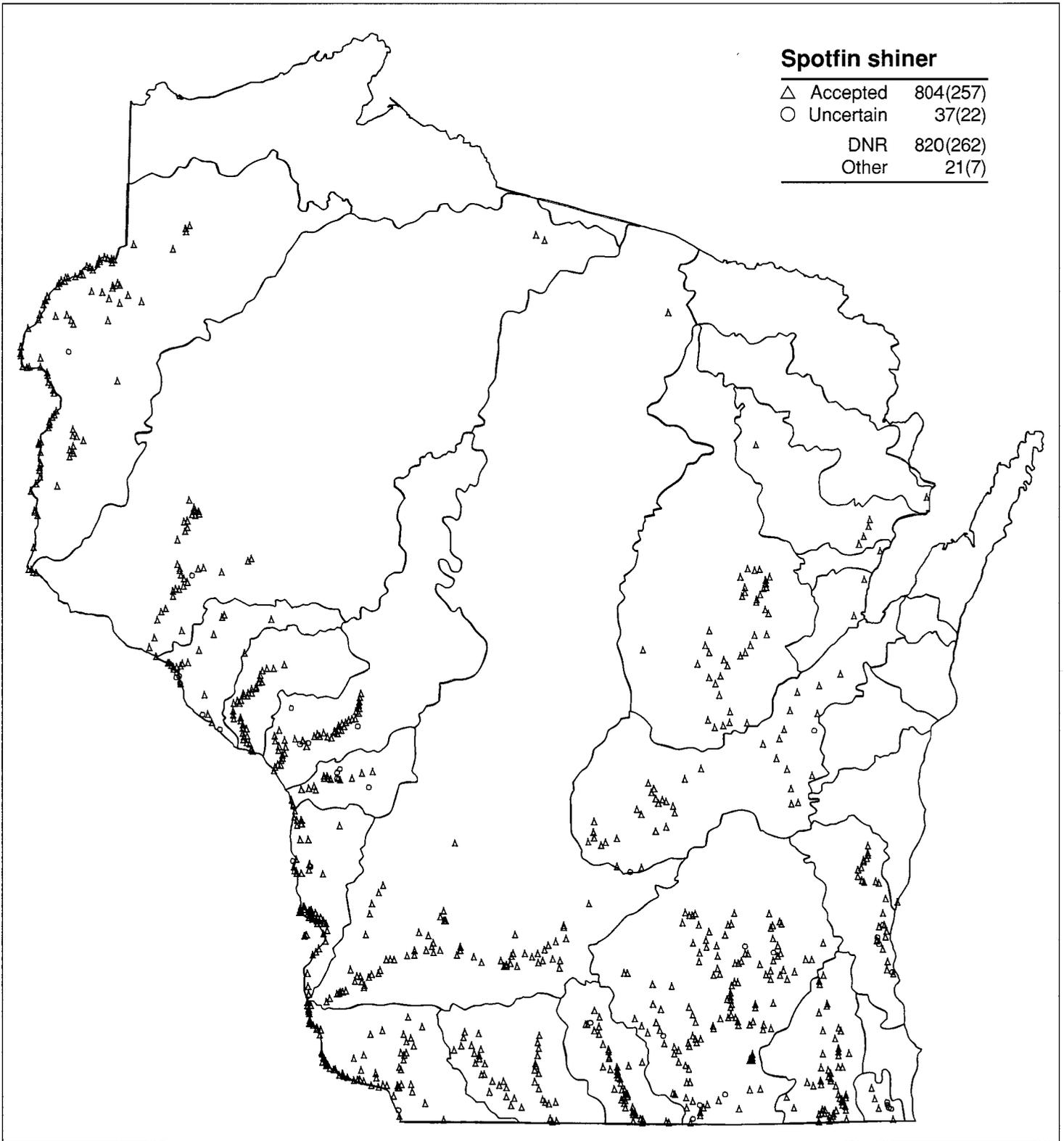
Map 58(E)



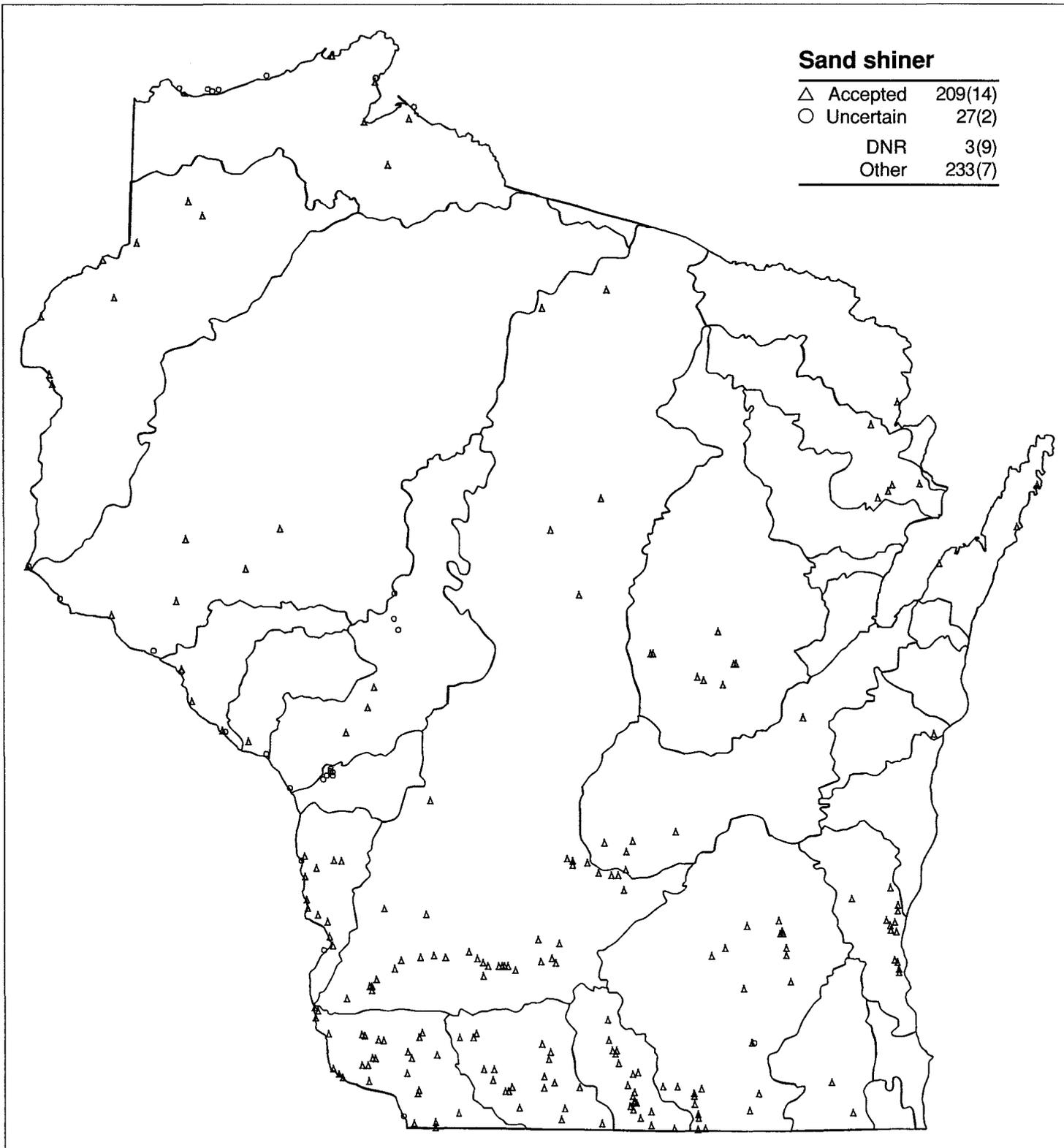


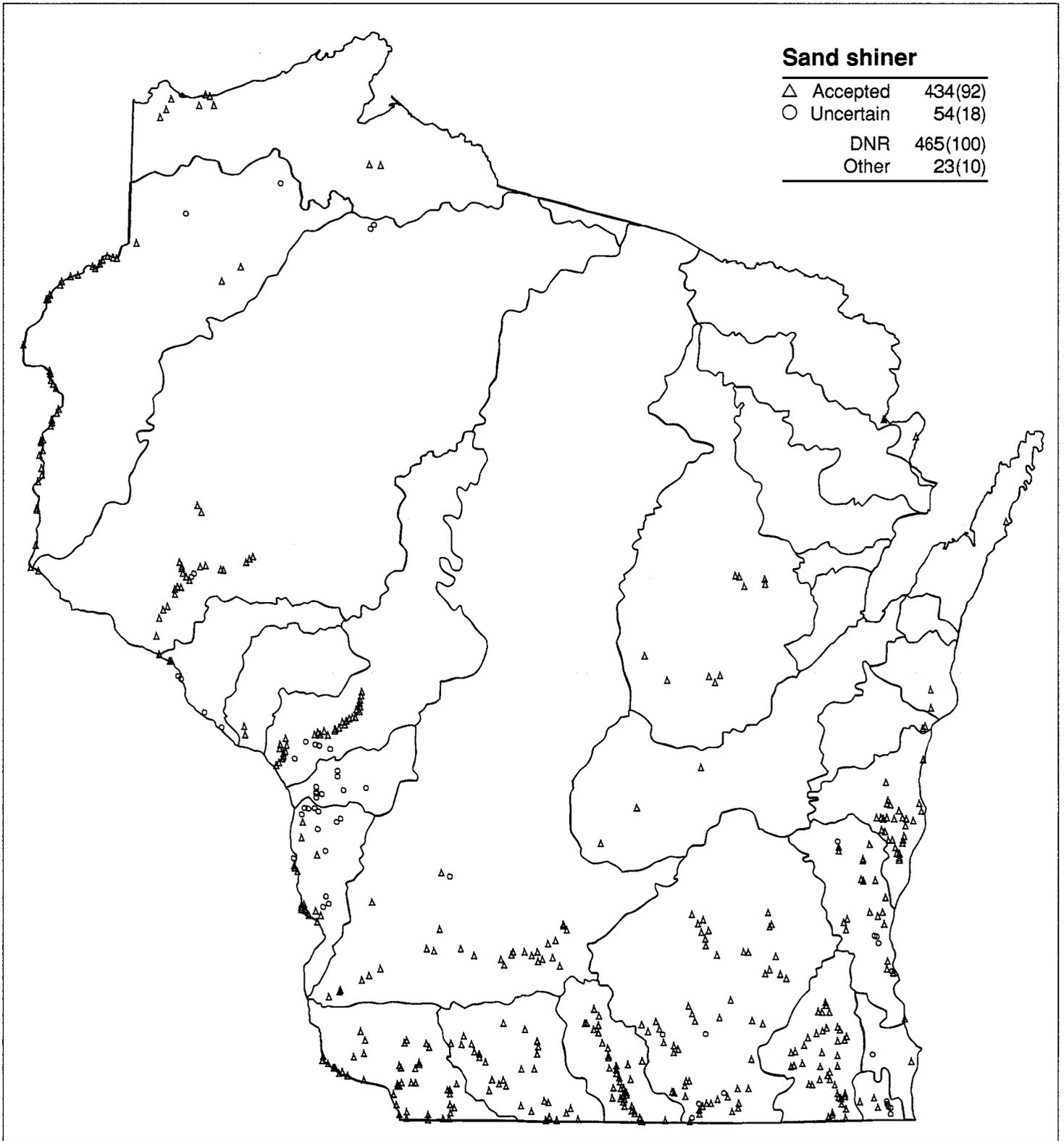
Map 59(E)



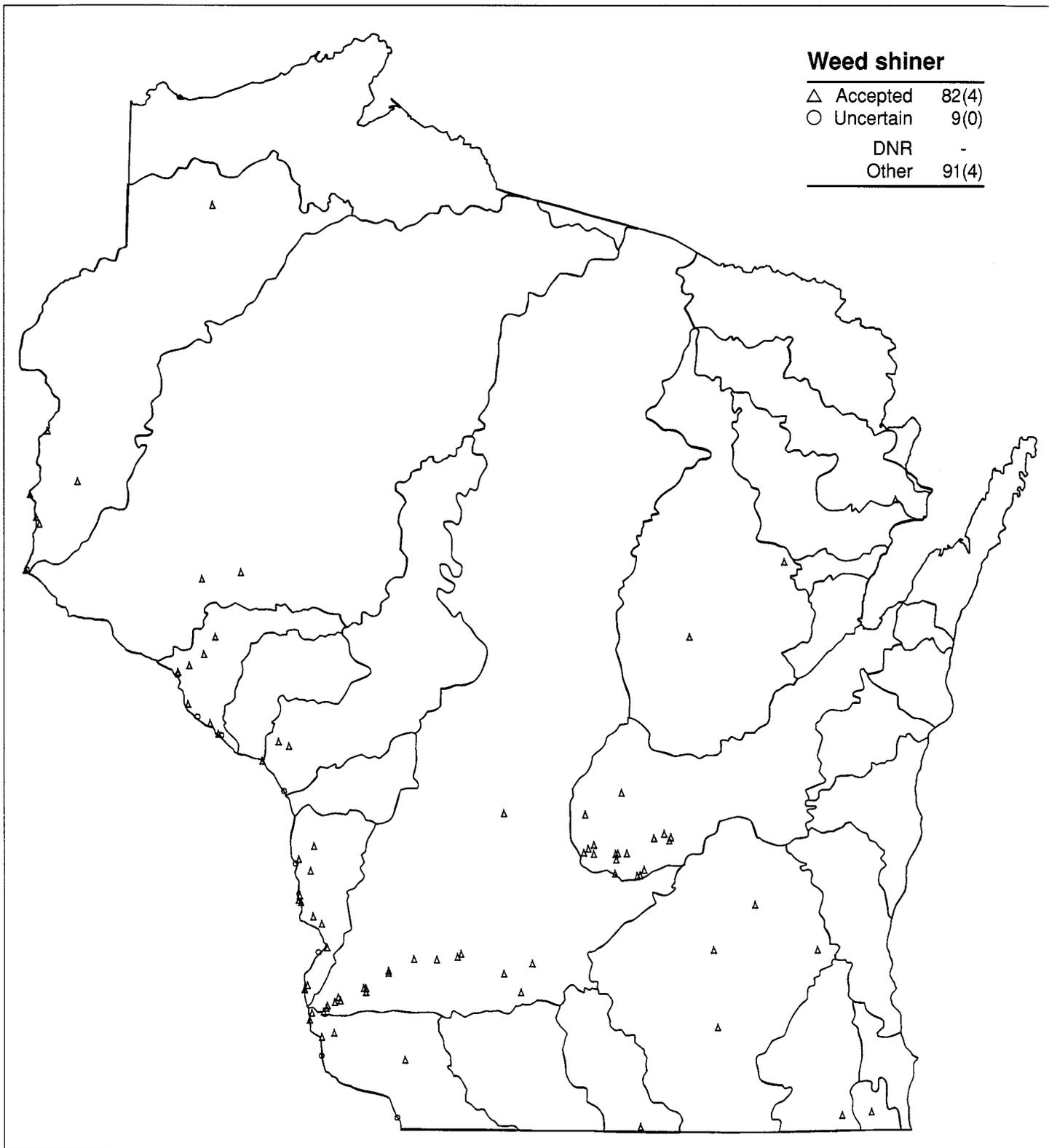


Map 60(E)

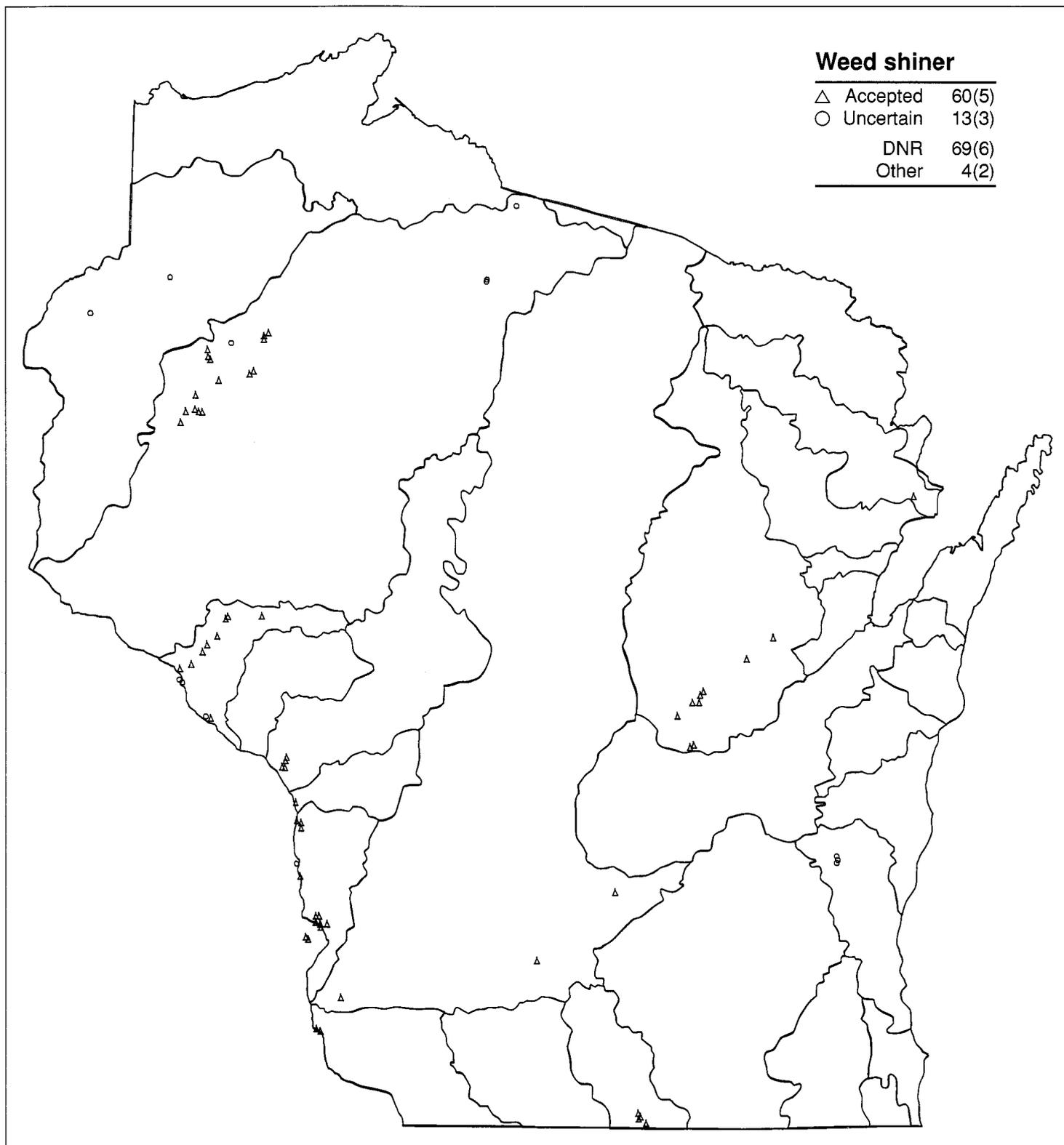




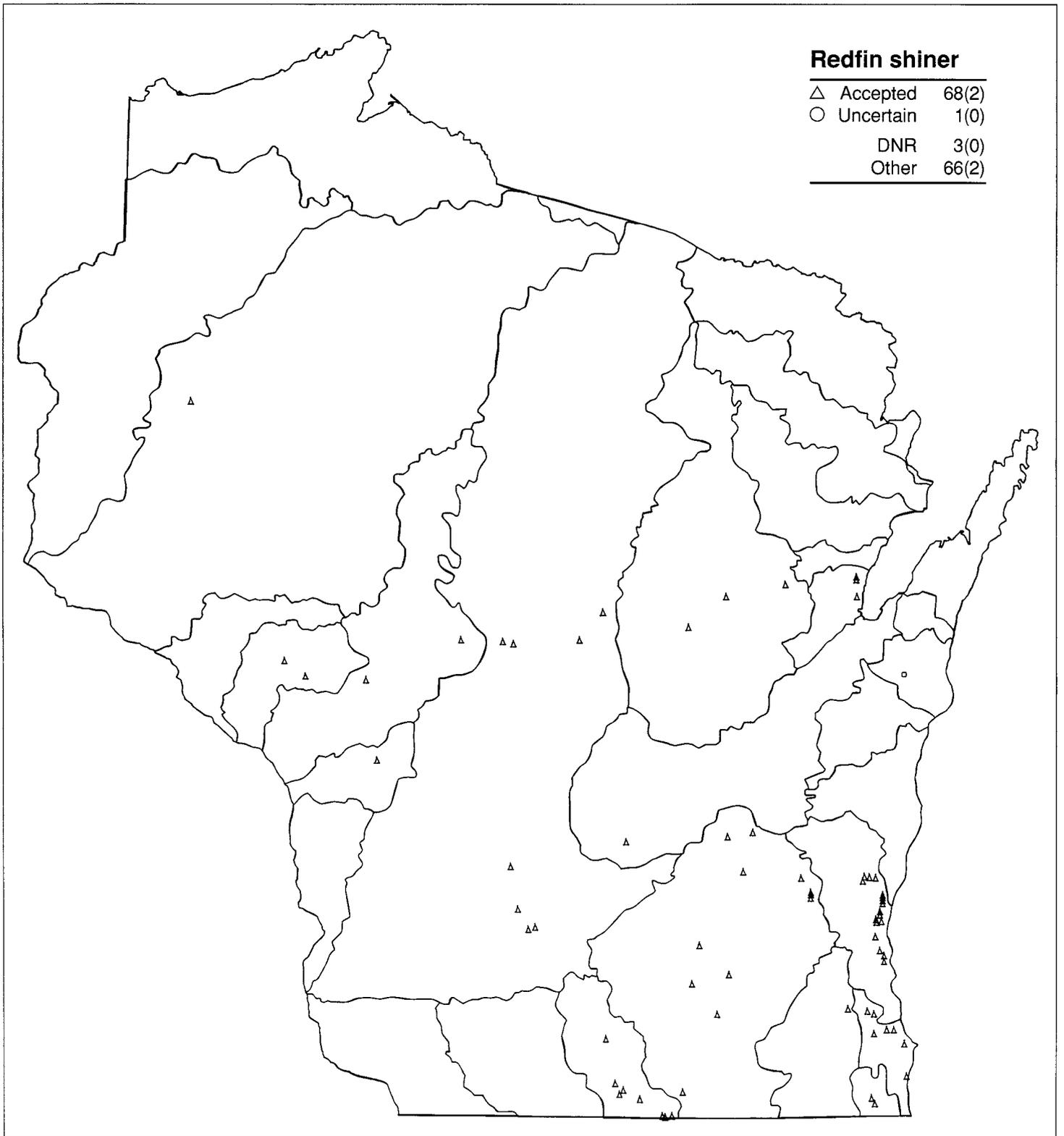
Map 61(E)

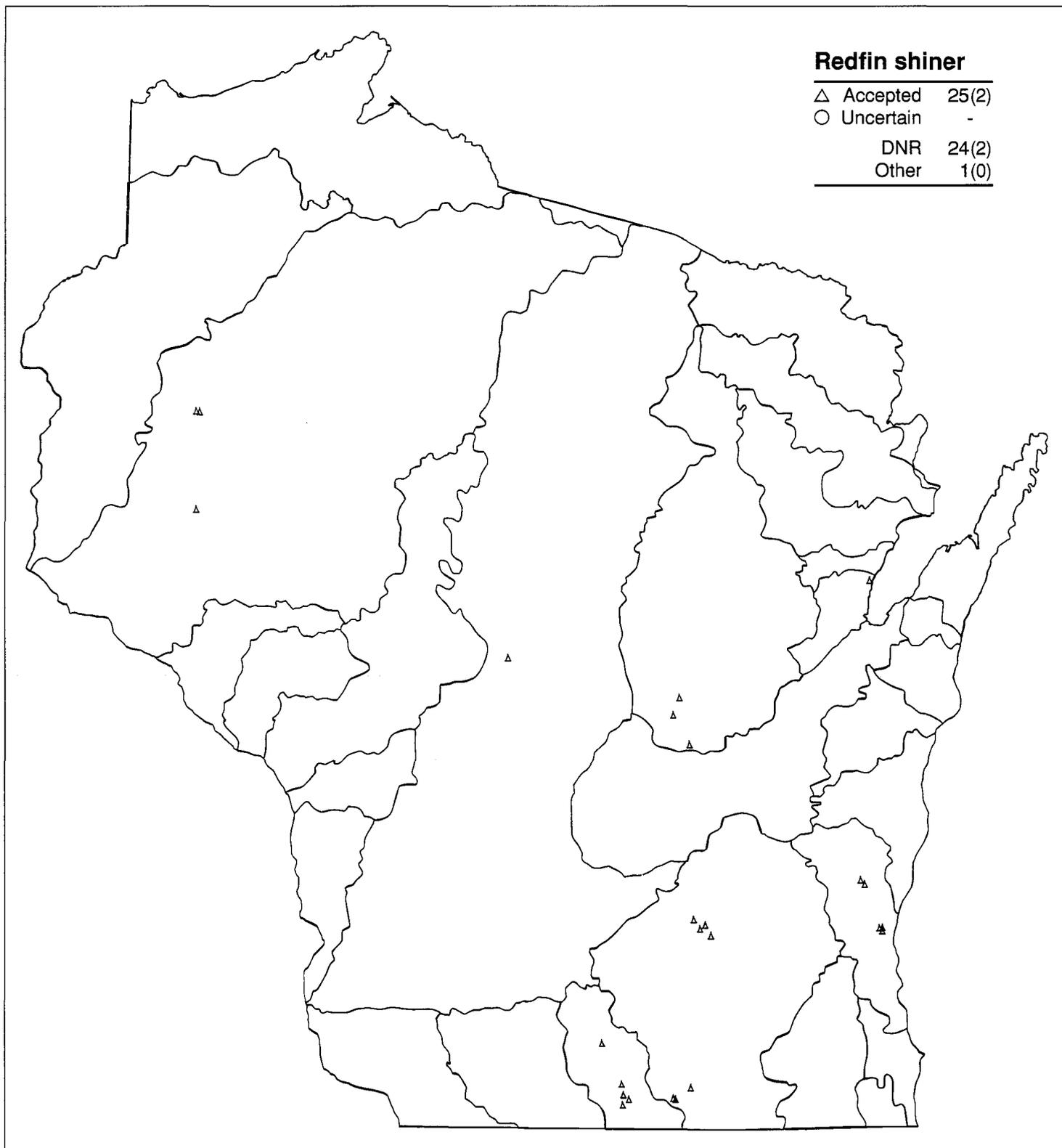


Map 61(L)

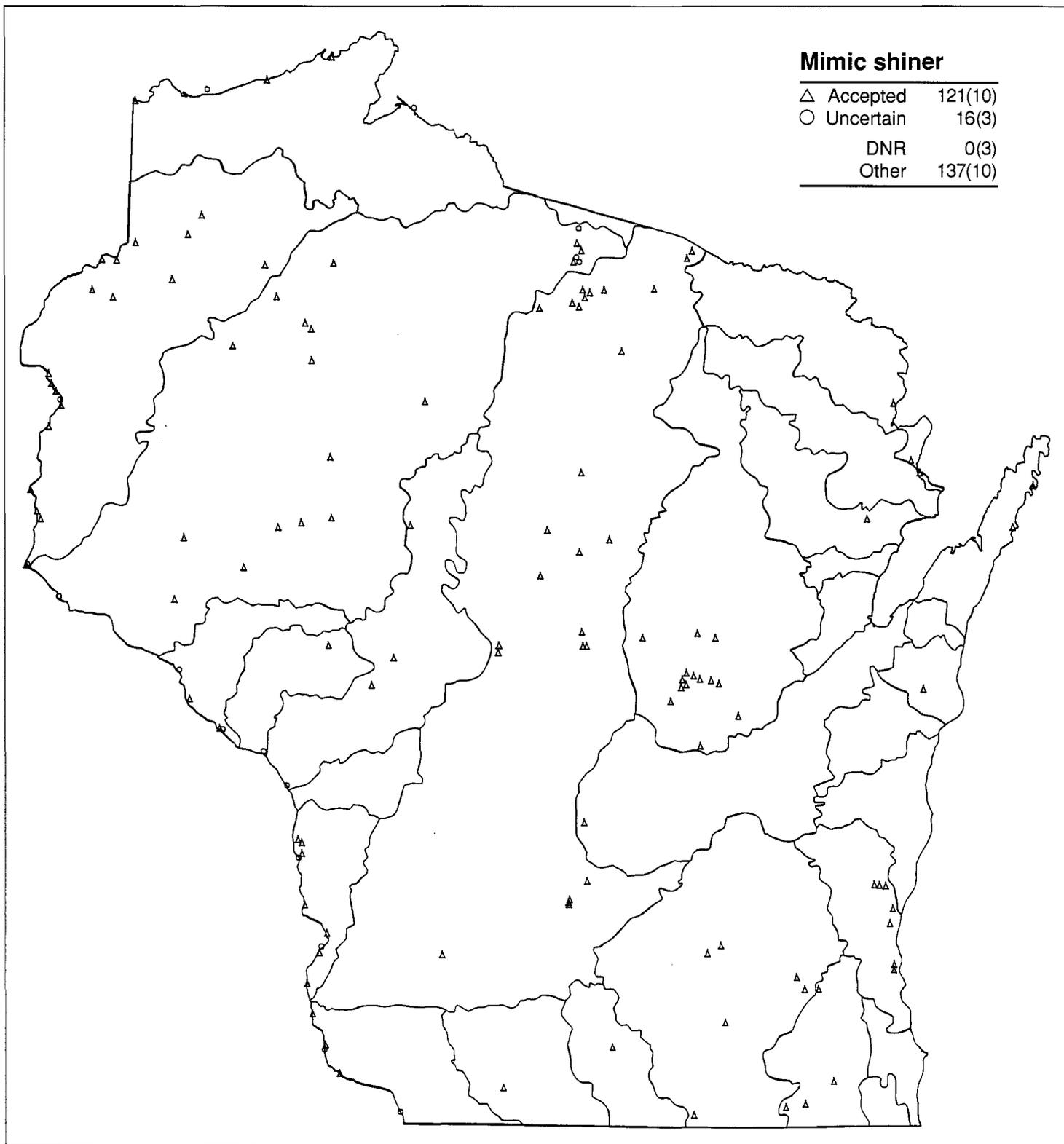


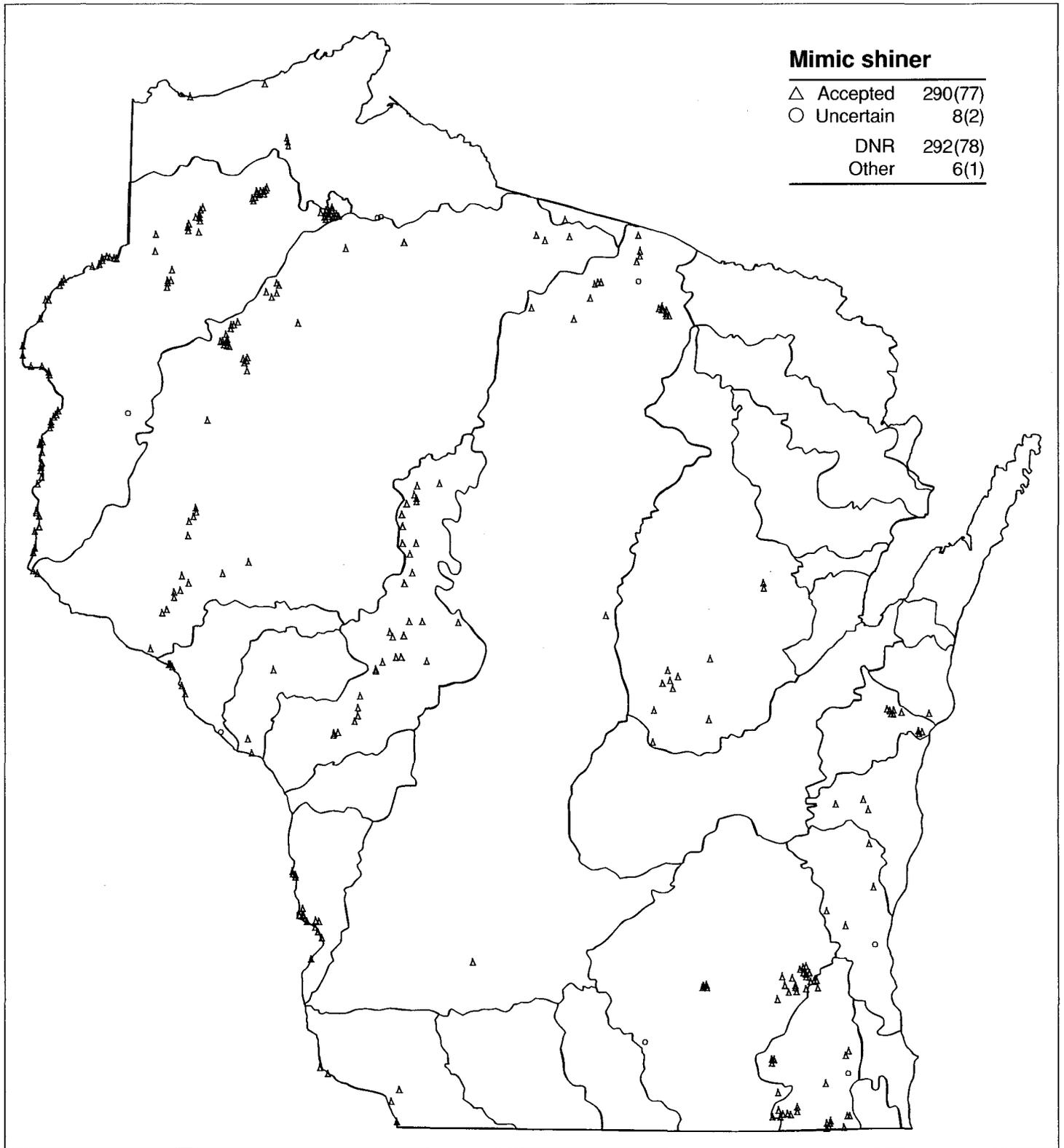
Map 62(E)





Map 63(E)

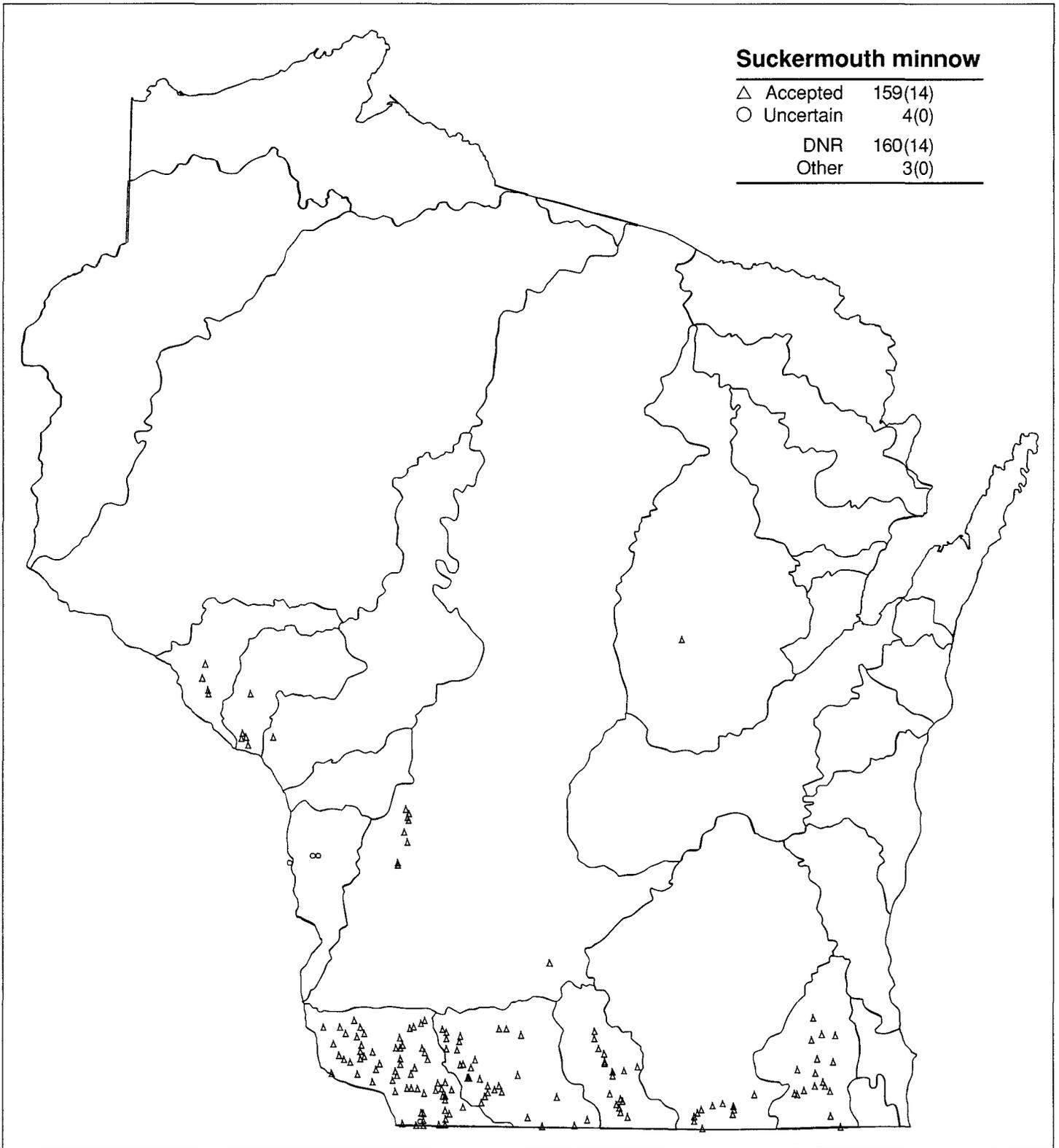




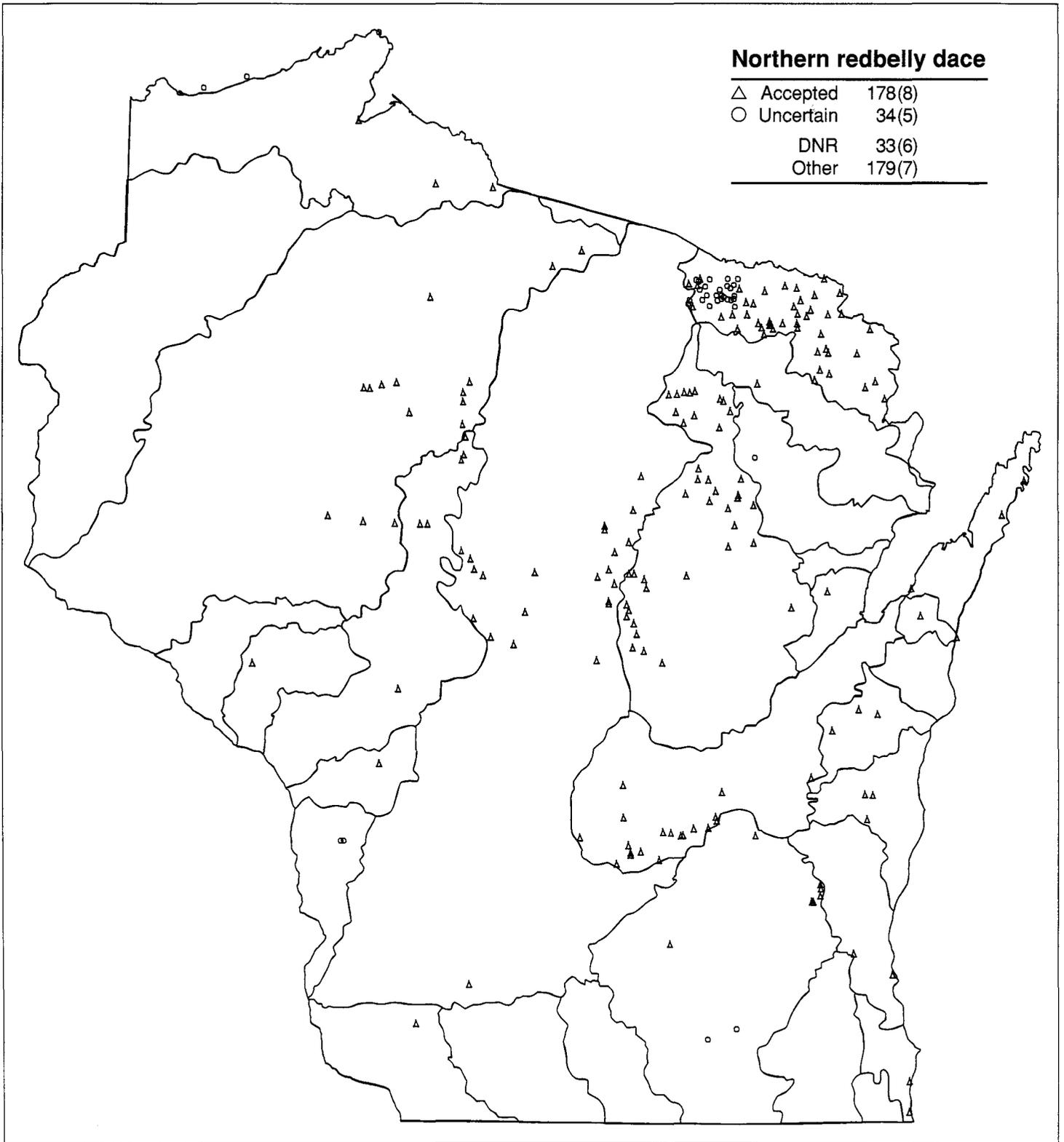
Map 64(E)

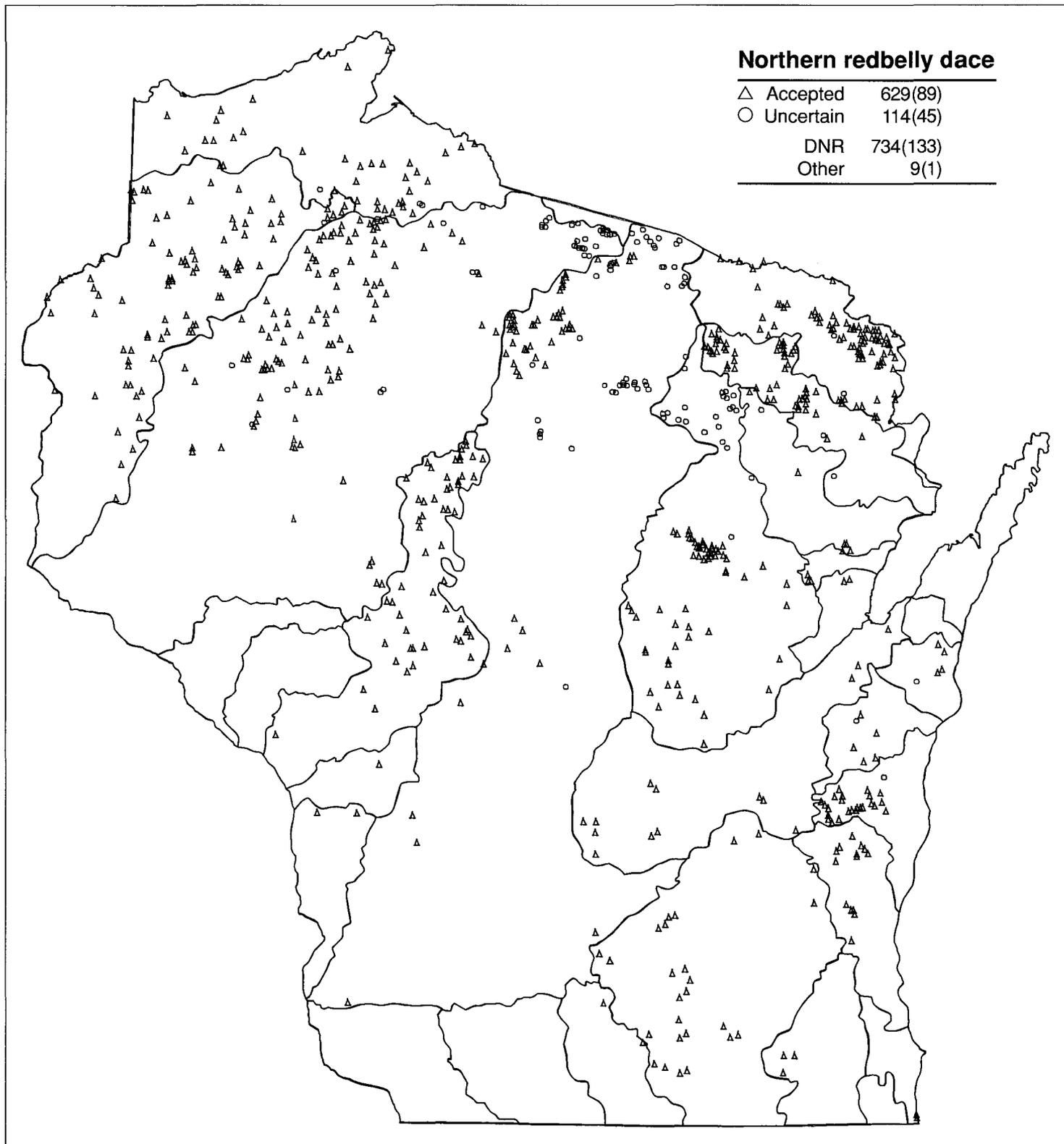


Map 64(L)

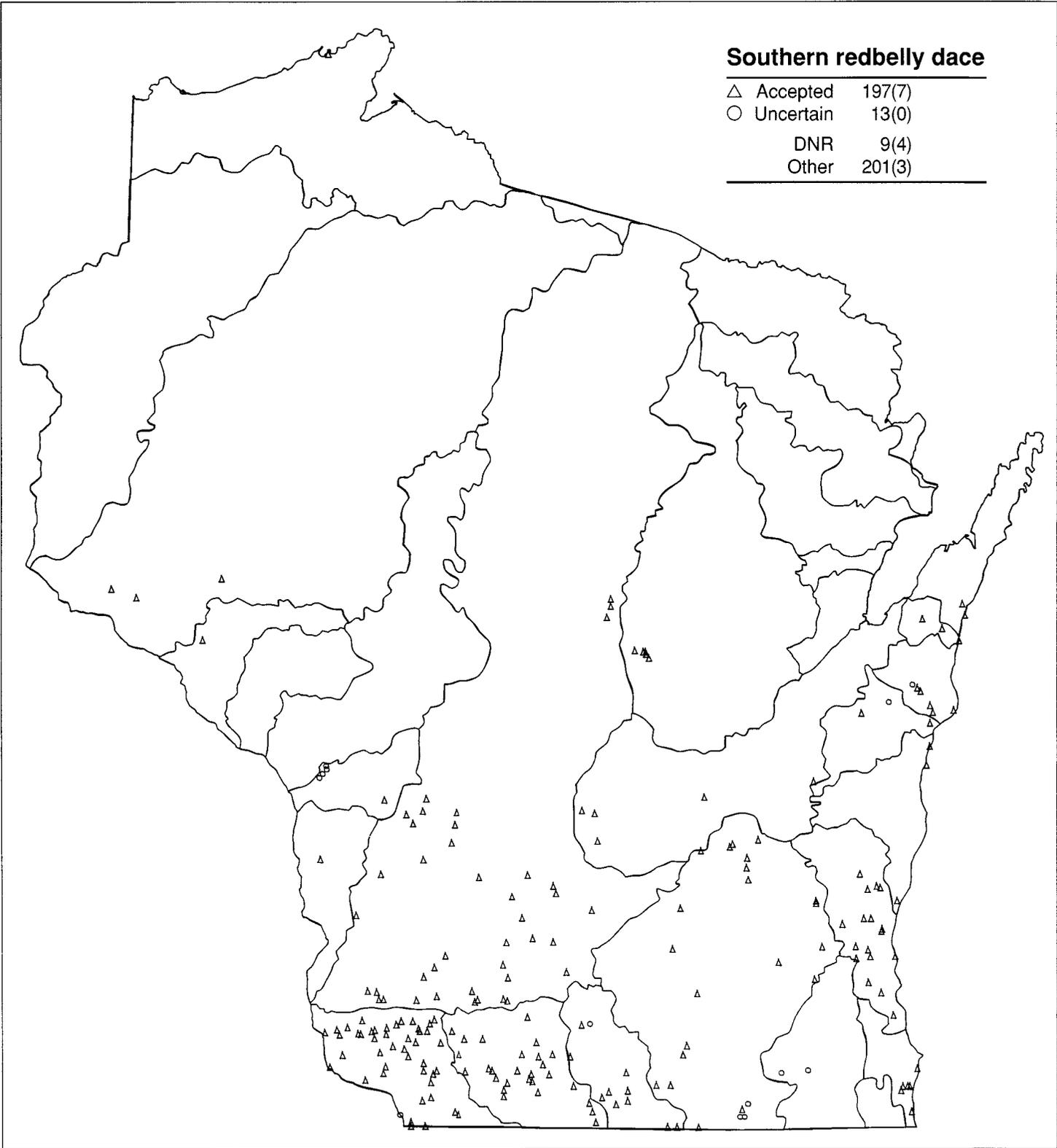


Map 65(E)

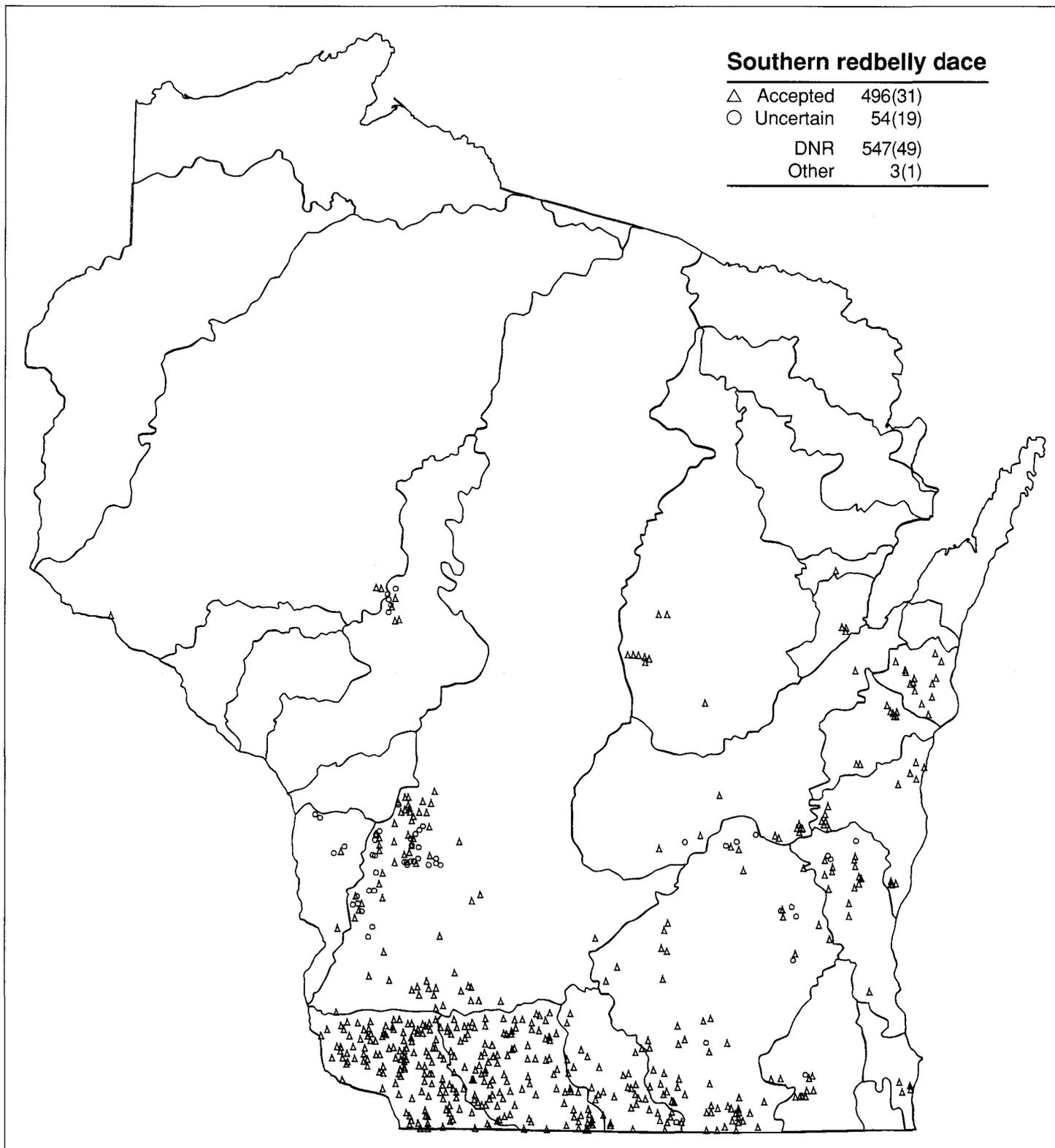




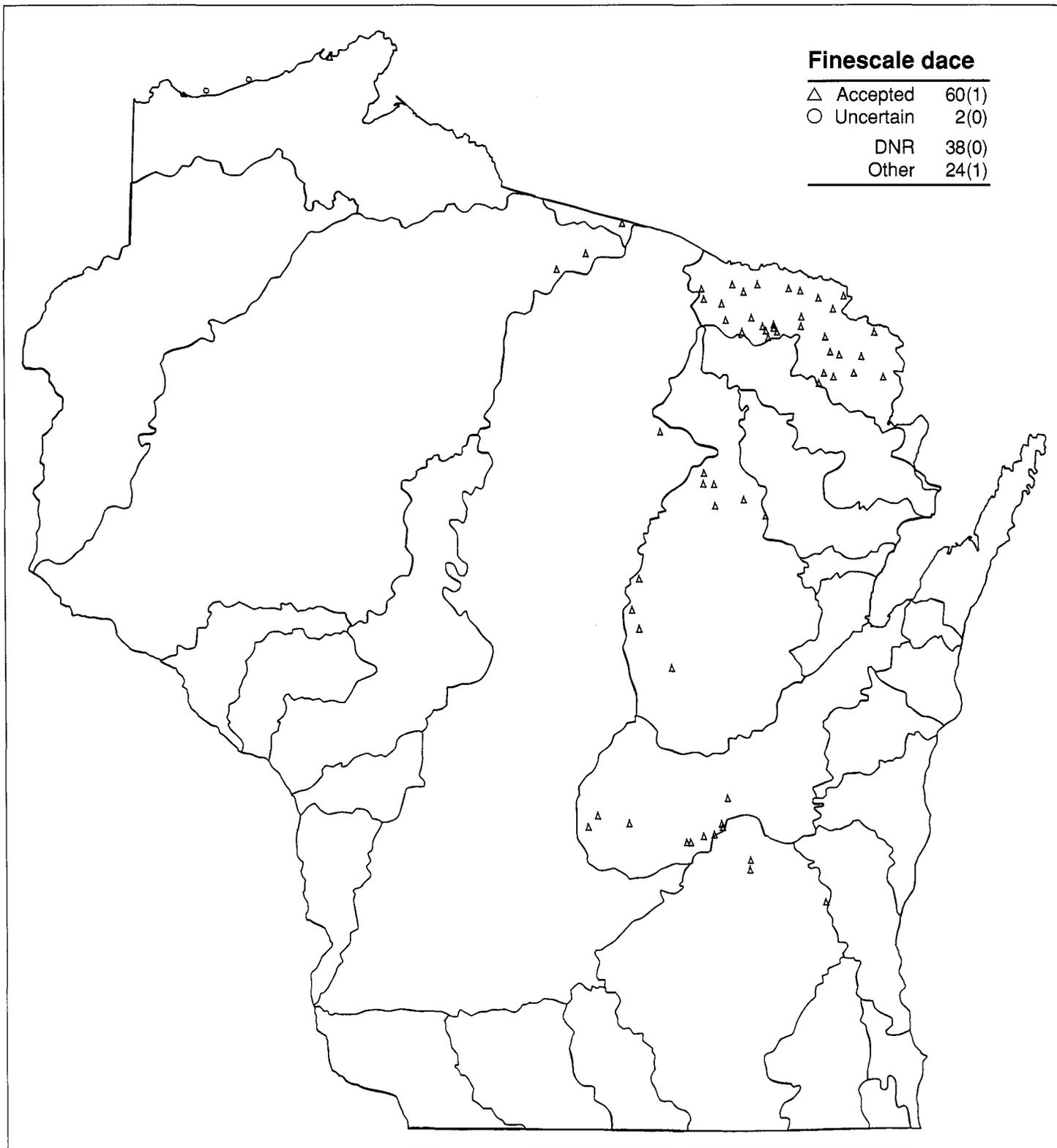
Map 66(E)



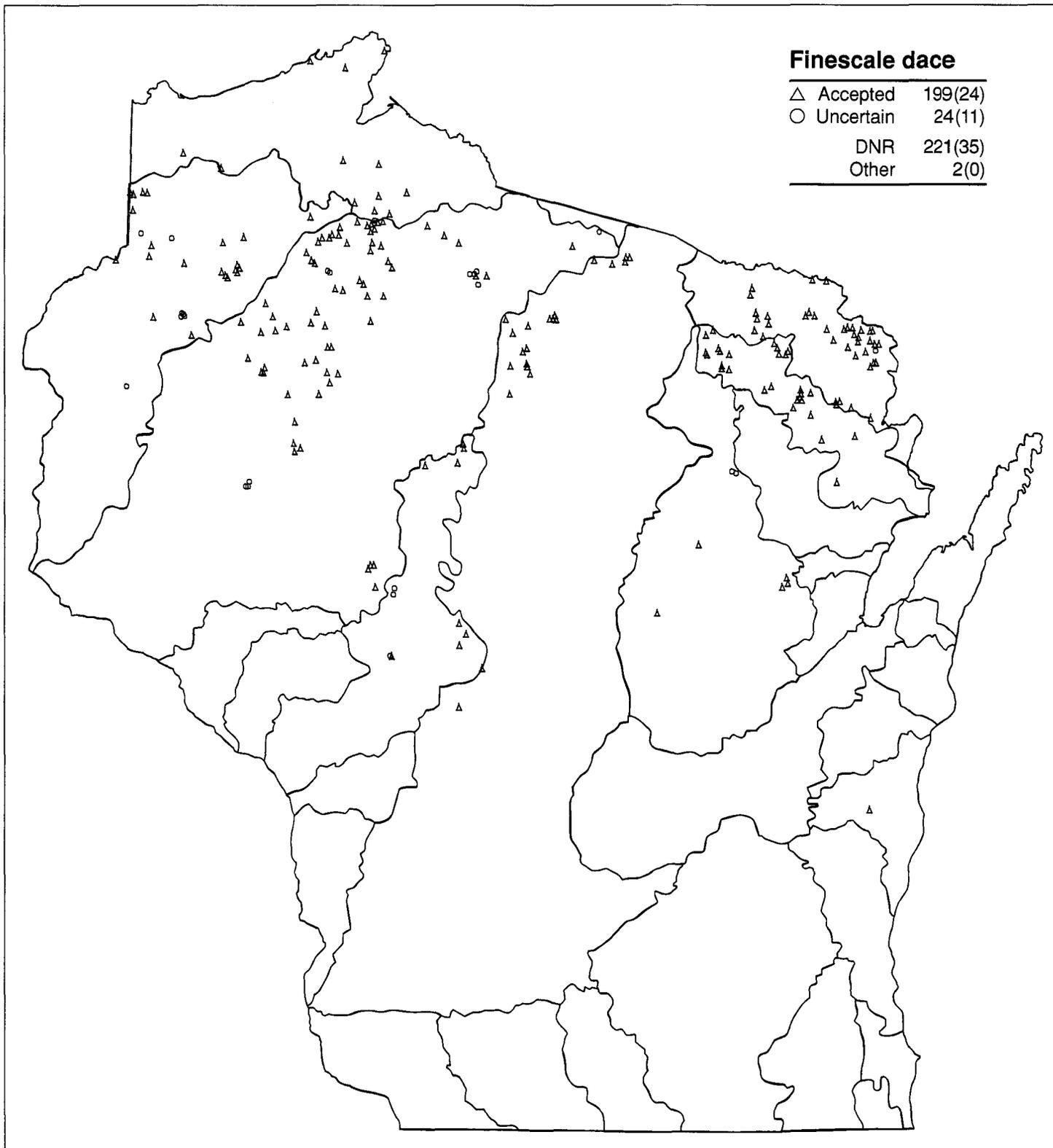
Map 66(L)



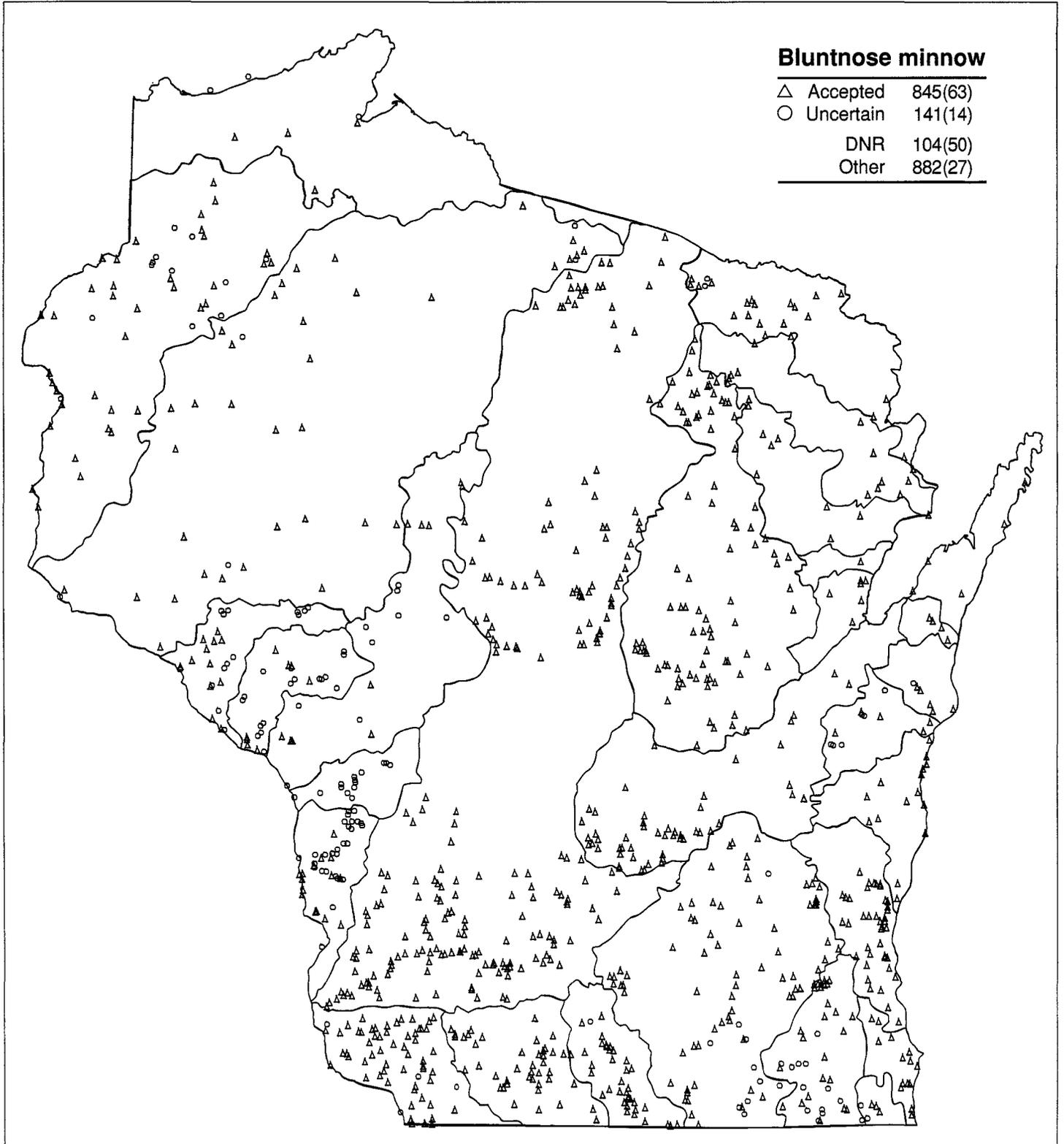
Map 67(E)

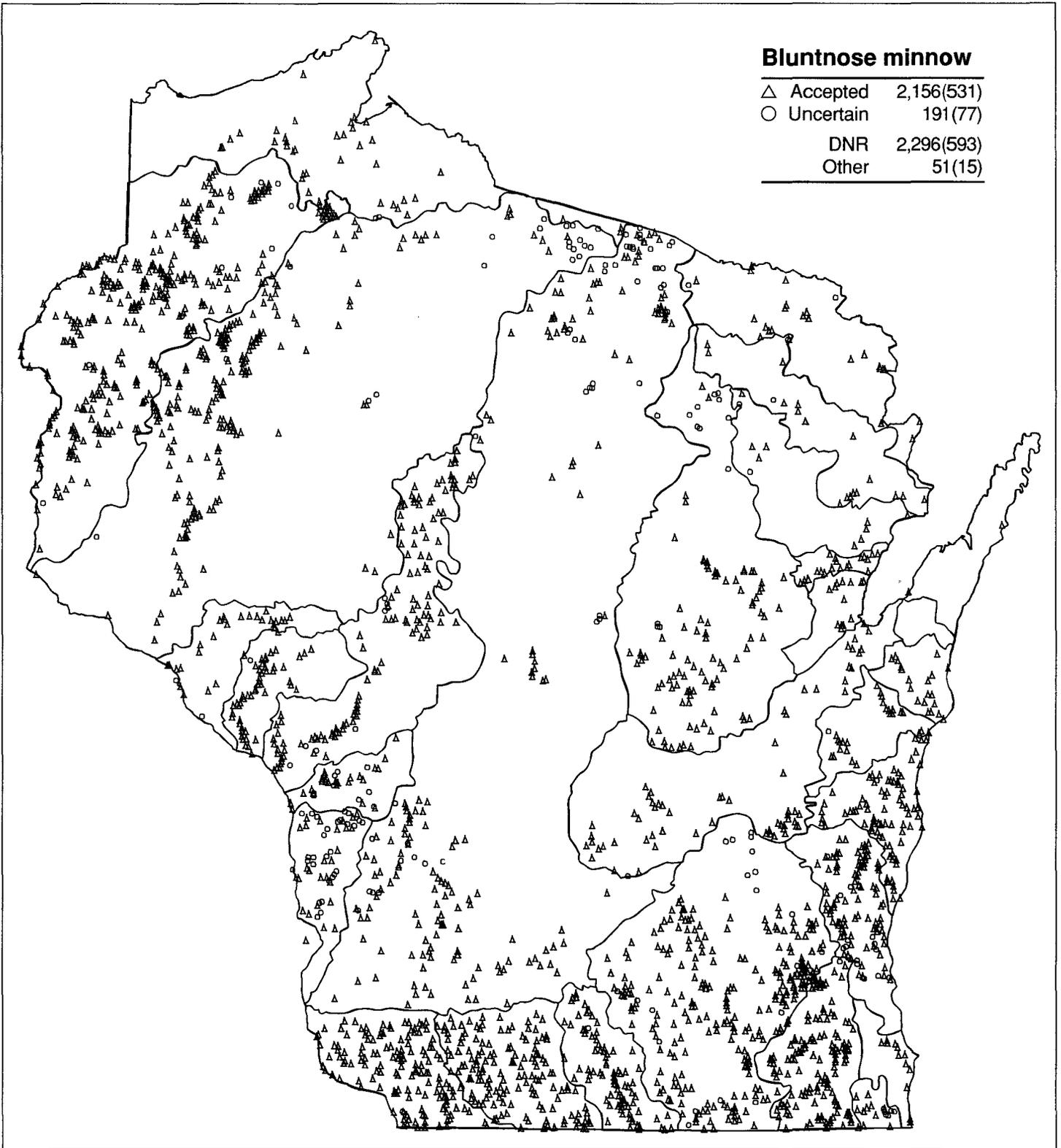


Map 67(L)

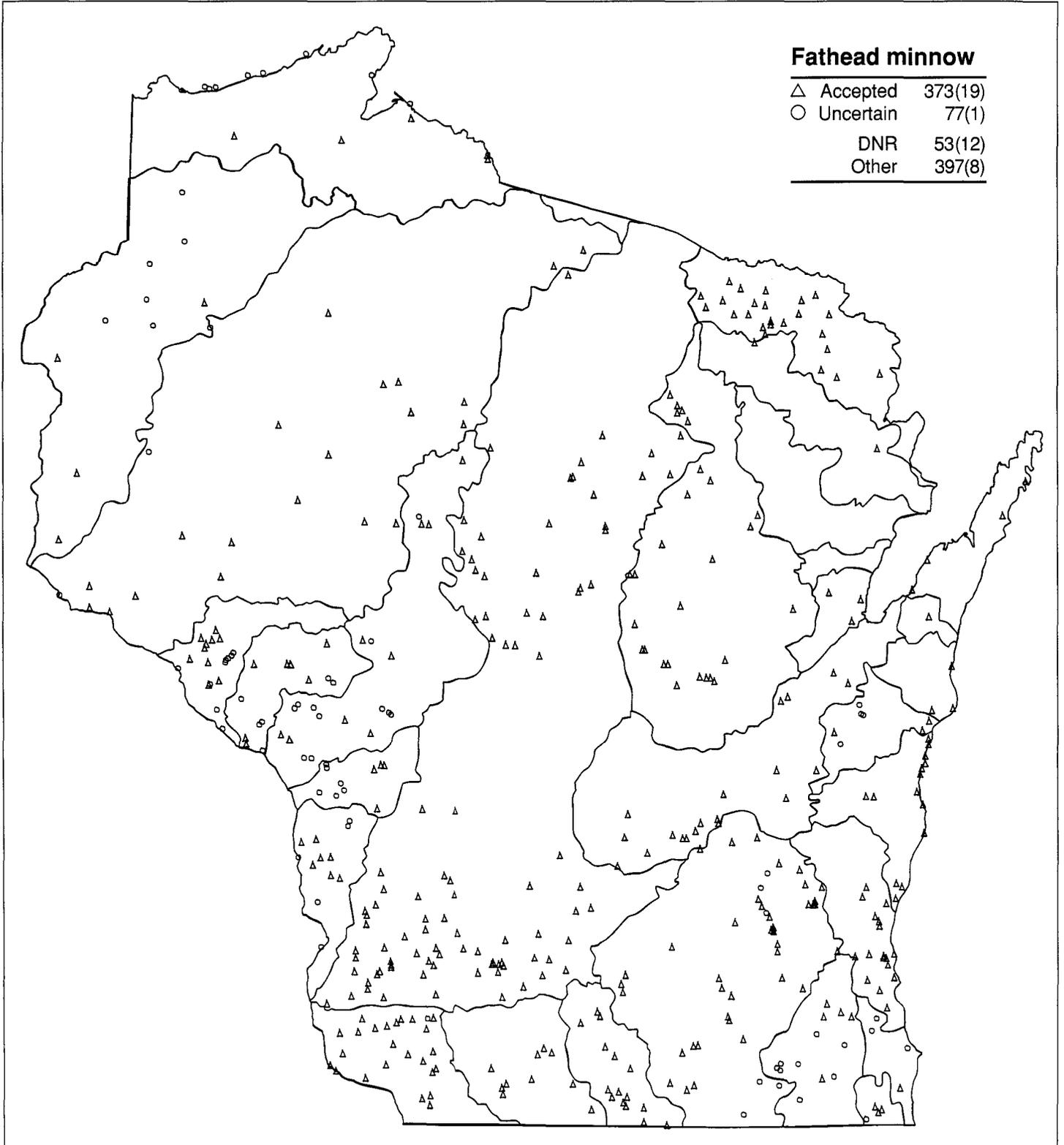


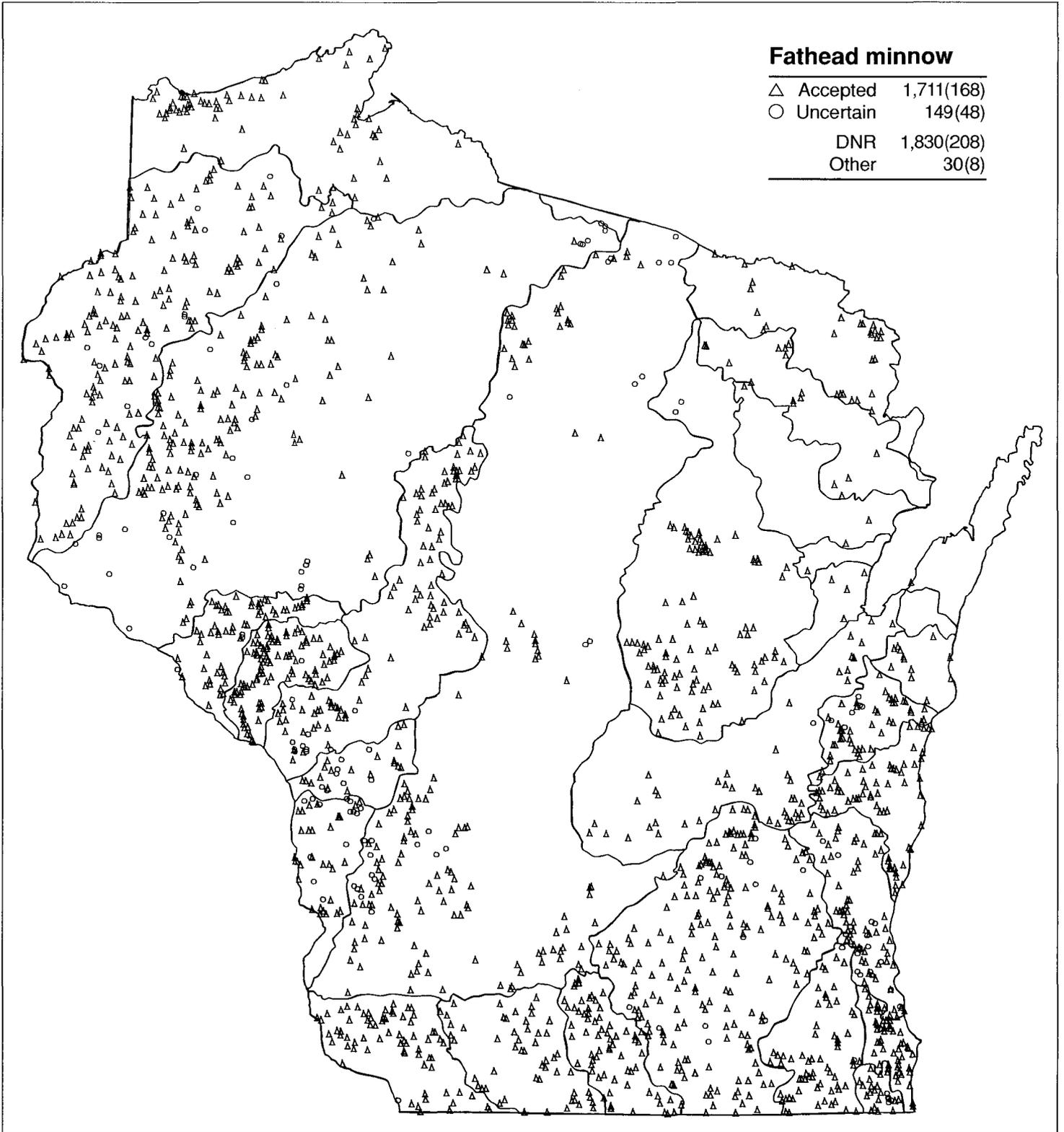
Map 68(E)



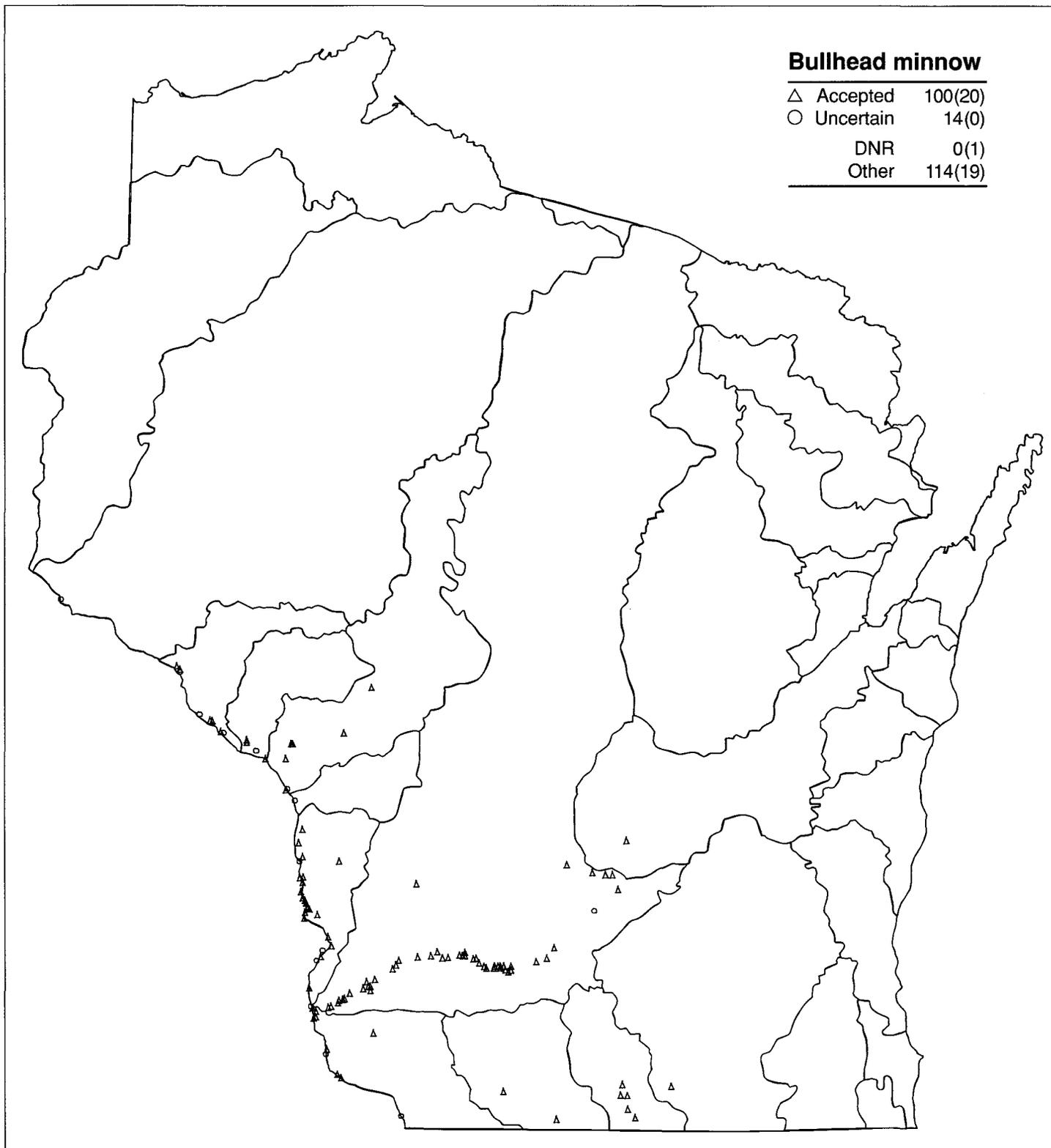


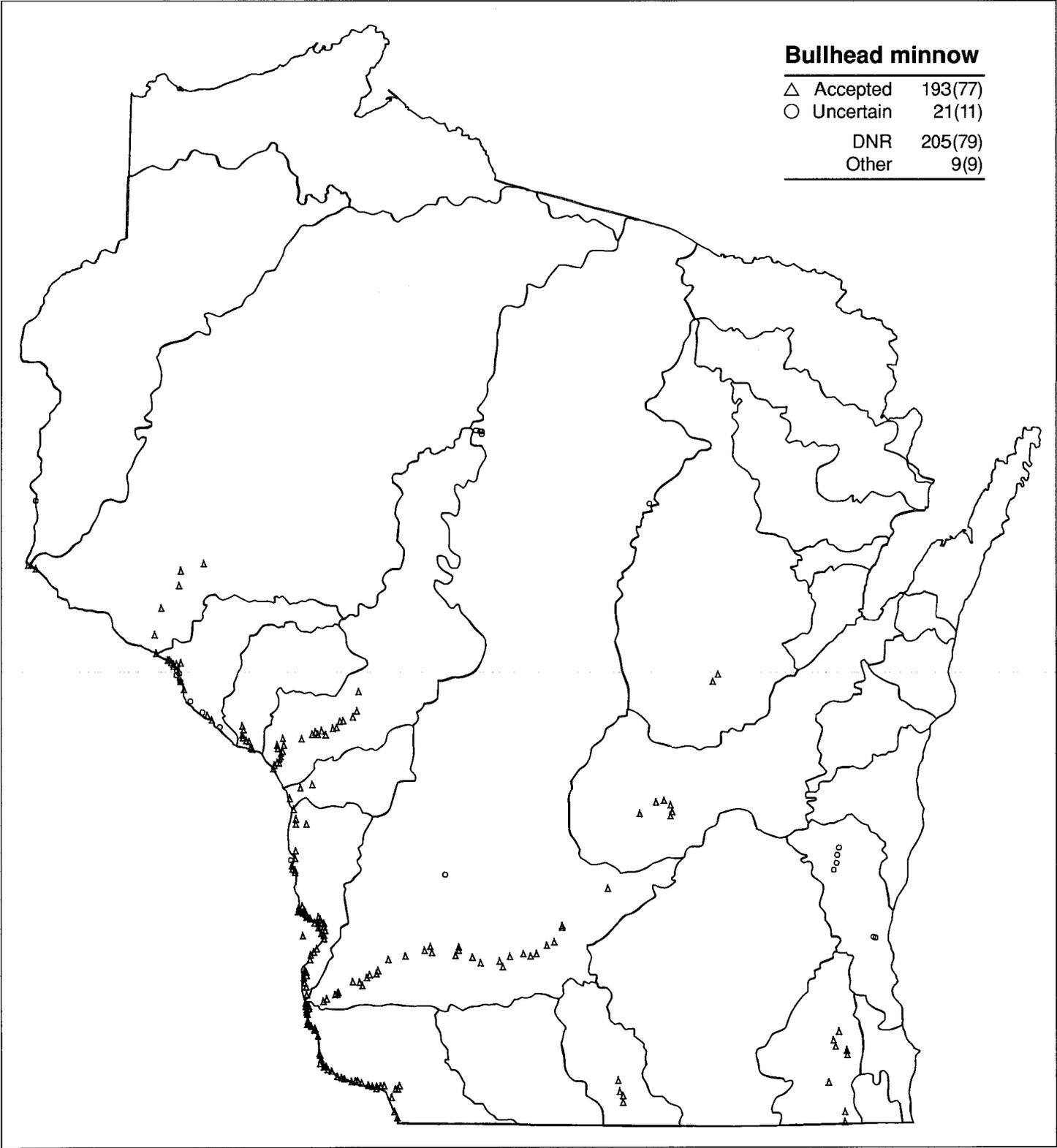
Map 69(E)



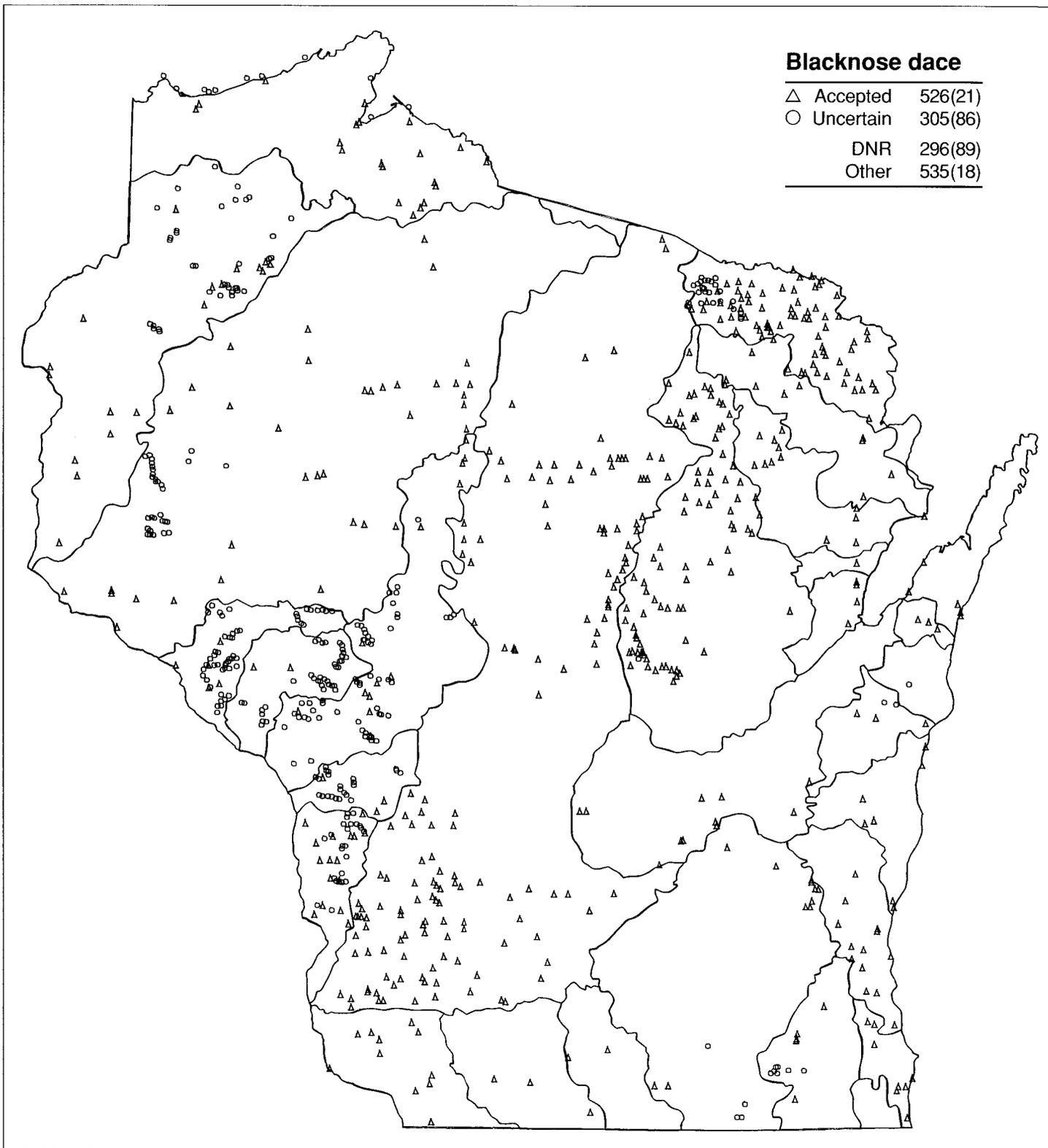


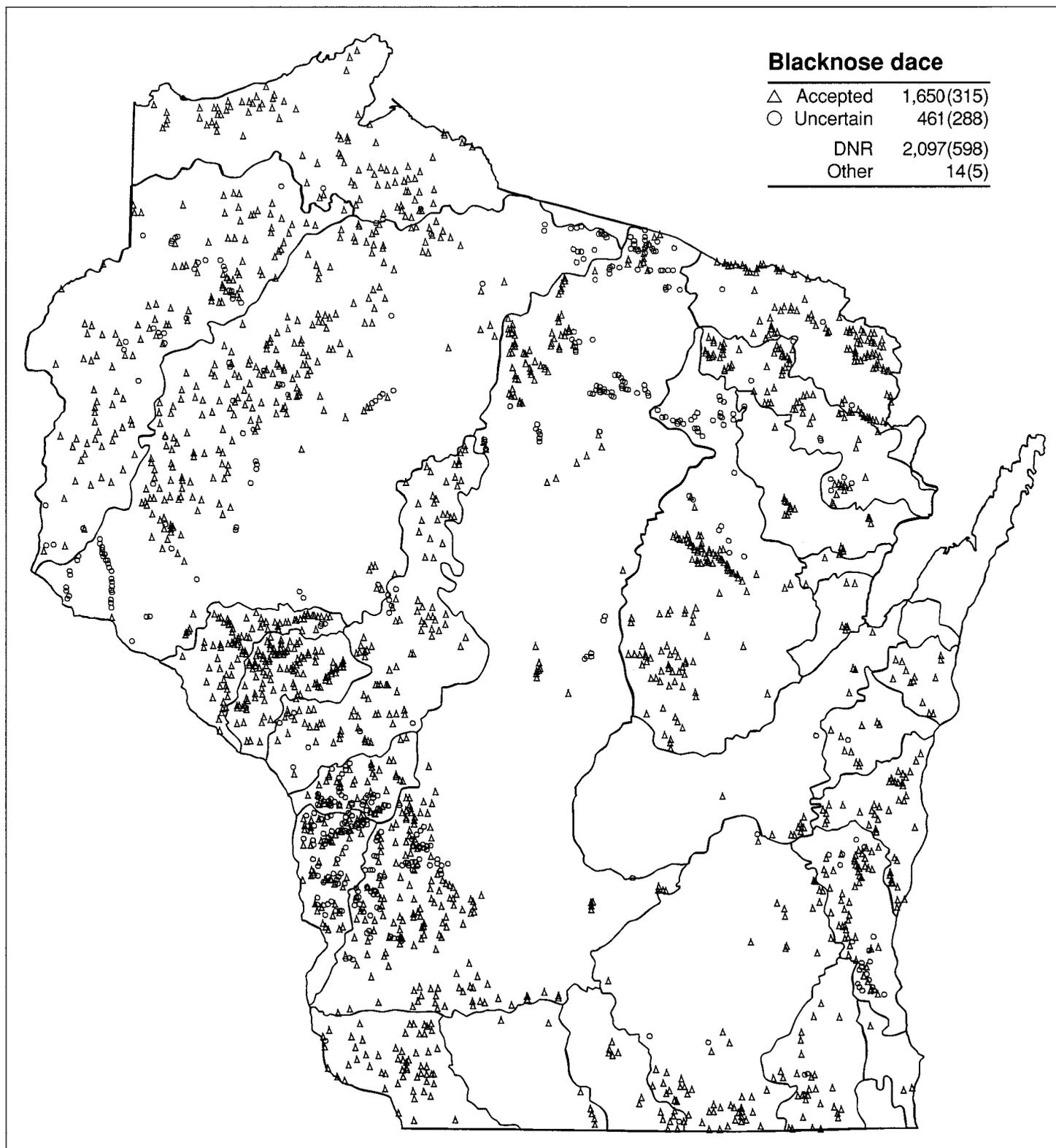
Map 70(E)



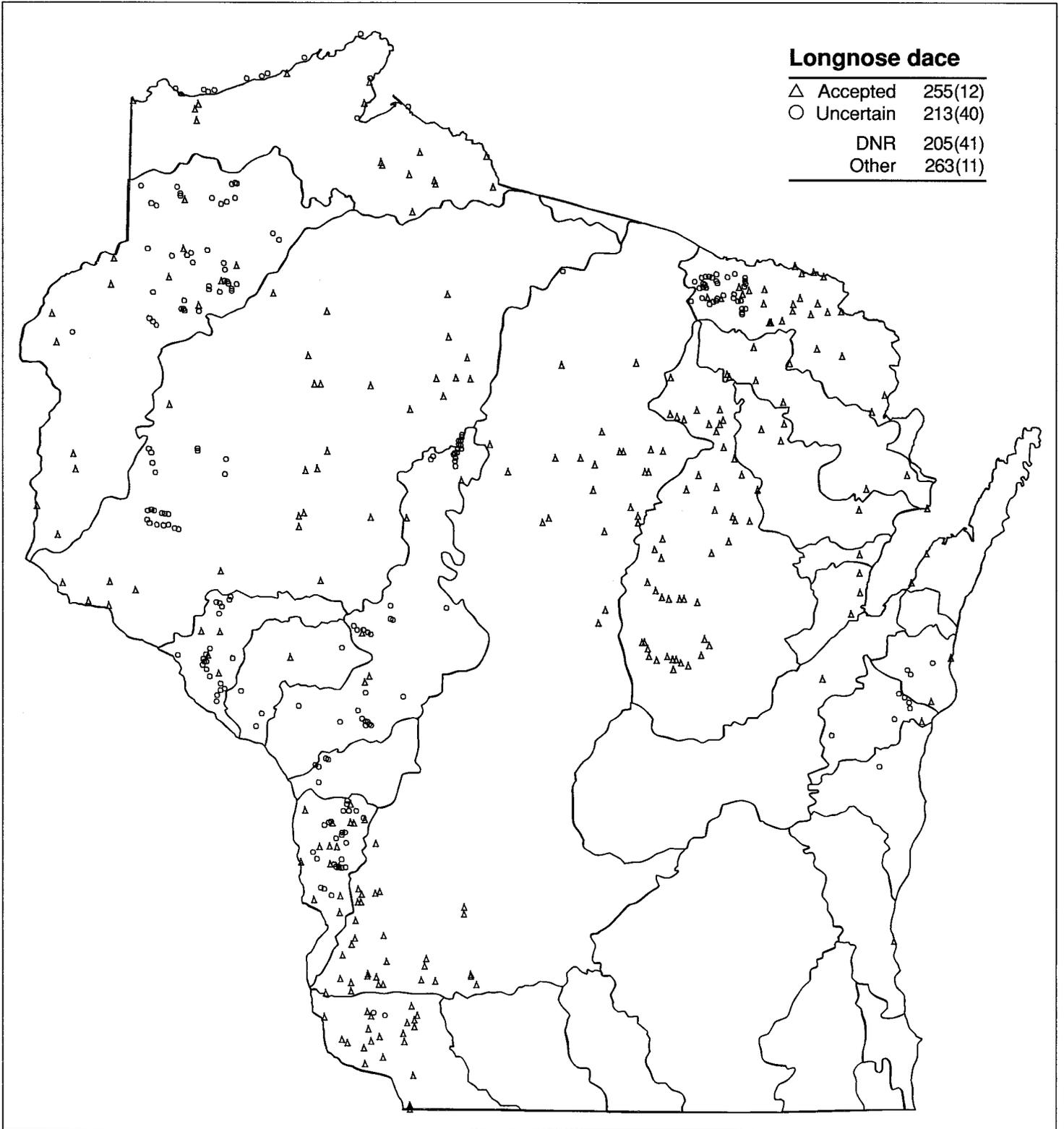


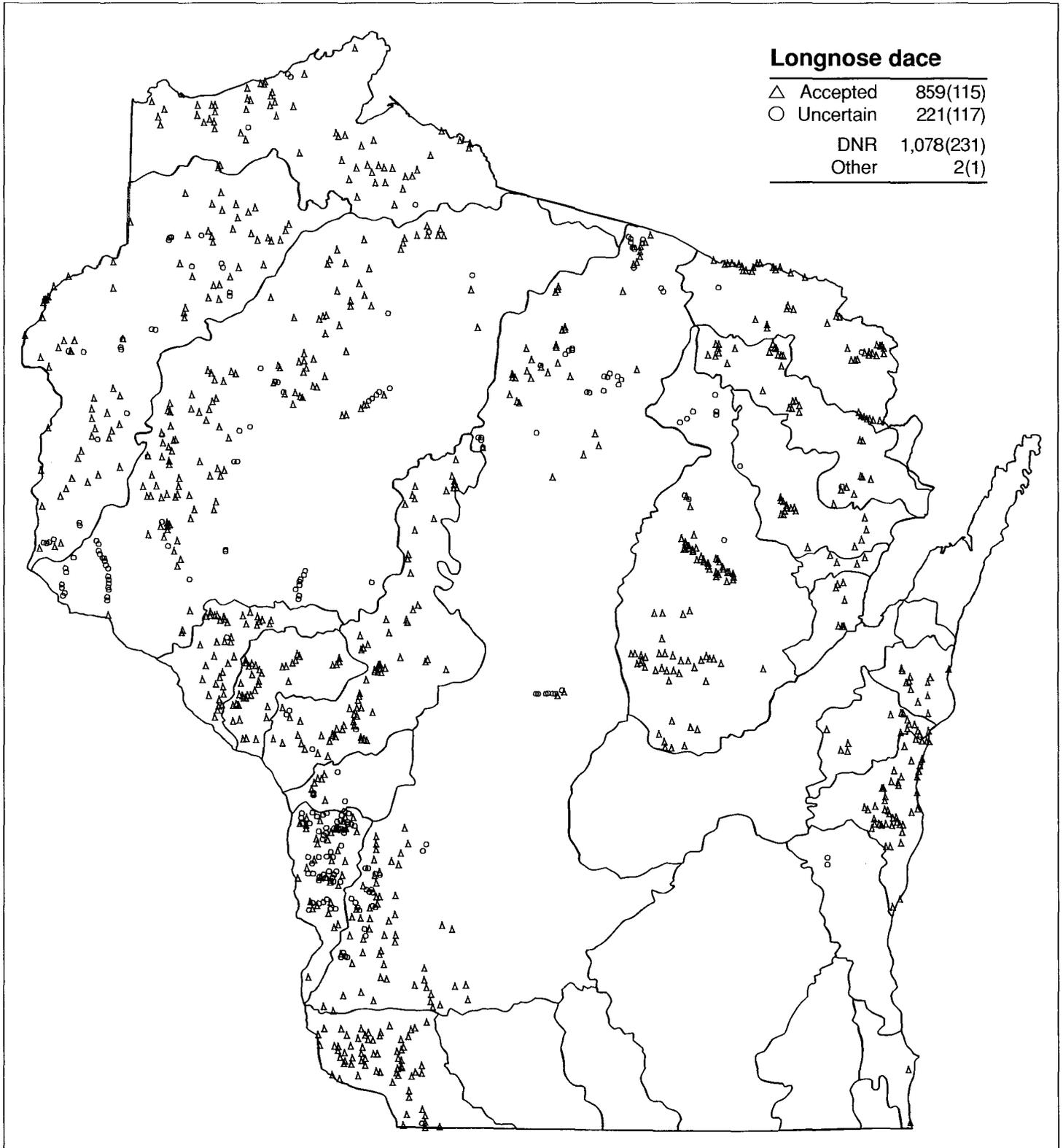
Map 71(E)



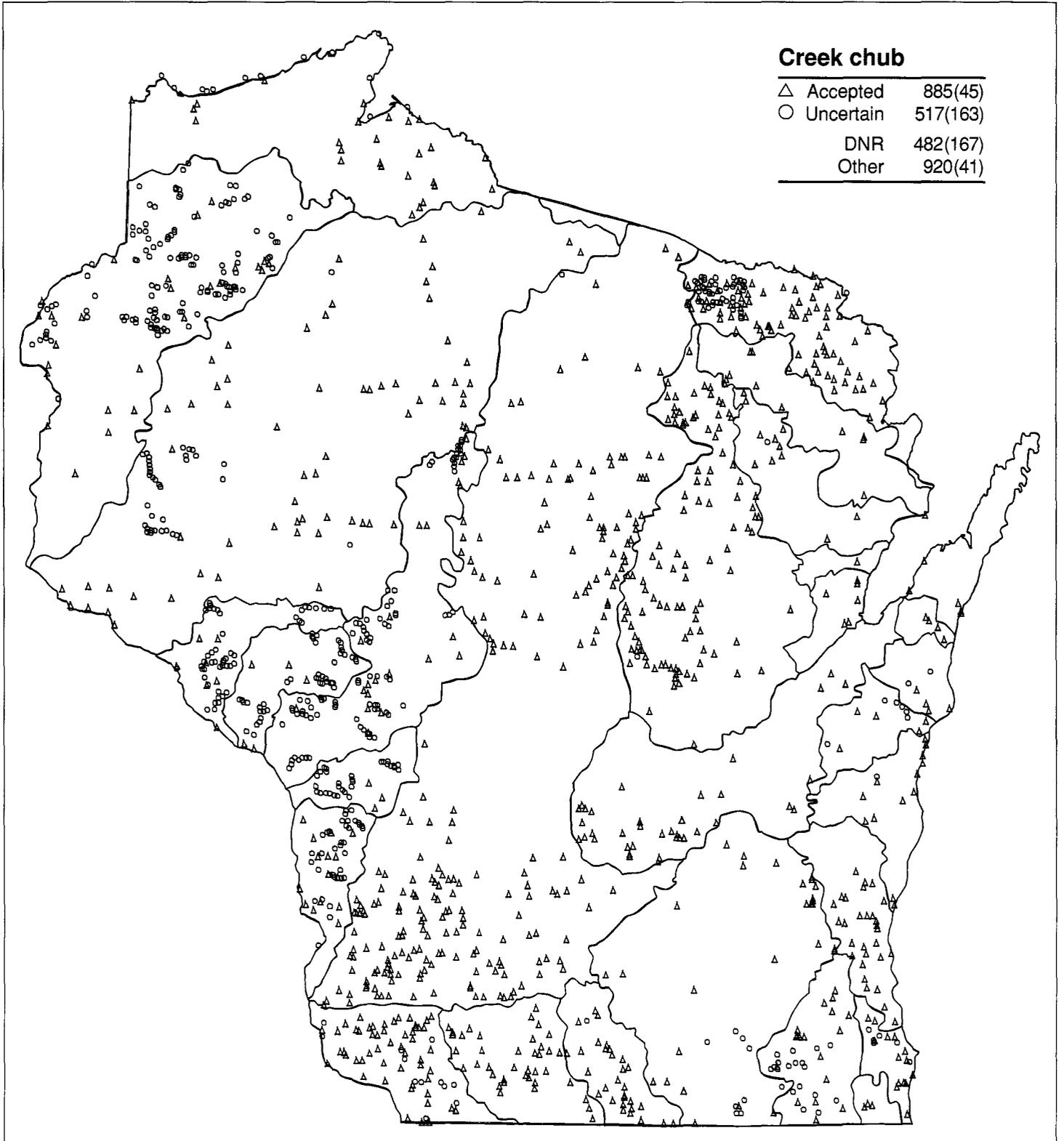


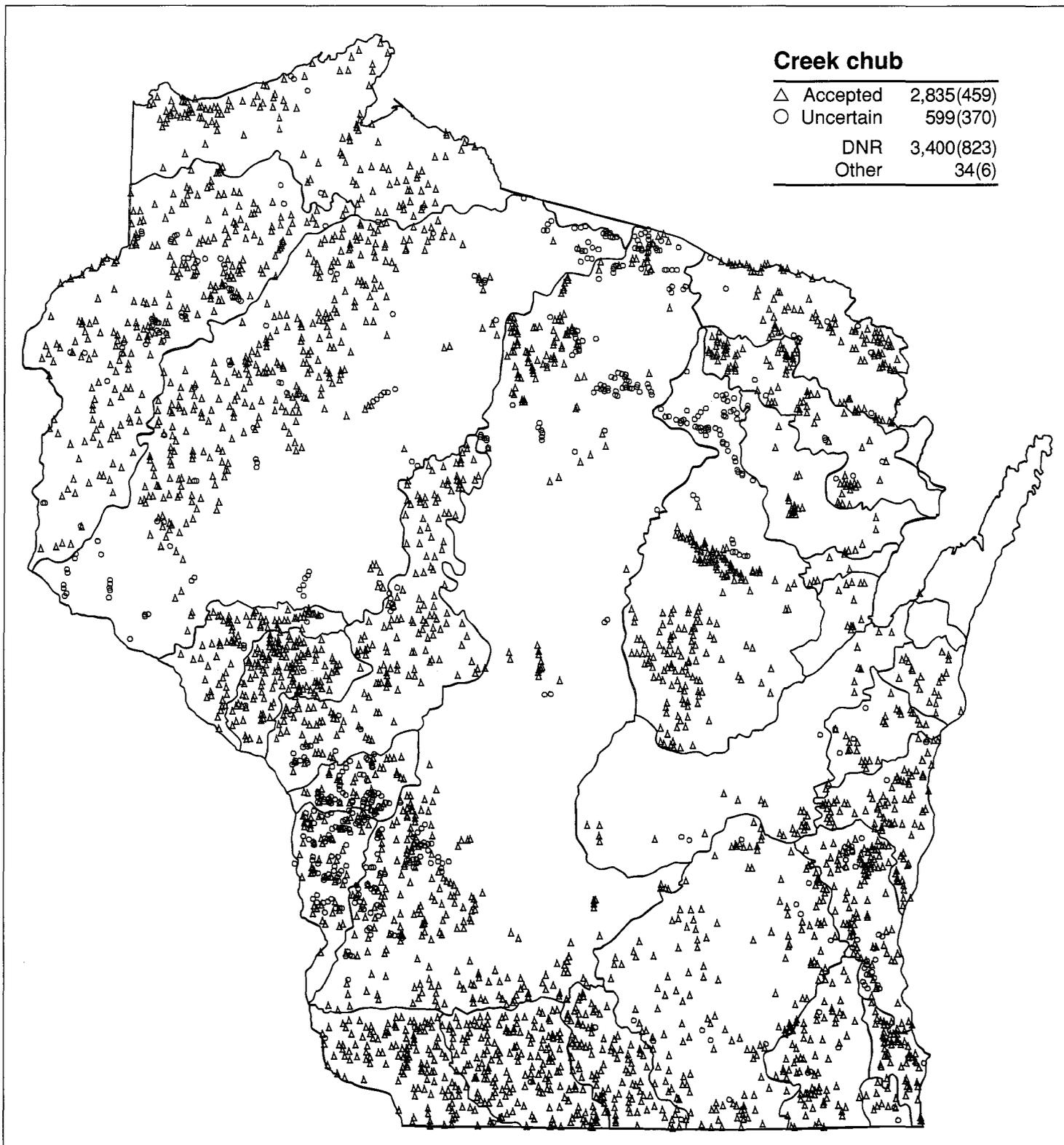
Map 72(E)



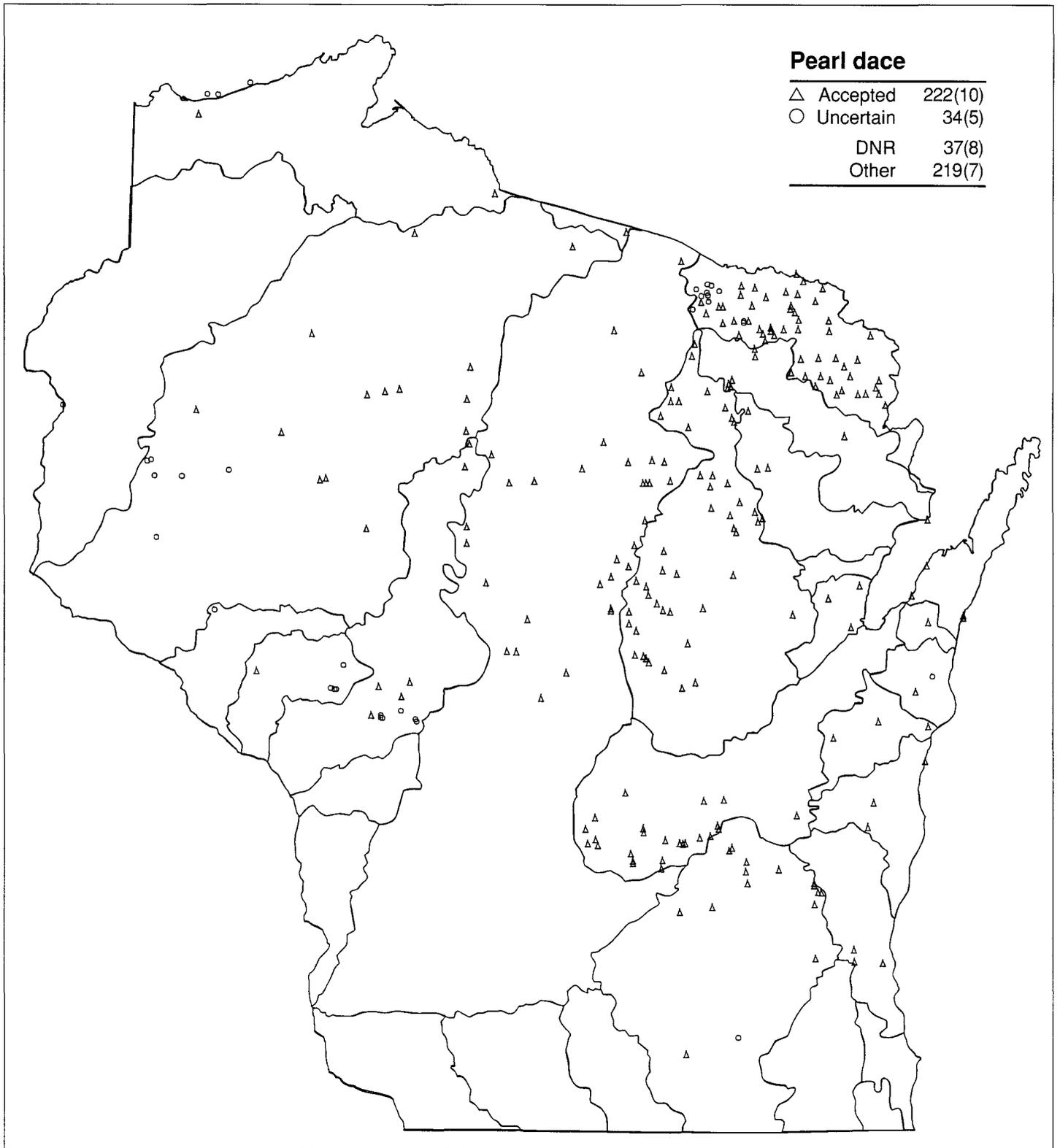


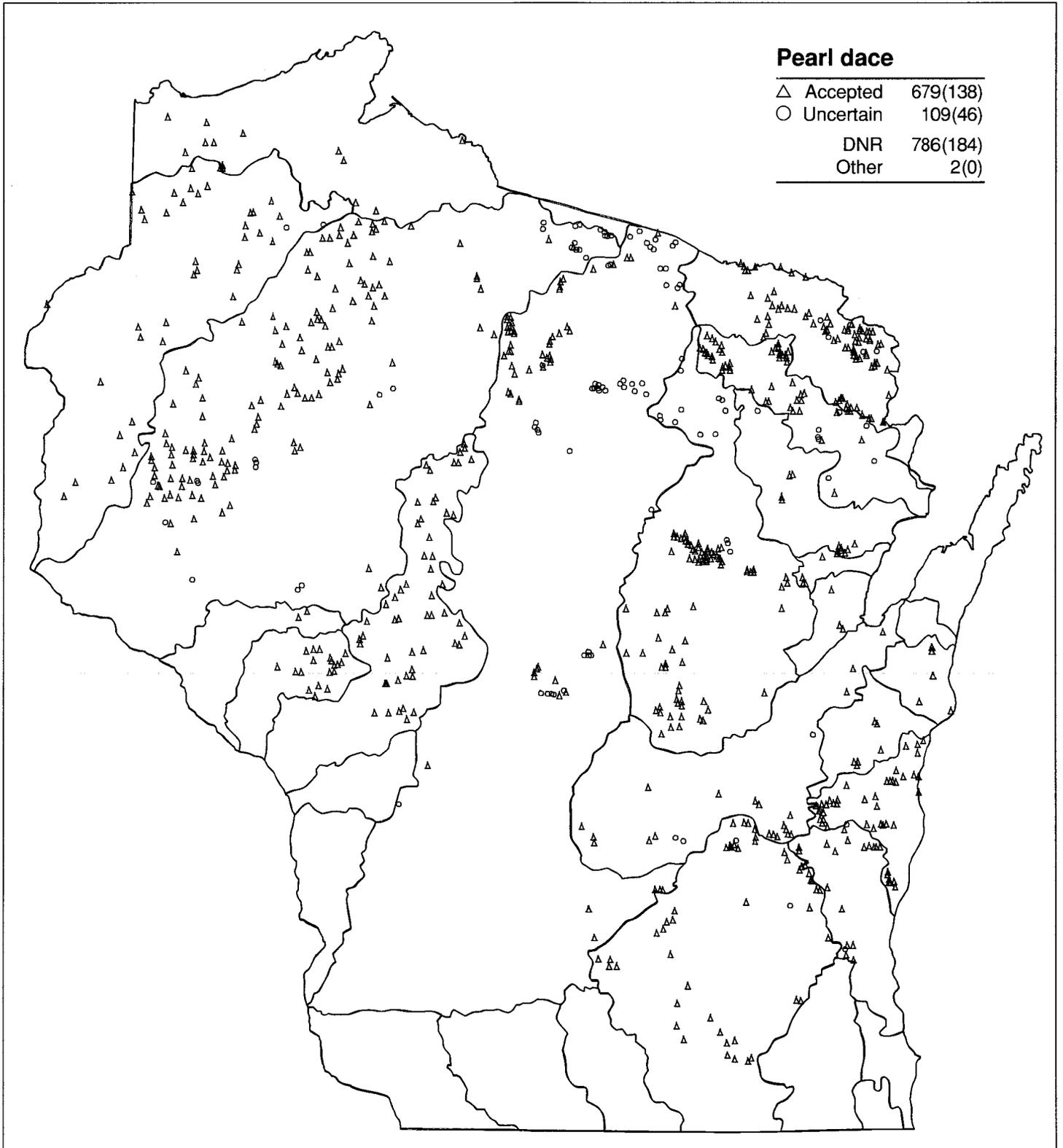
Map 73(E)



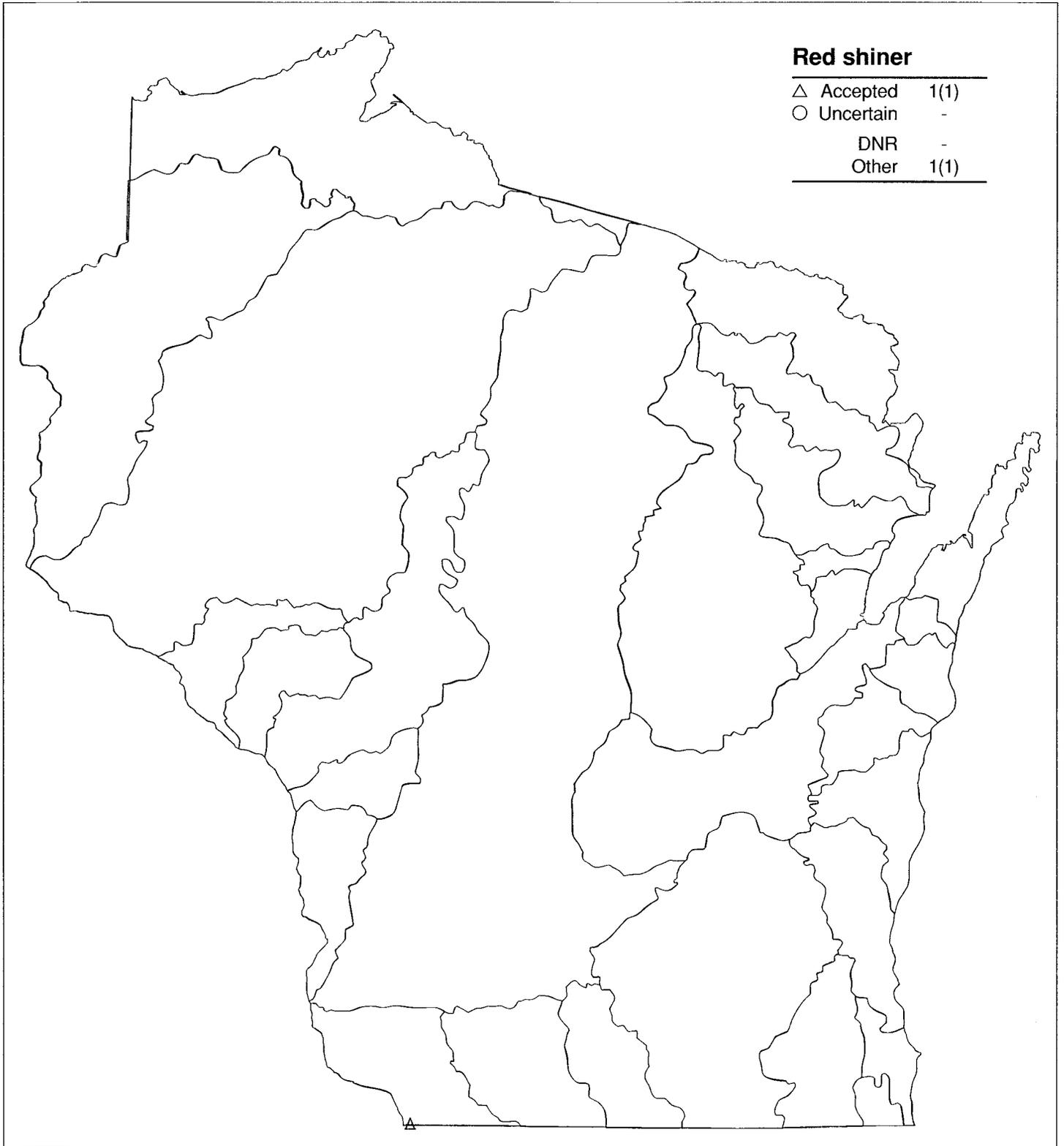


Map 74(E)



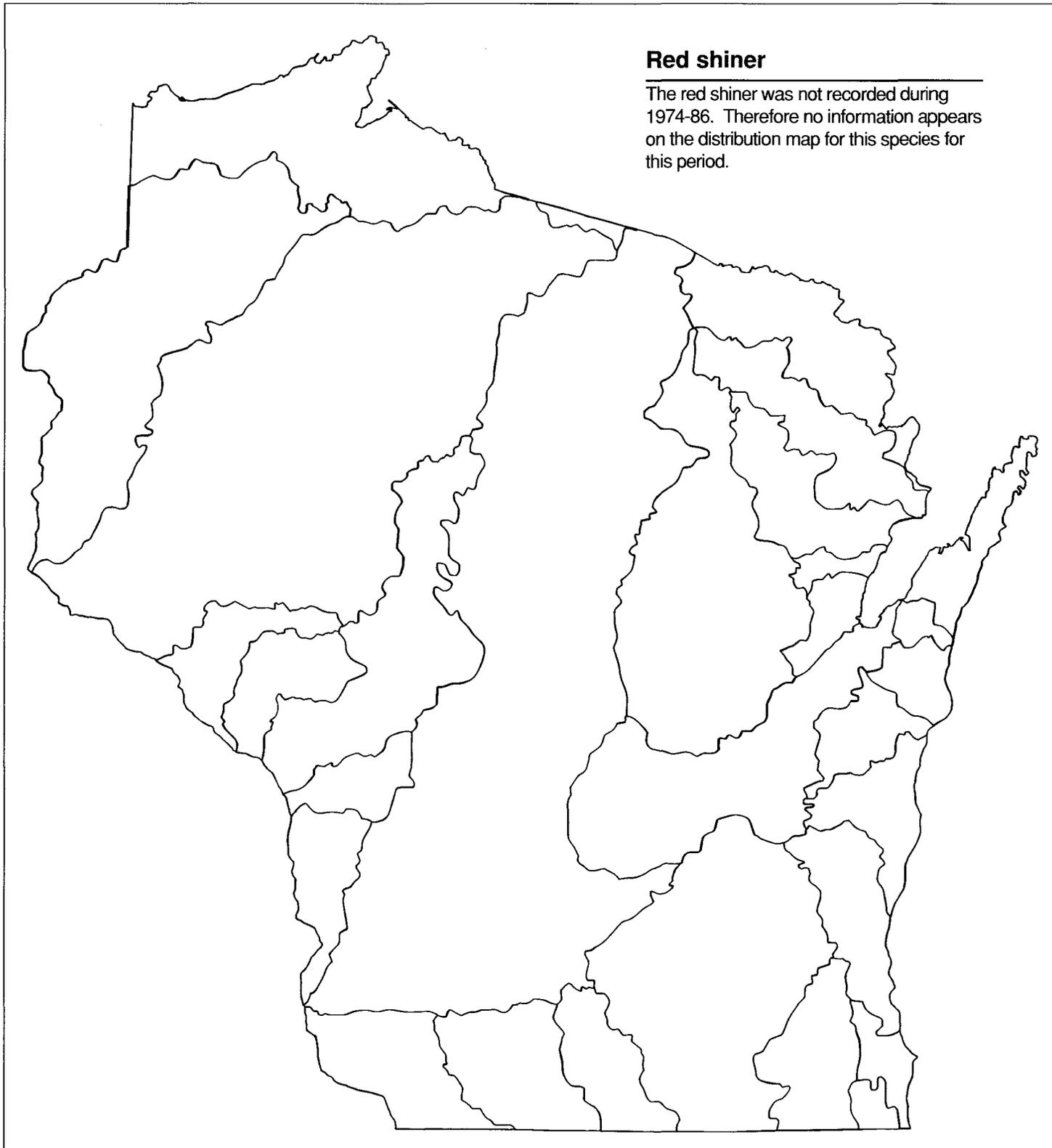


Map 75(E)

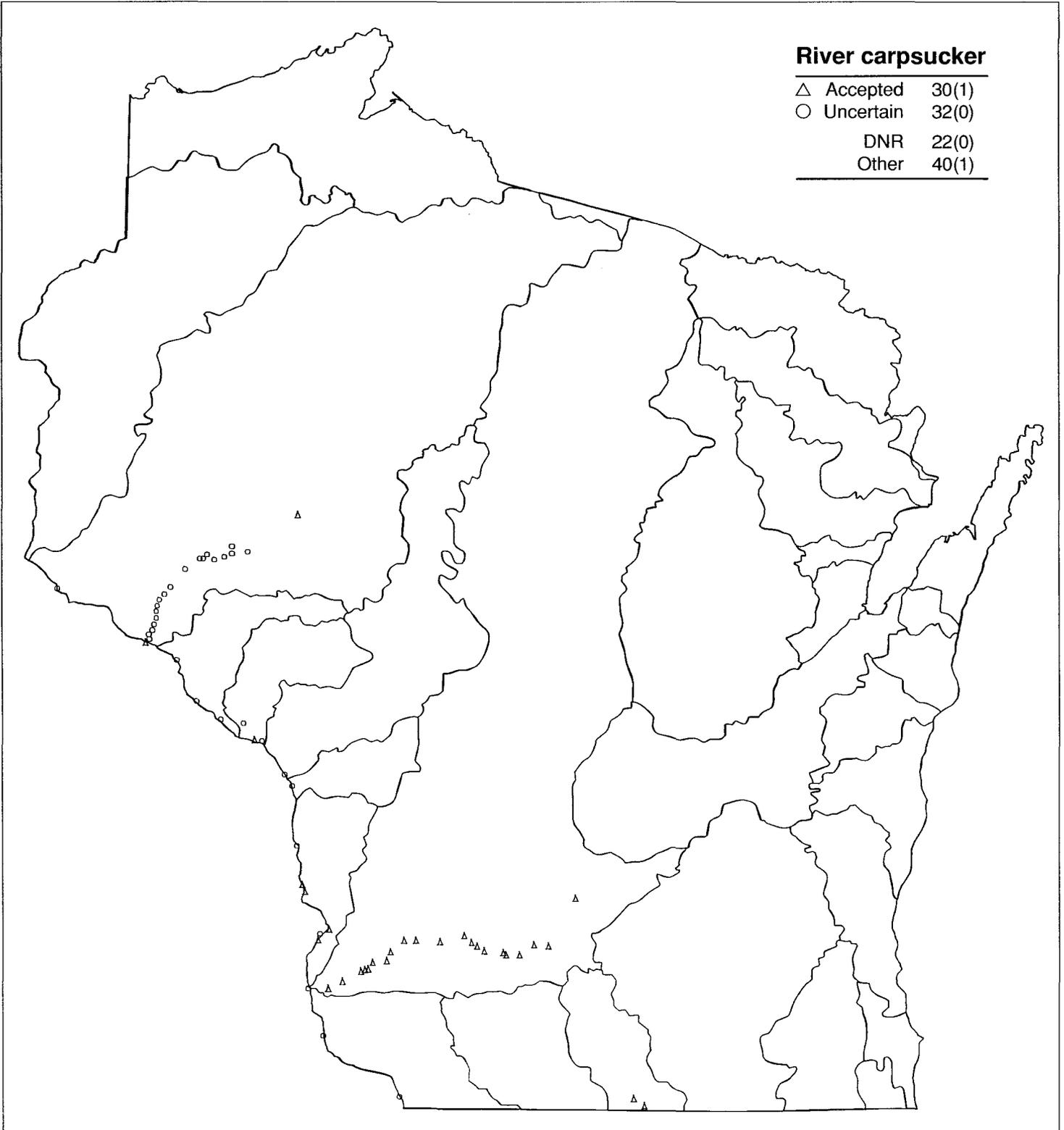


Red shiner

The red shiner was not recorded during 1974-86. Therefore no information appears on the distribution map for this species for this period.

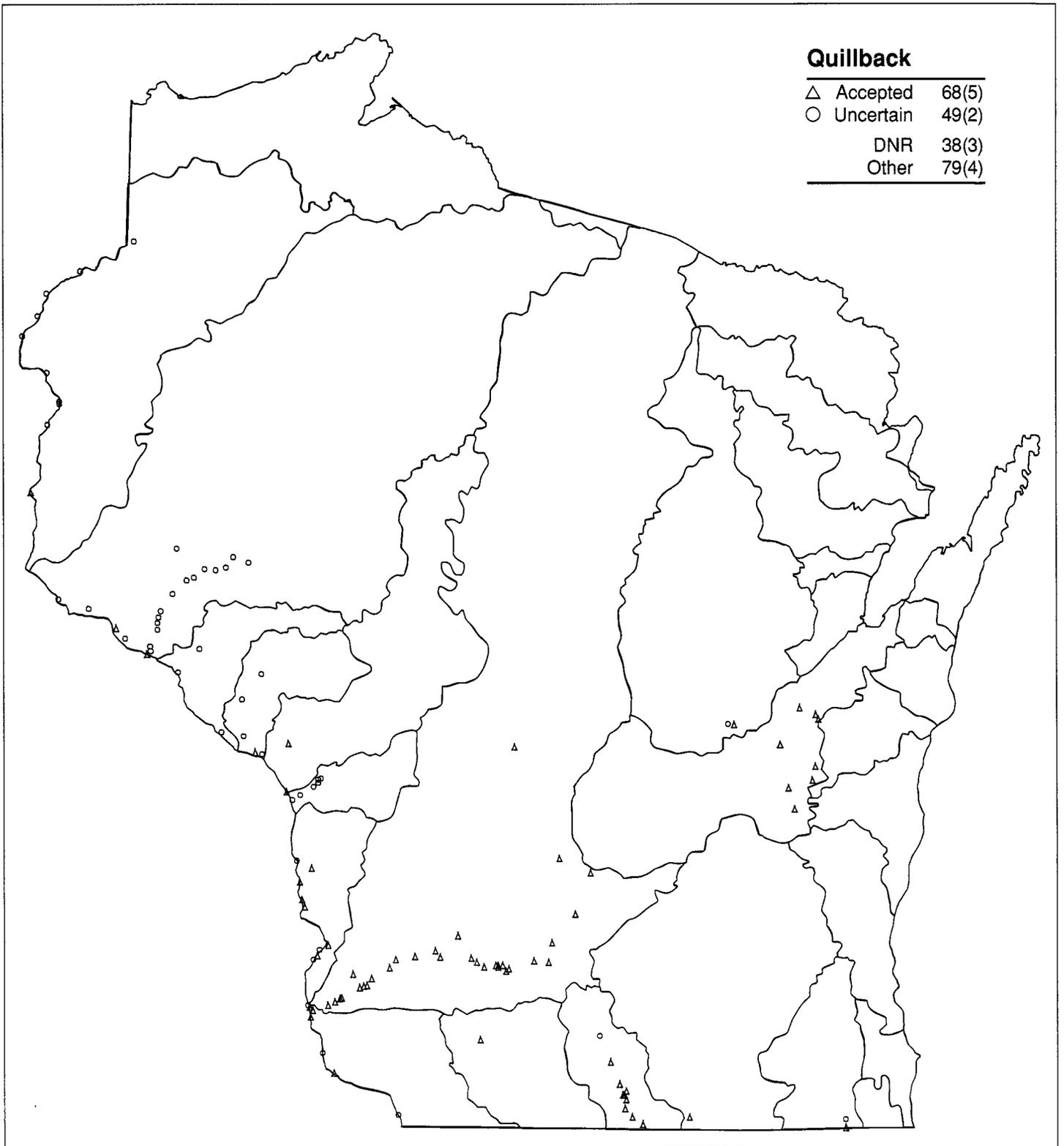


Map 76(E)



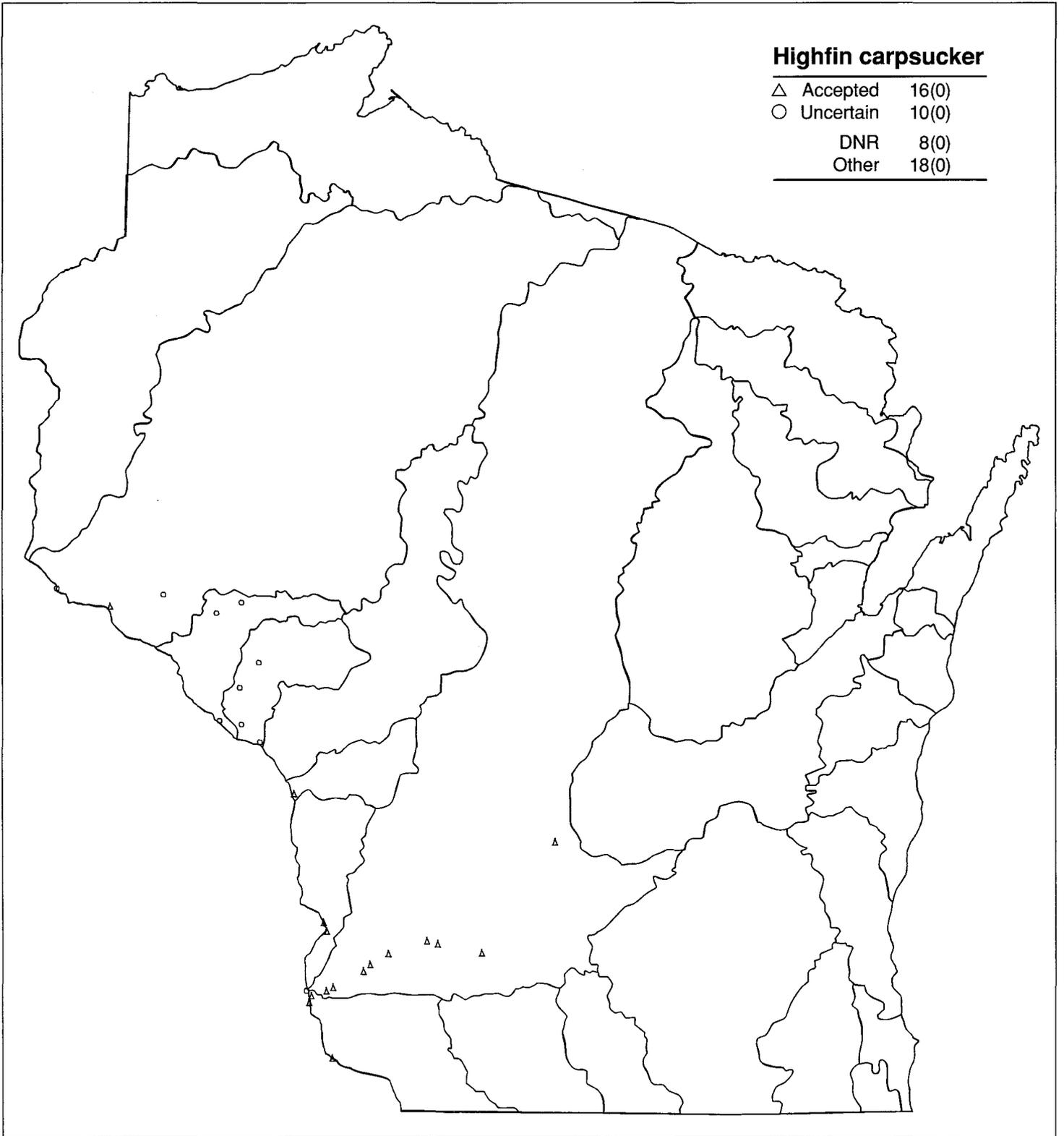


Map 77(E)





Map 78(E)



Highfin carpsucker

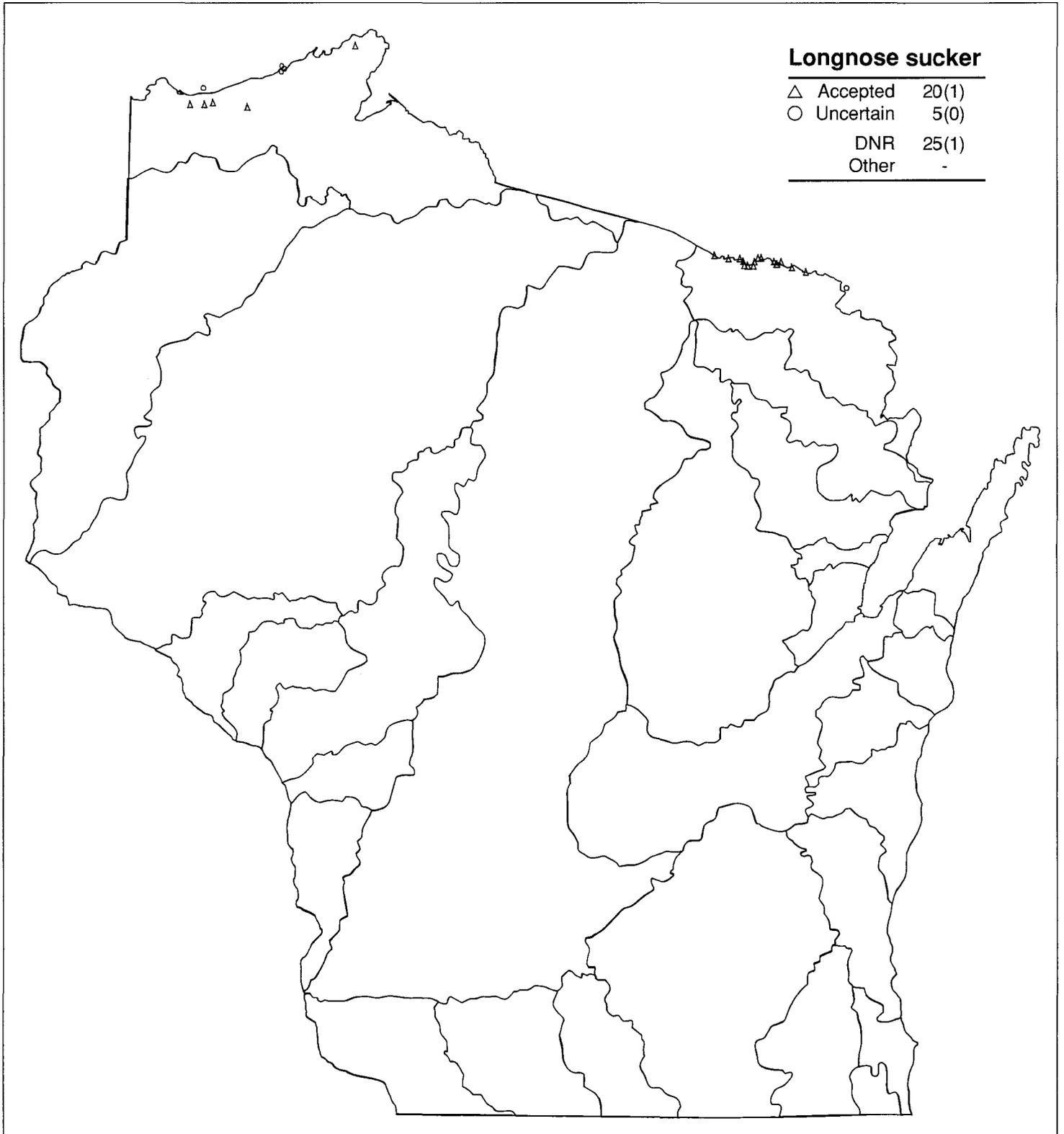
△	Accepted	67(6)
○	Uncertain	10(2)
	DNR	74(6)
	Other	3(2)



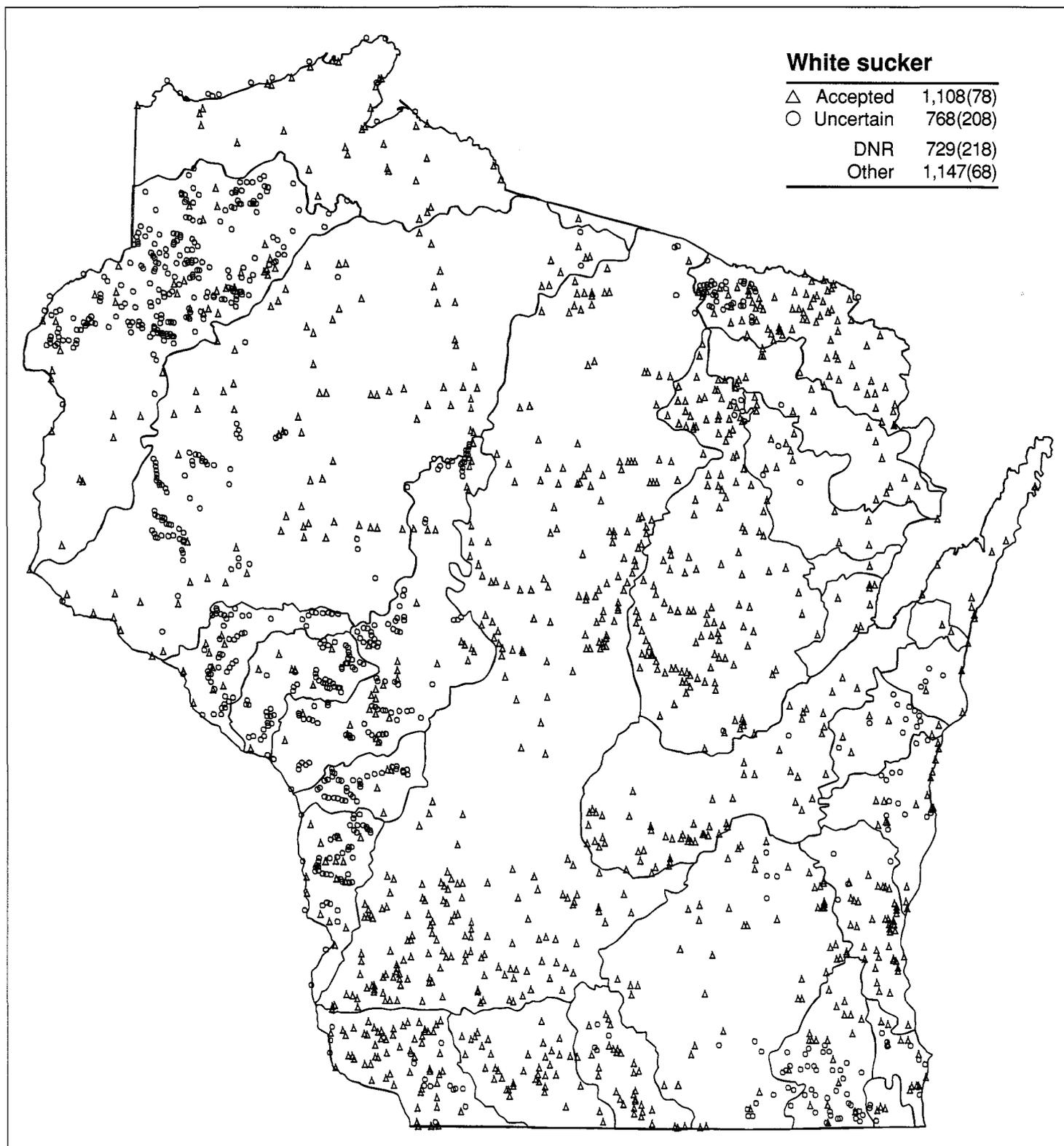
Map 79(E)

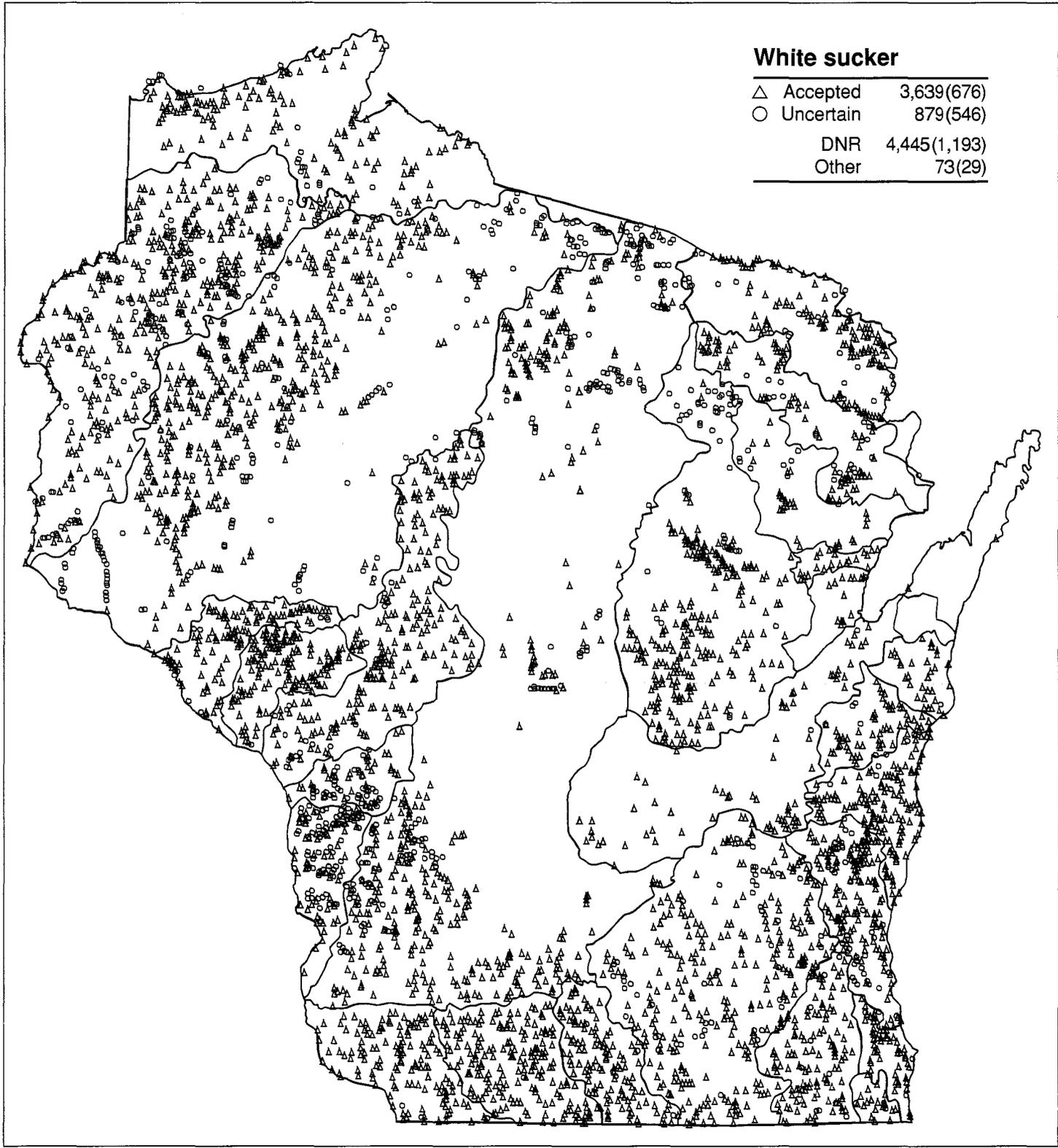


Map 79(L)

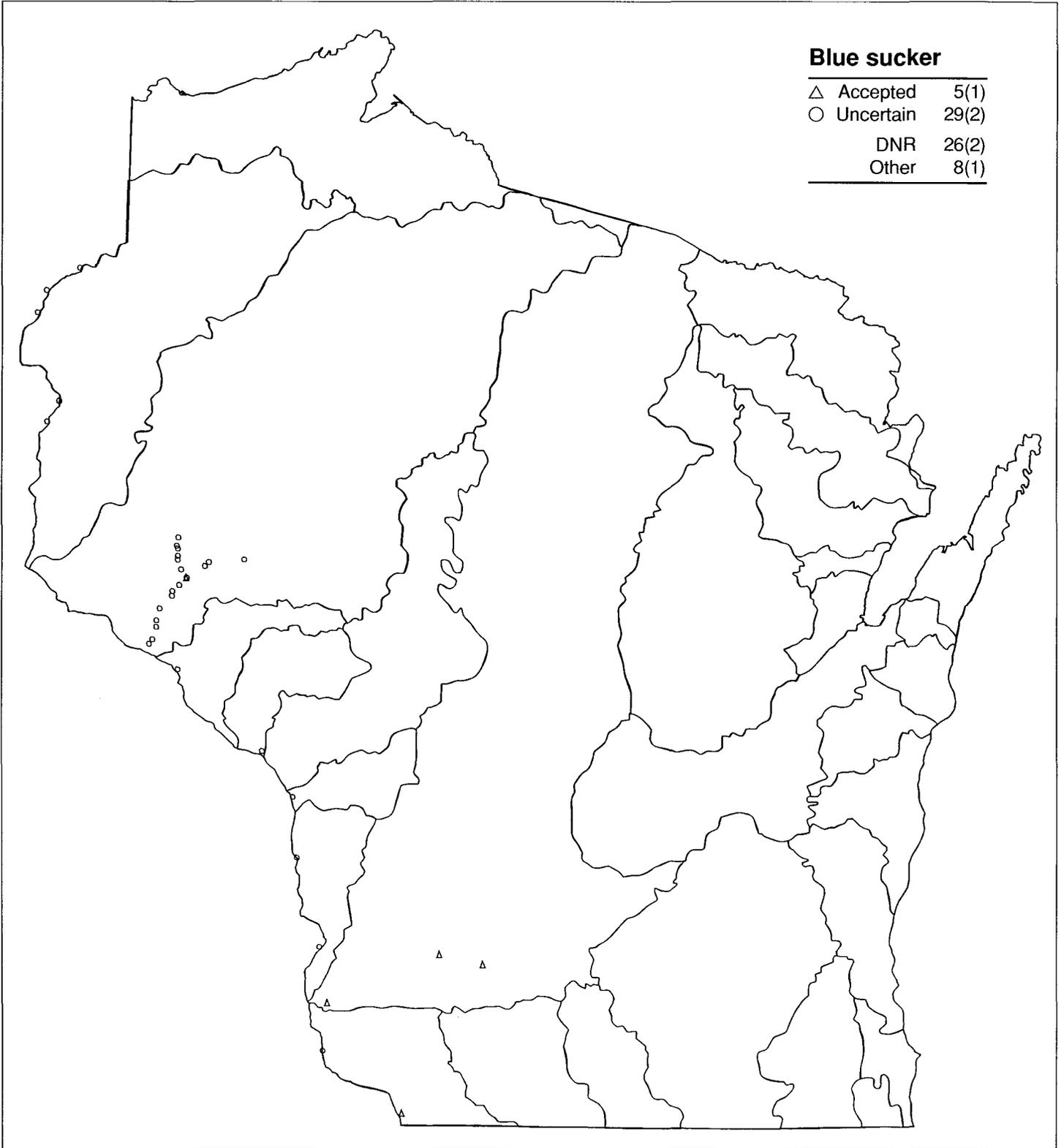


Map 80(E)





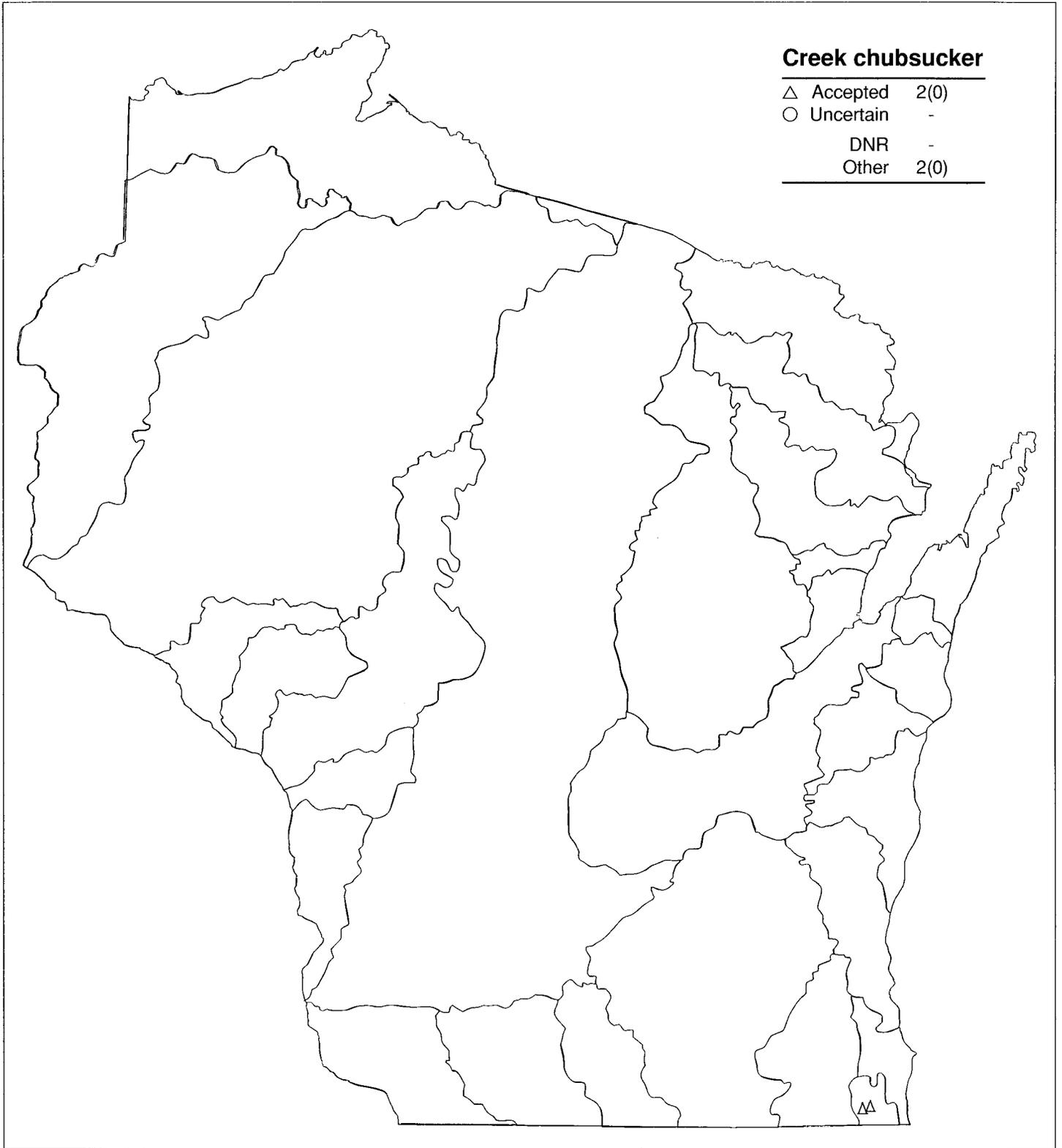
Map 81(E)



Map 81(L)

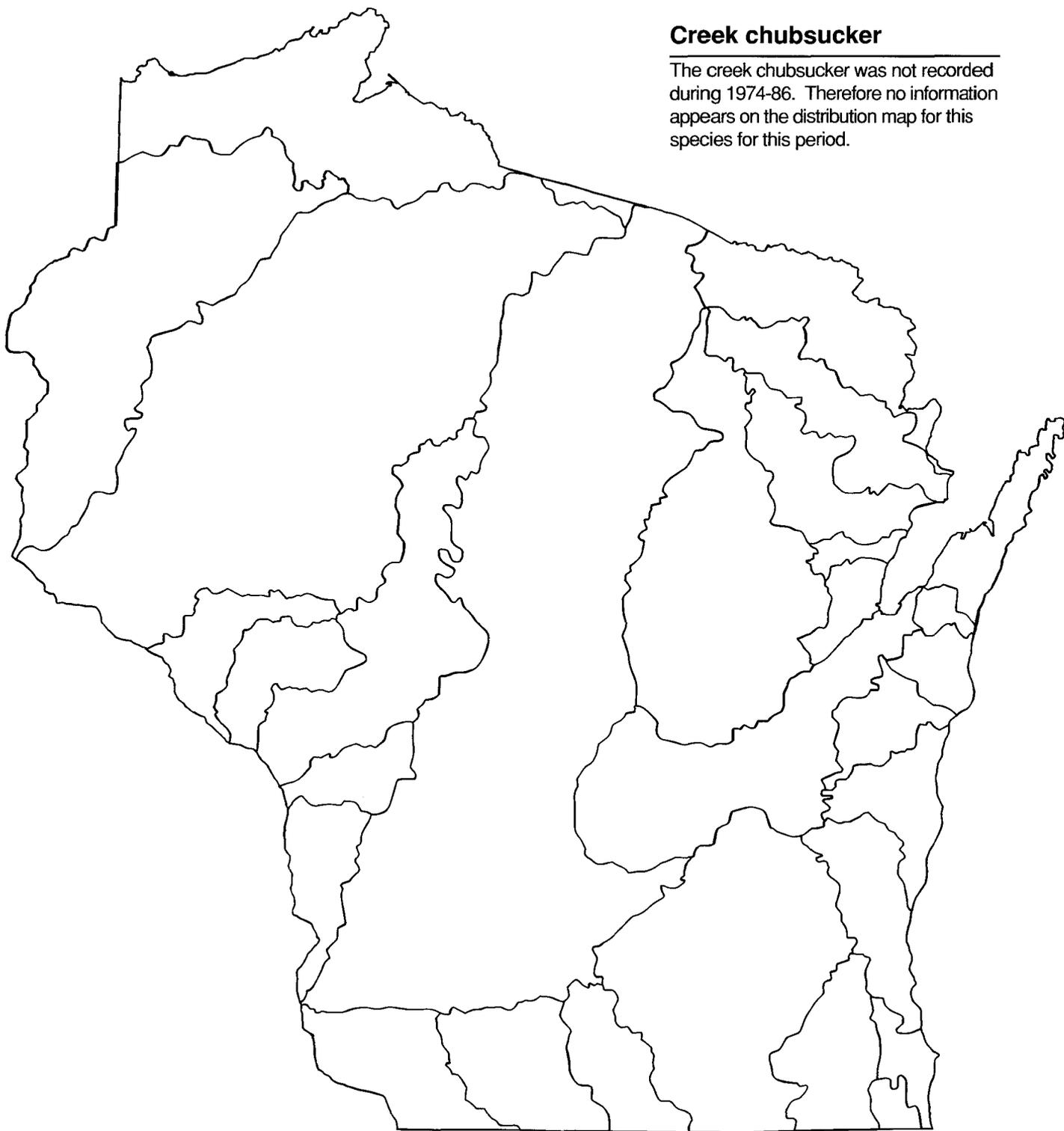


Map 82(E)

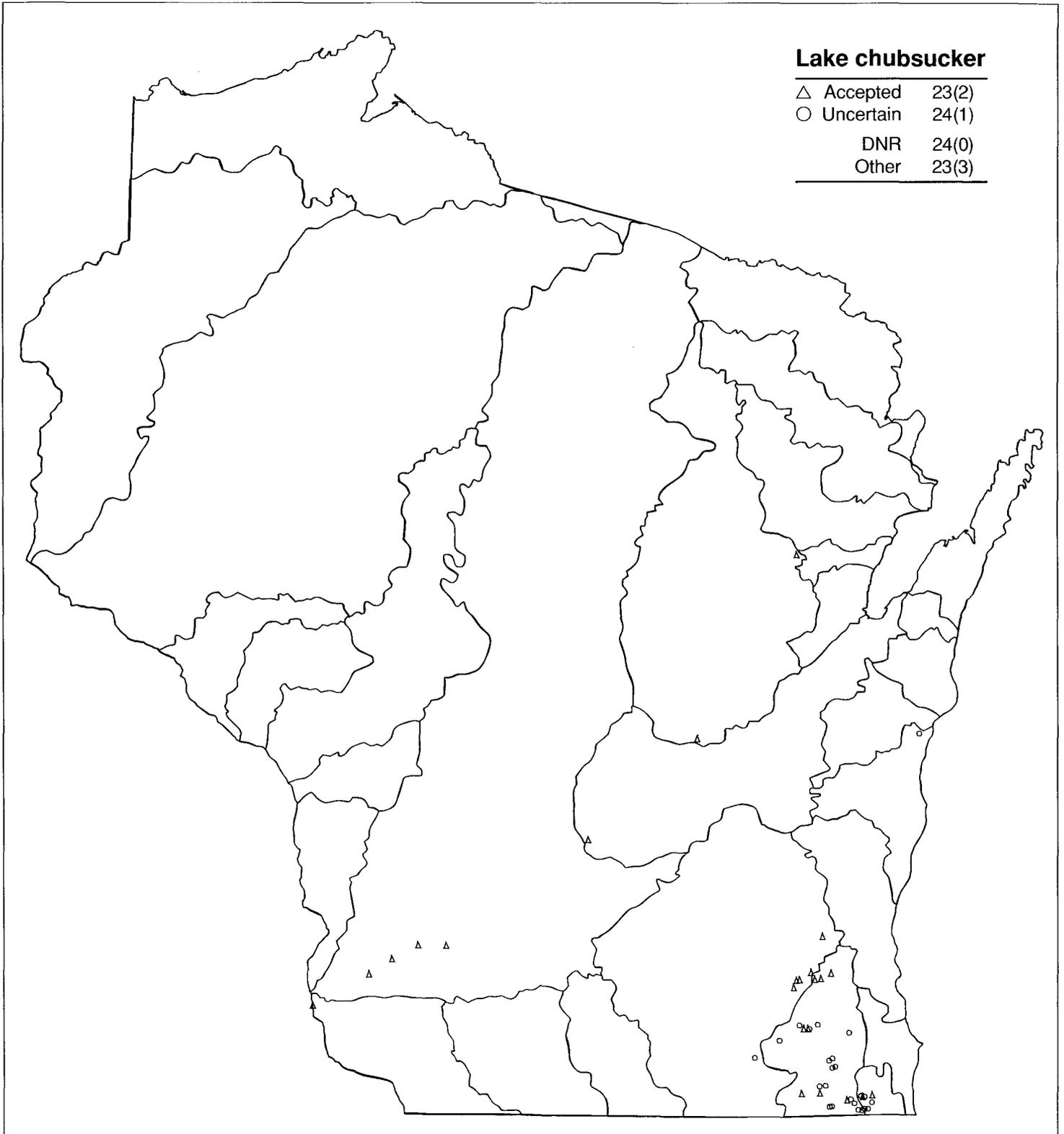


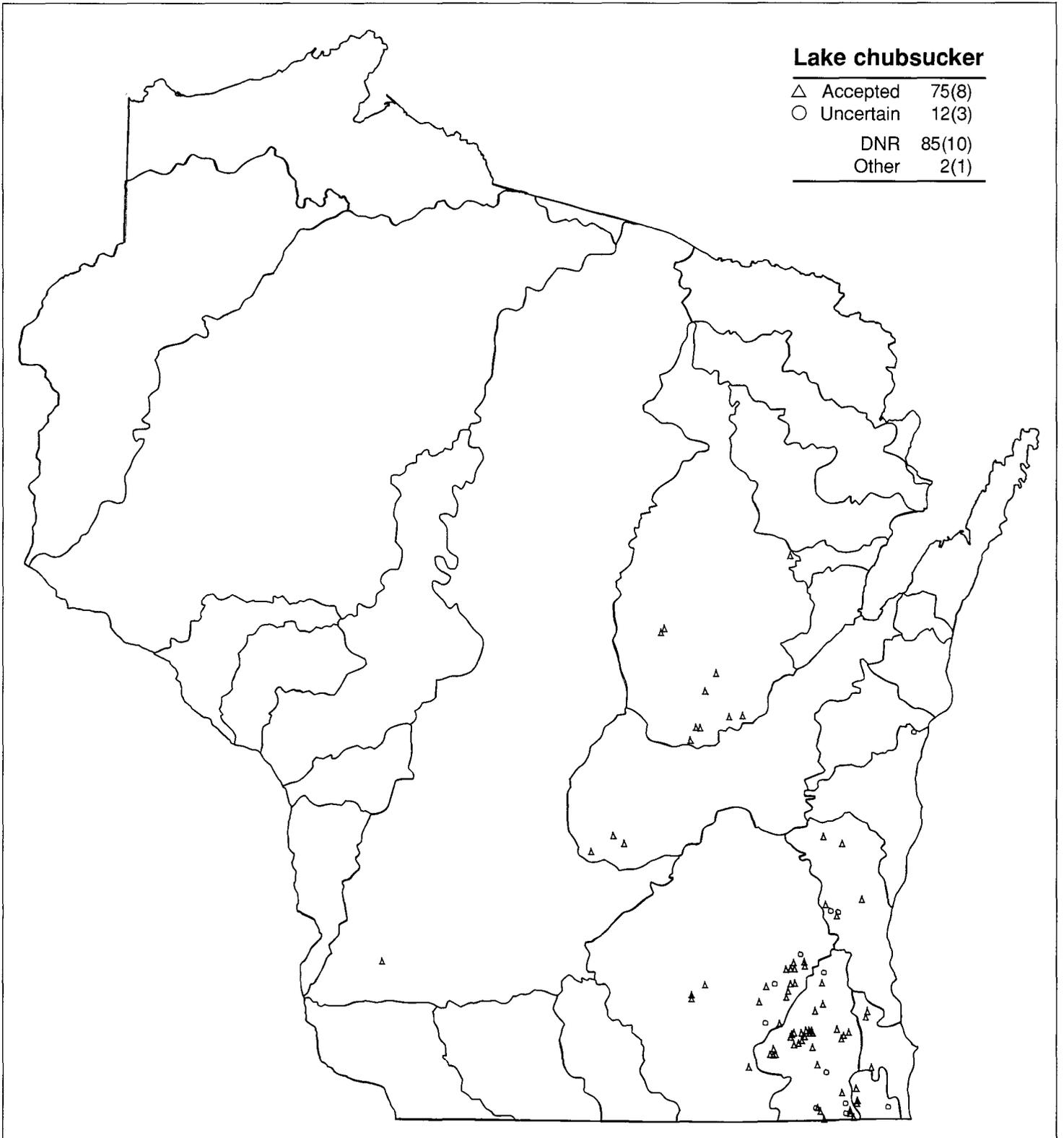
Creek chubsucker

The creek chubsucker was not recorded during 1974-86. Therefore no information appears on the distribution map for this species for this period.

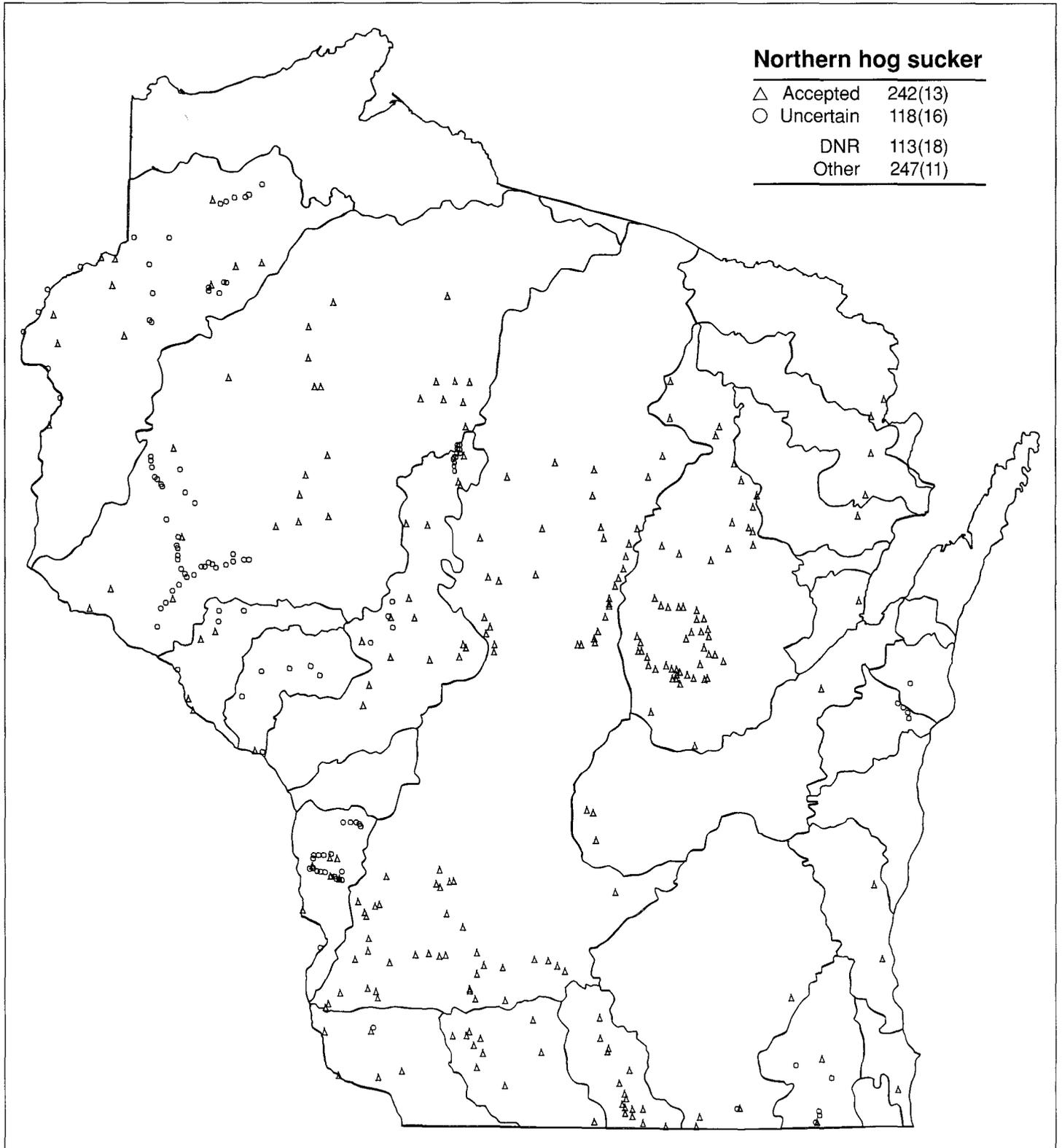


Map 83(E)

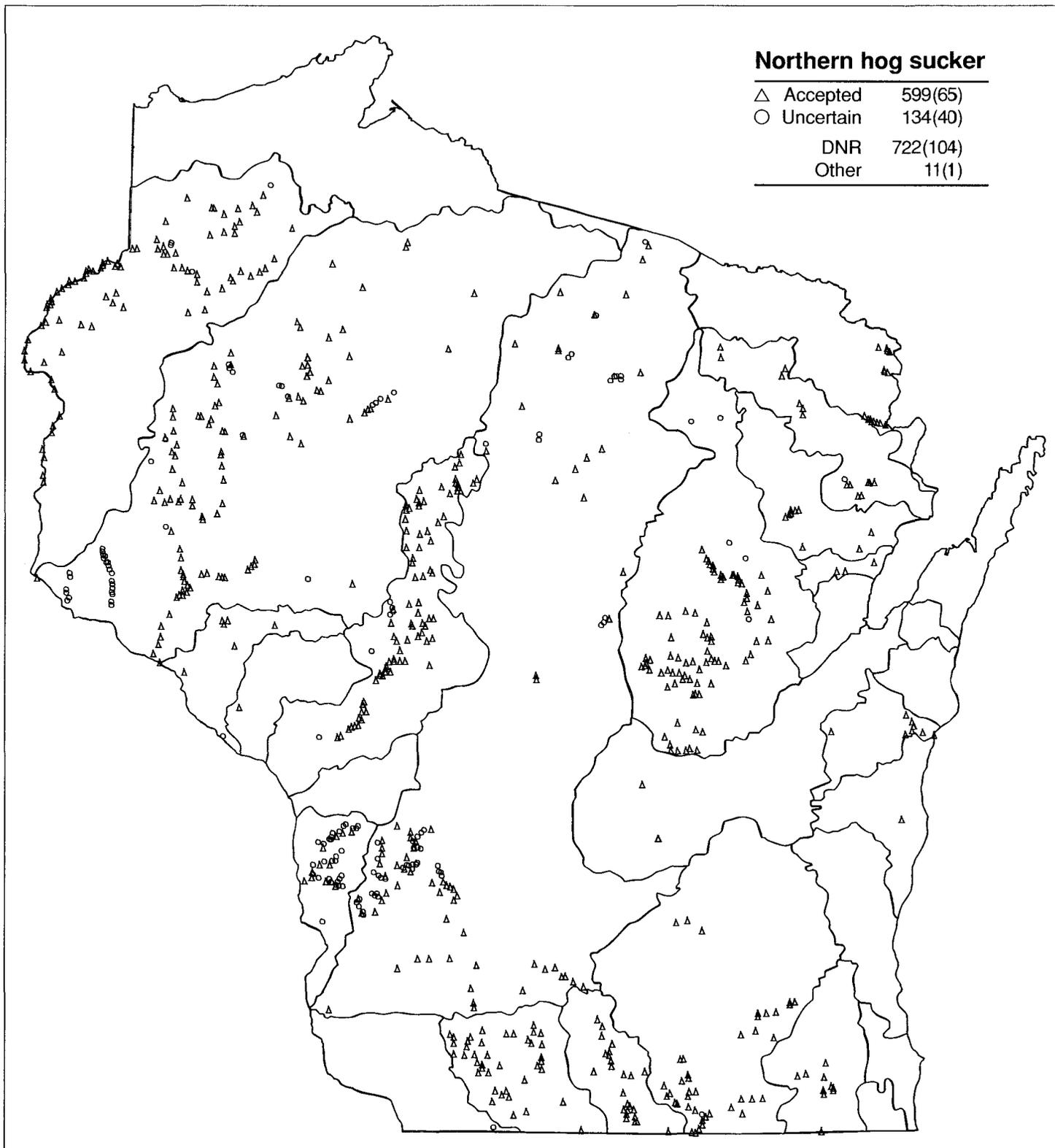




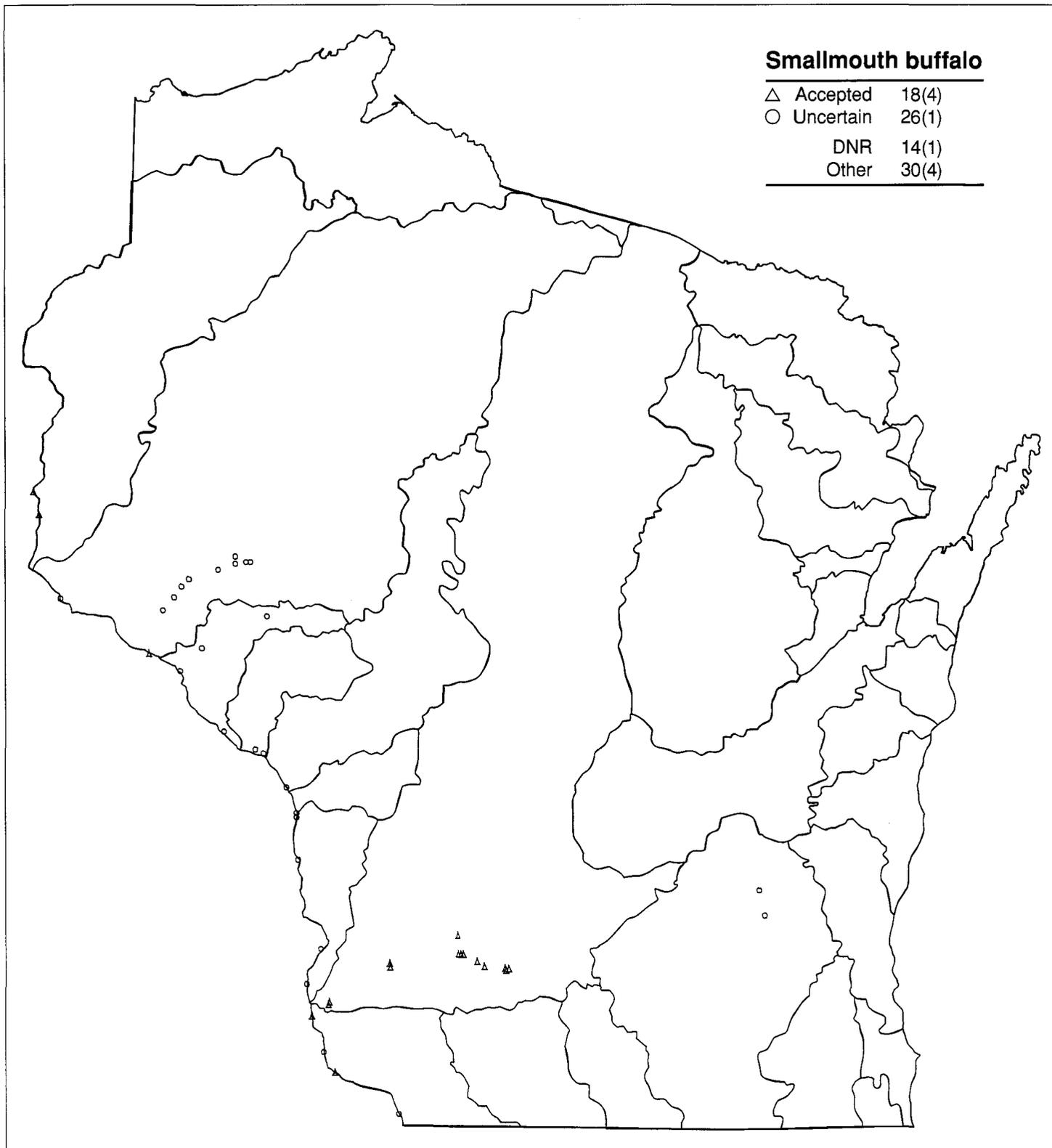
Map 84(E)



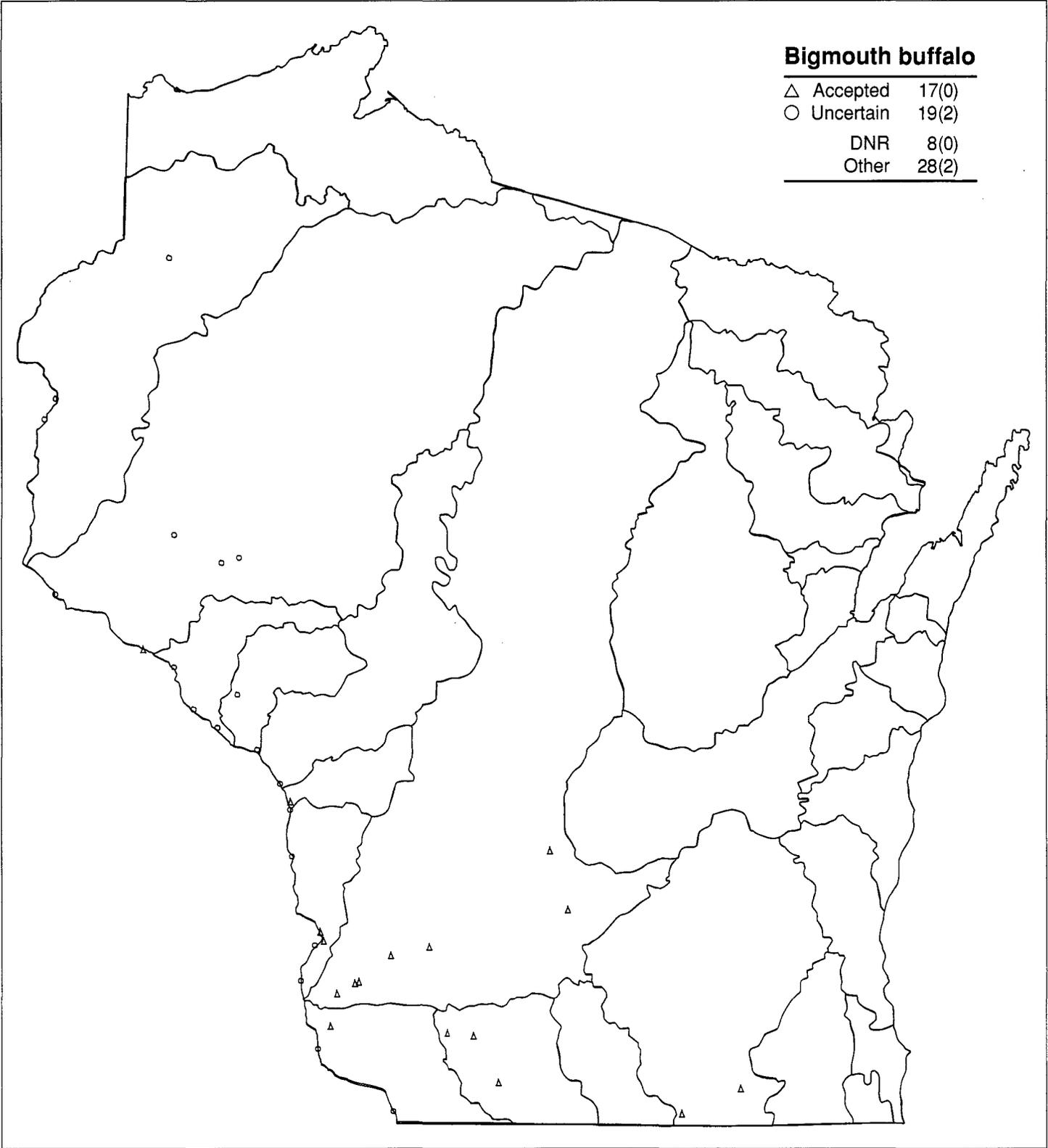
Map 84(L)

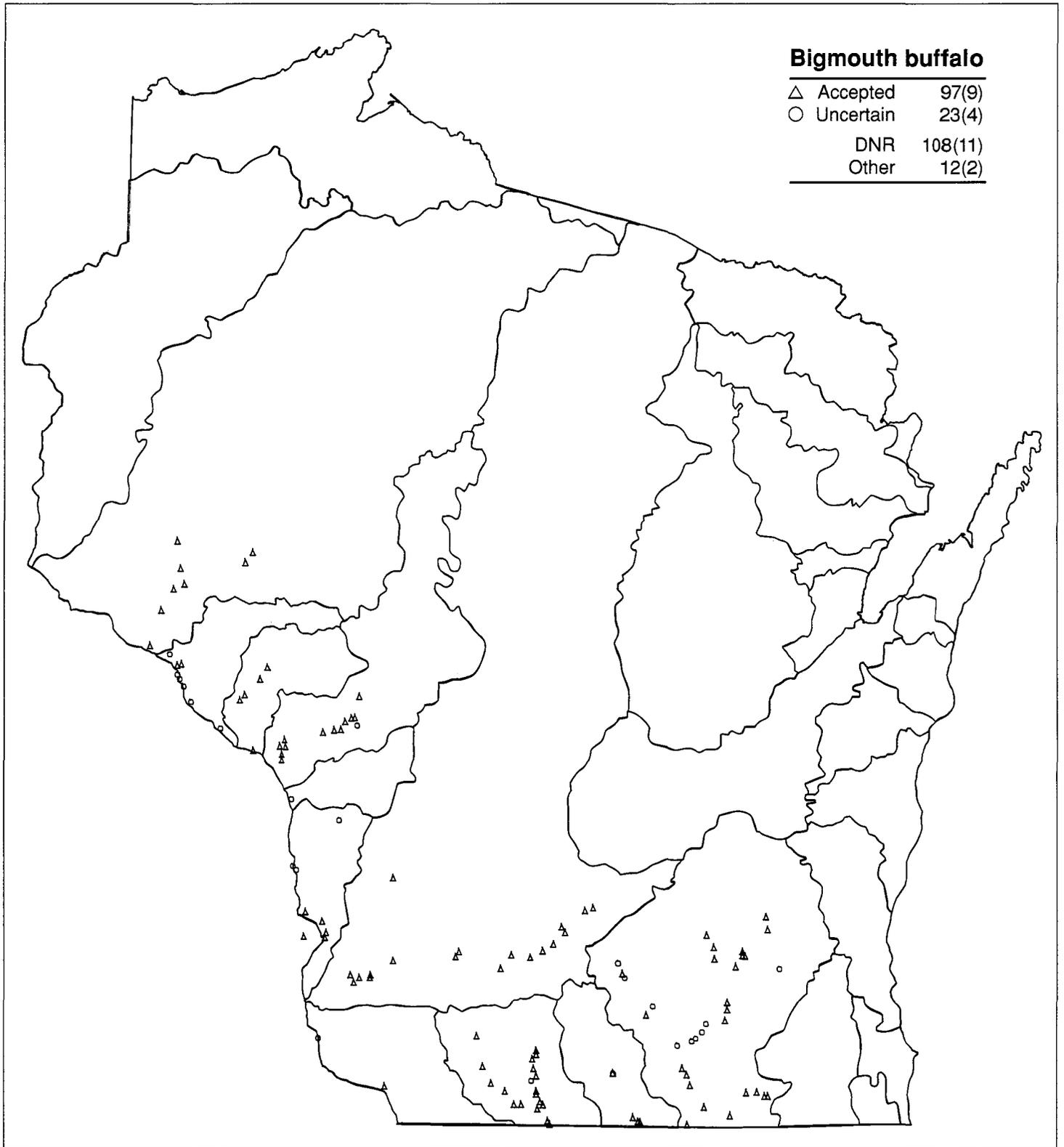


Map 85(E)

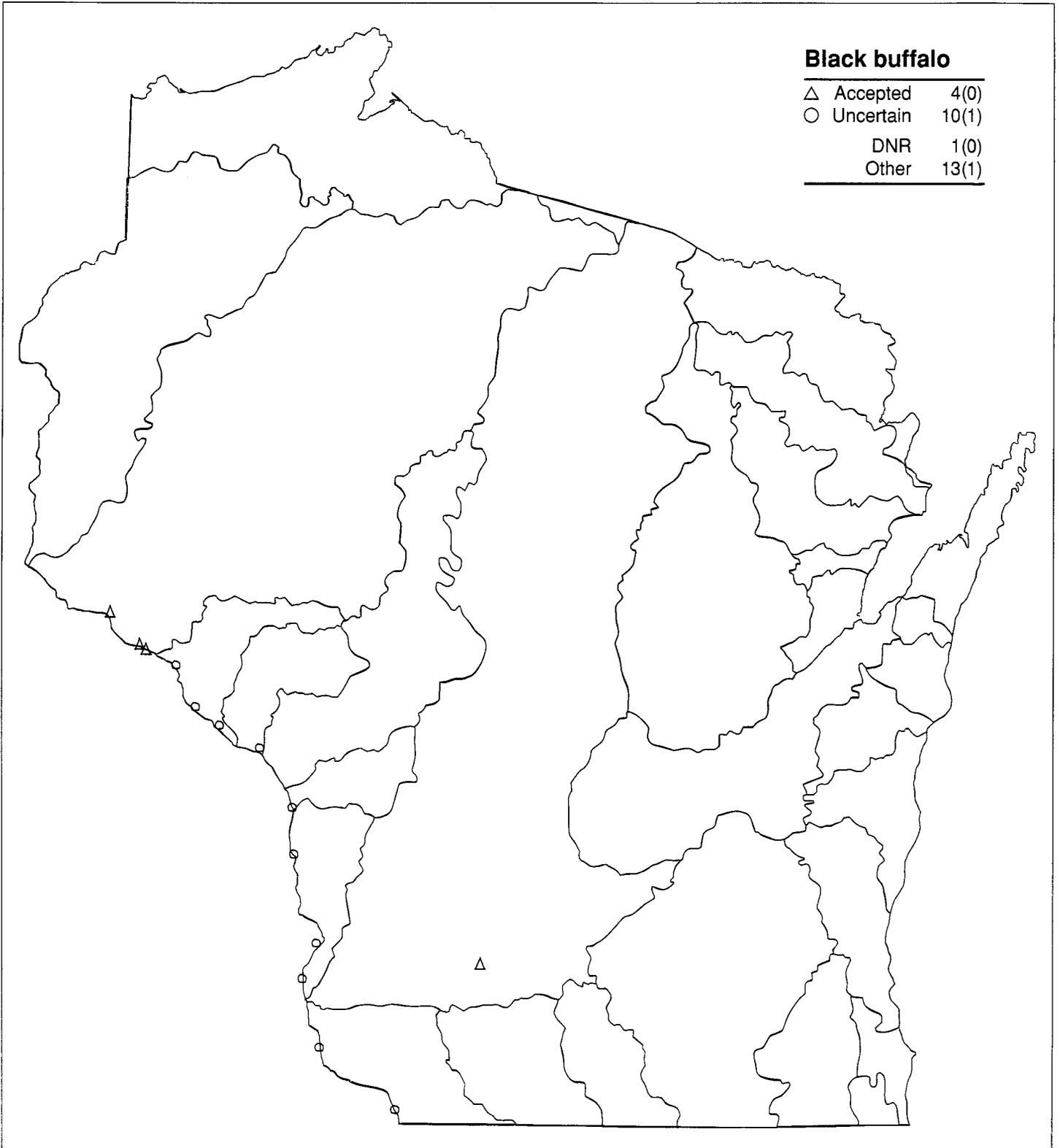


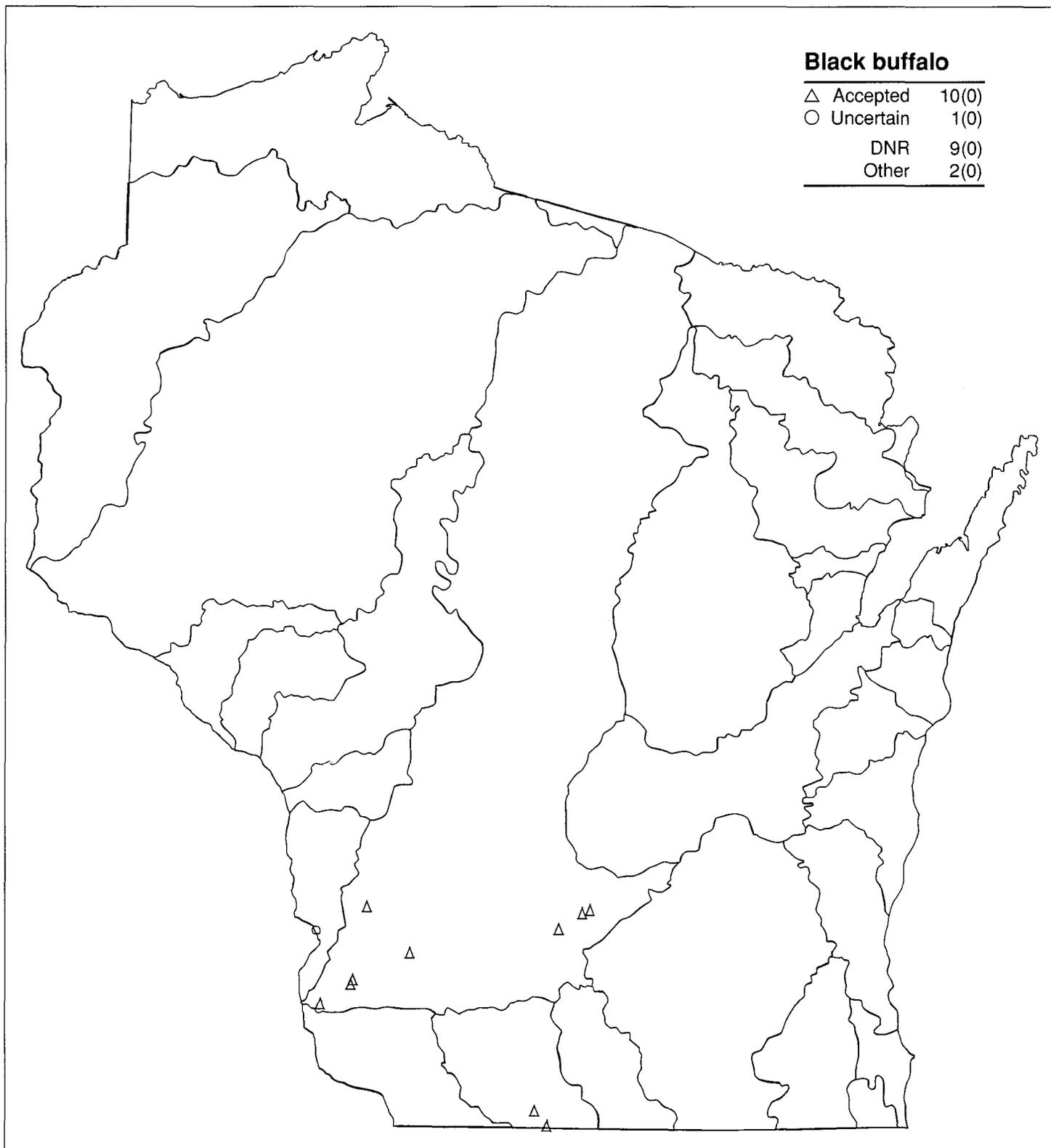
Map 86(E)



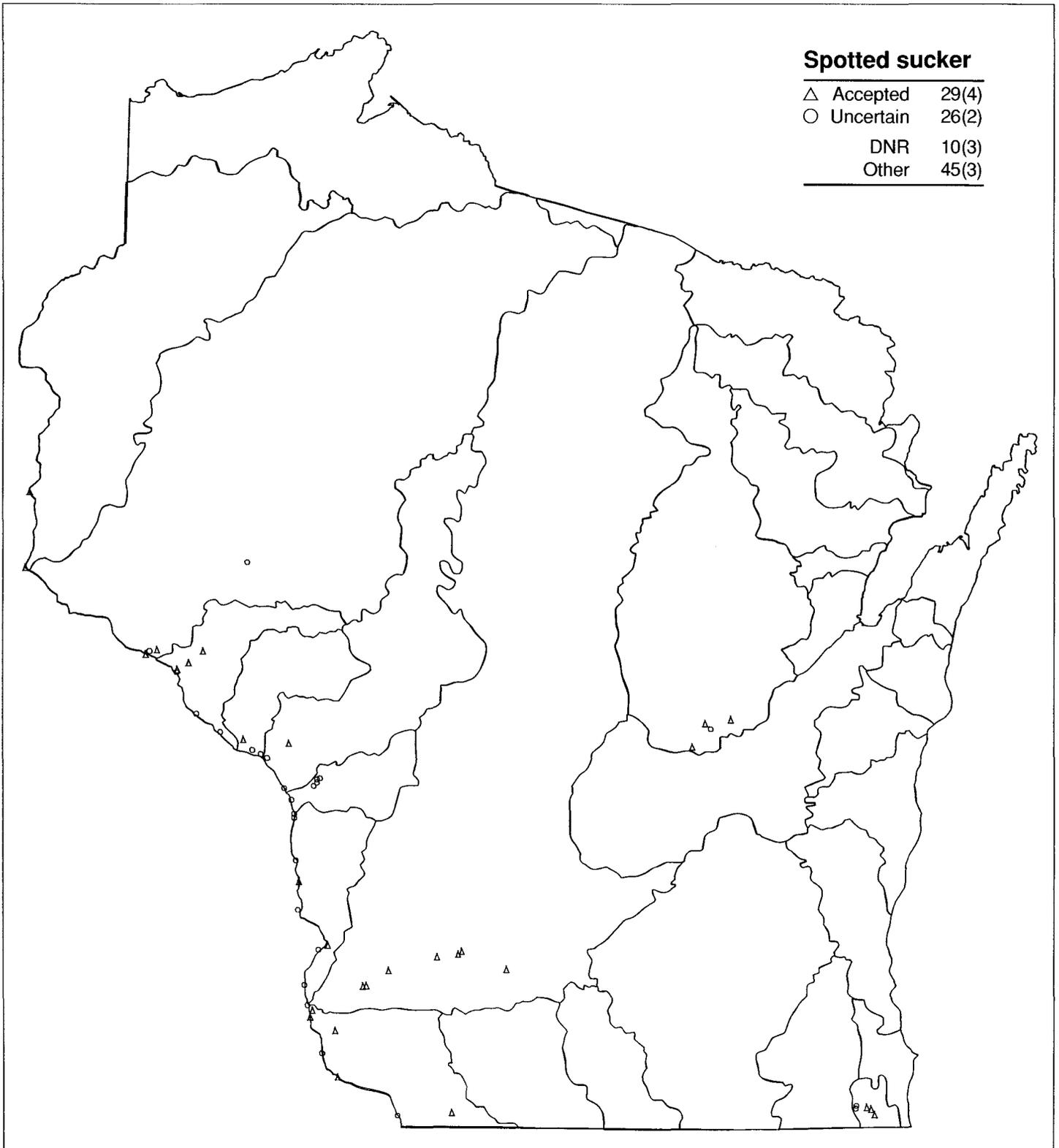


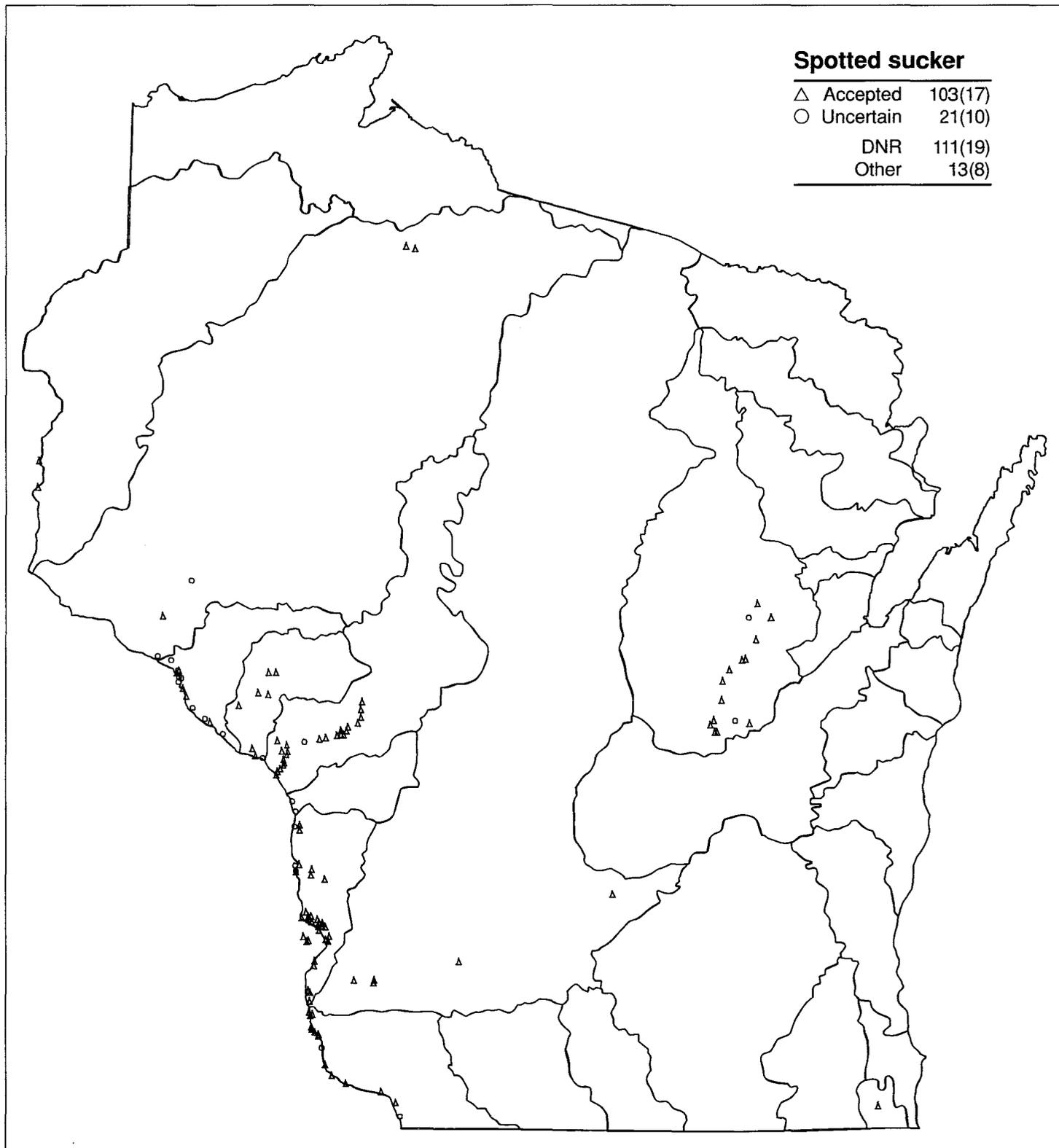
Map 87(E)



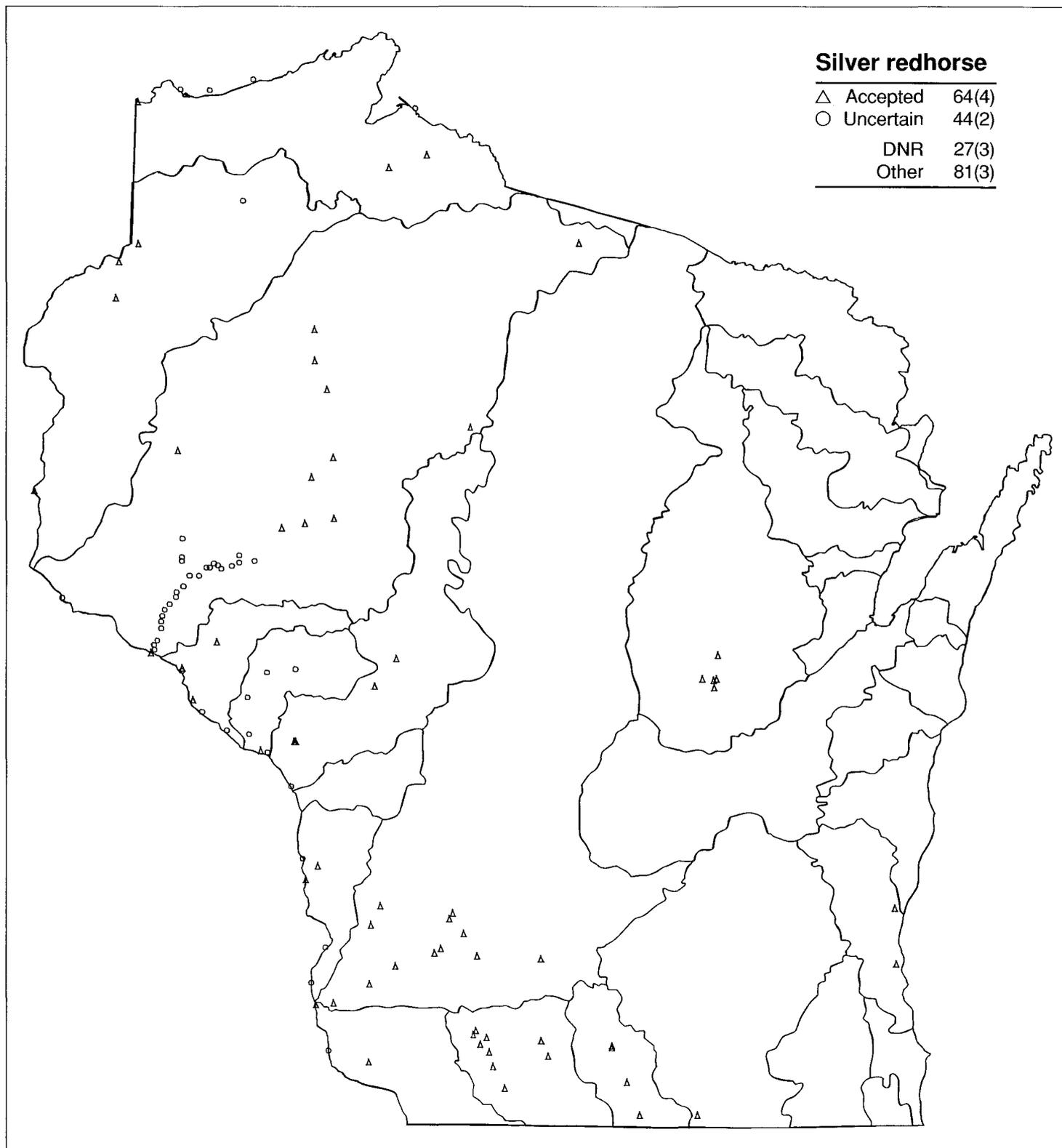


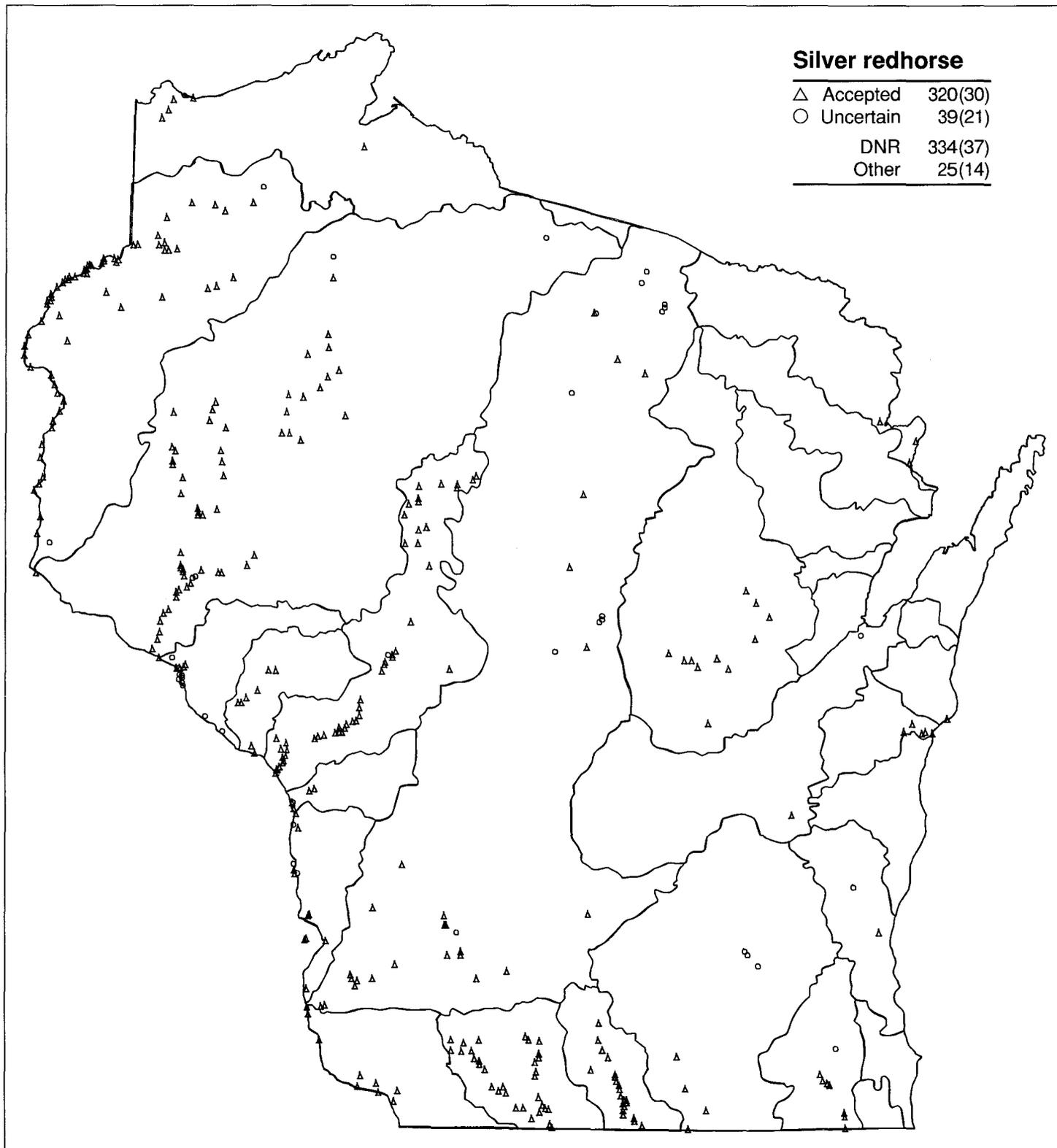
Map 88(E)



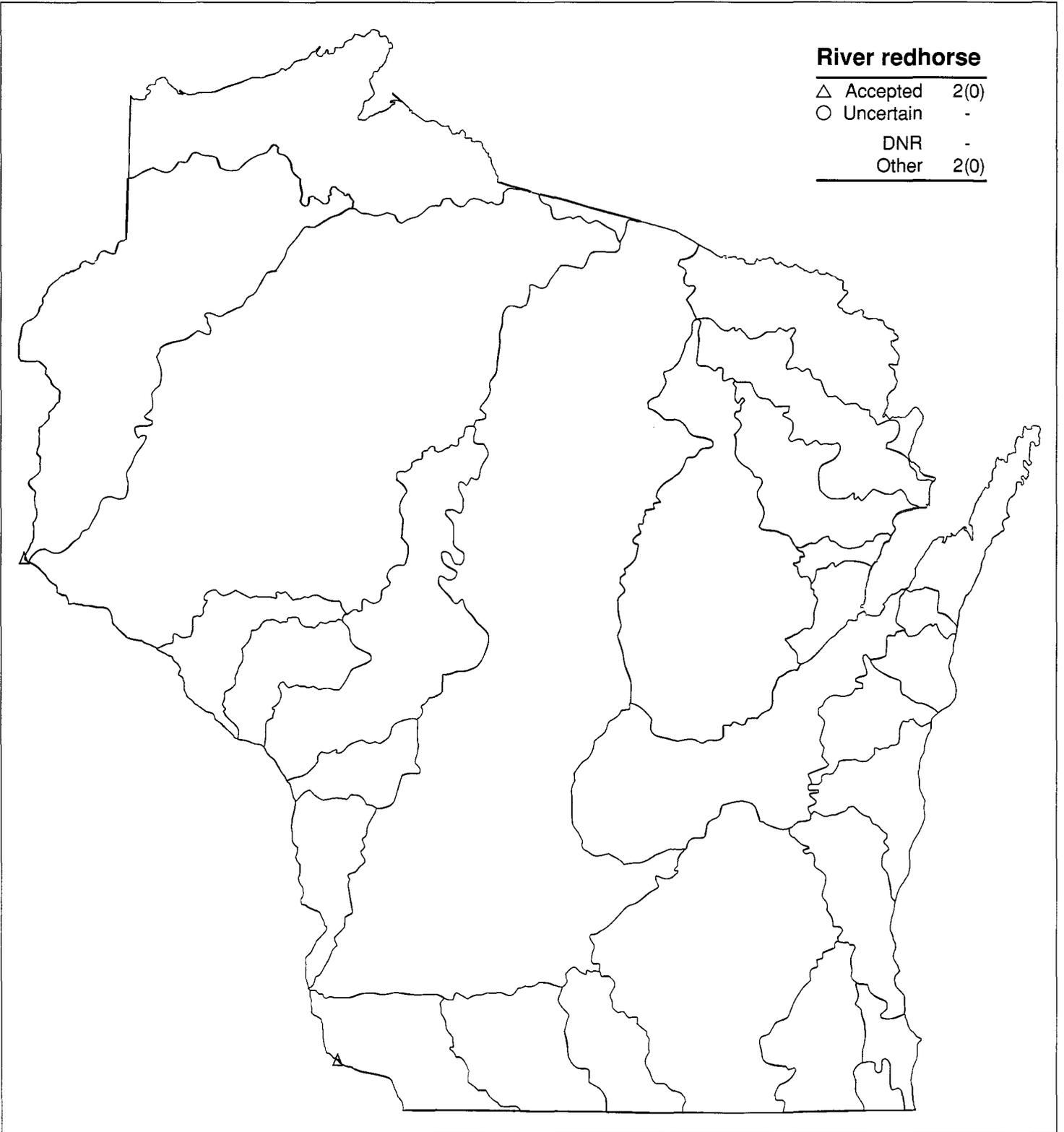


Map 89(E)

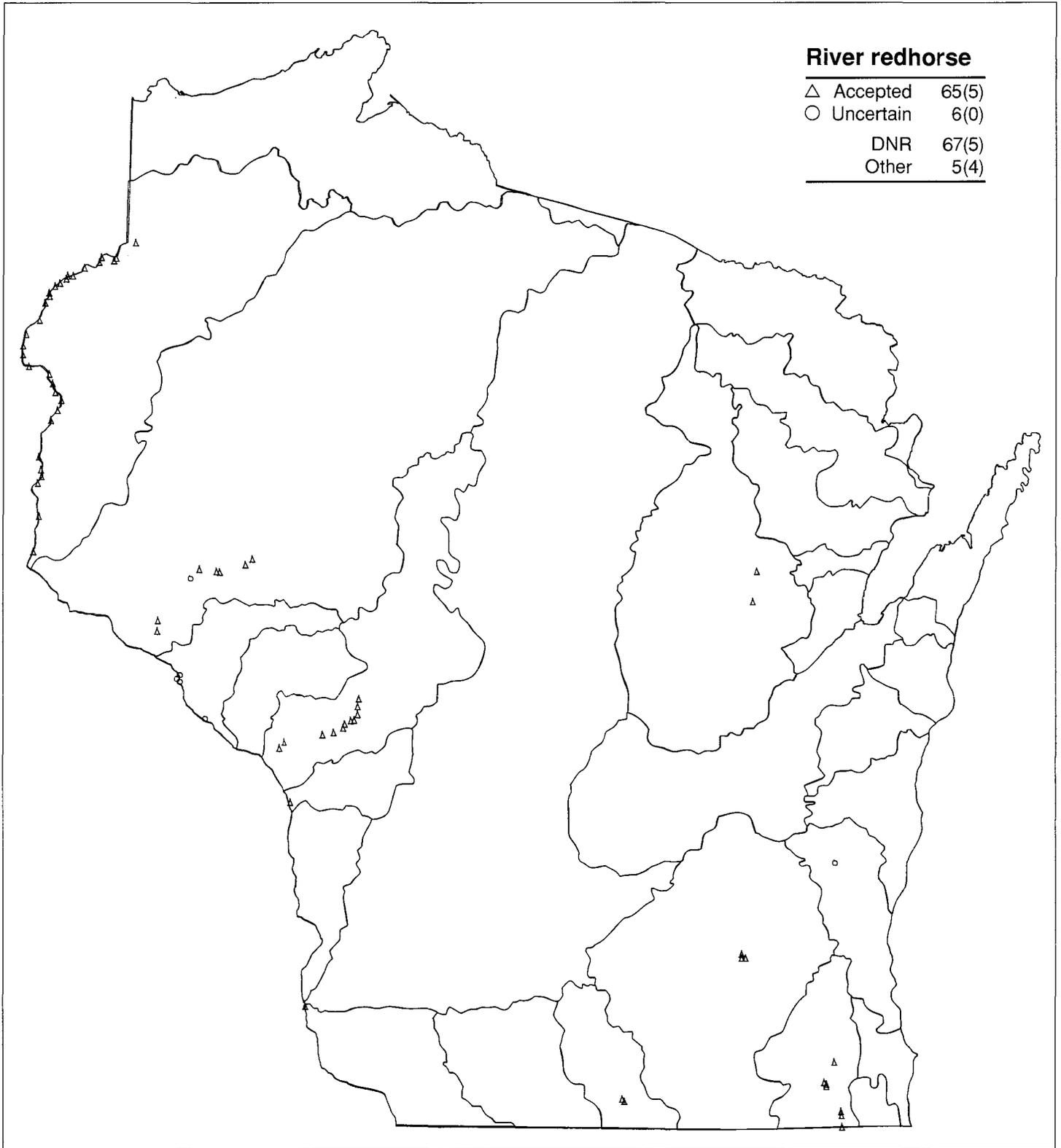




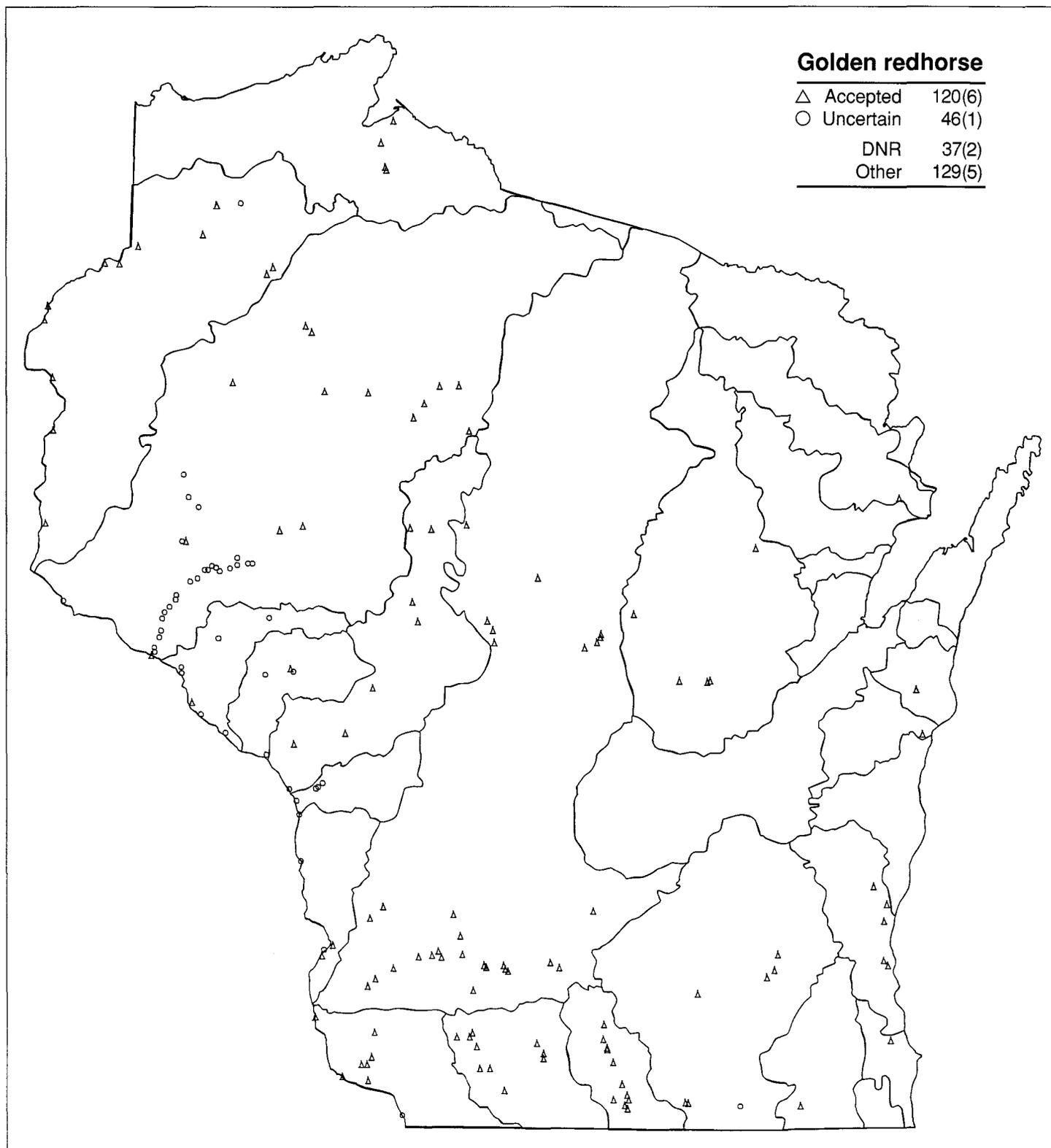
Map 90(E)



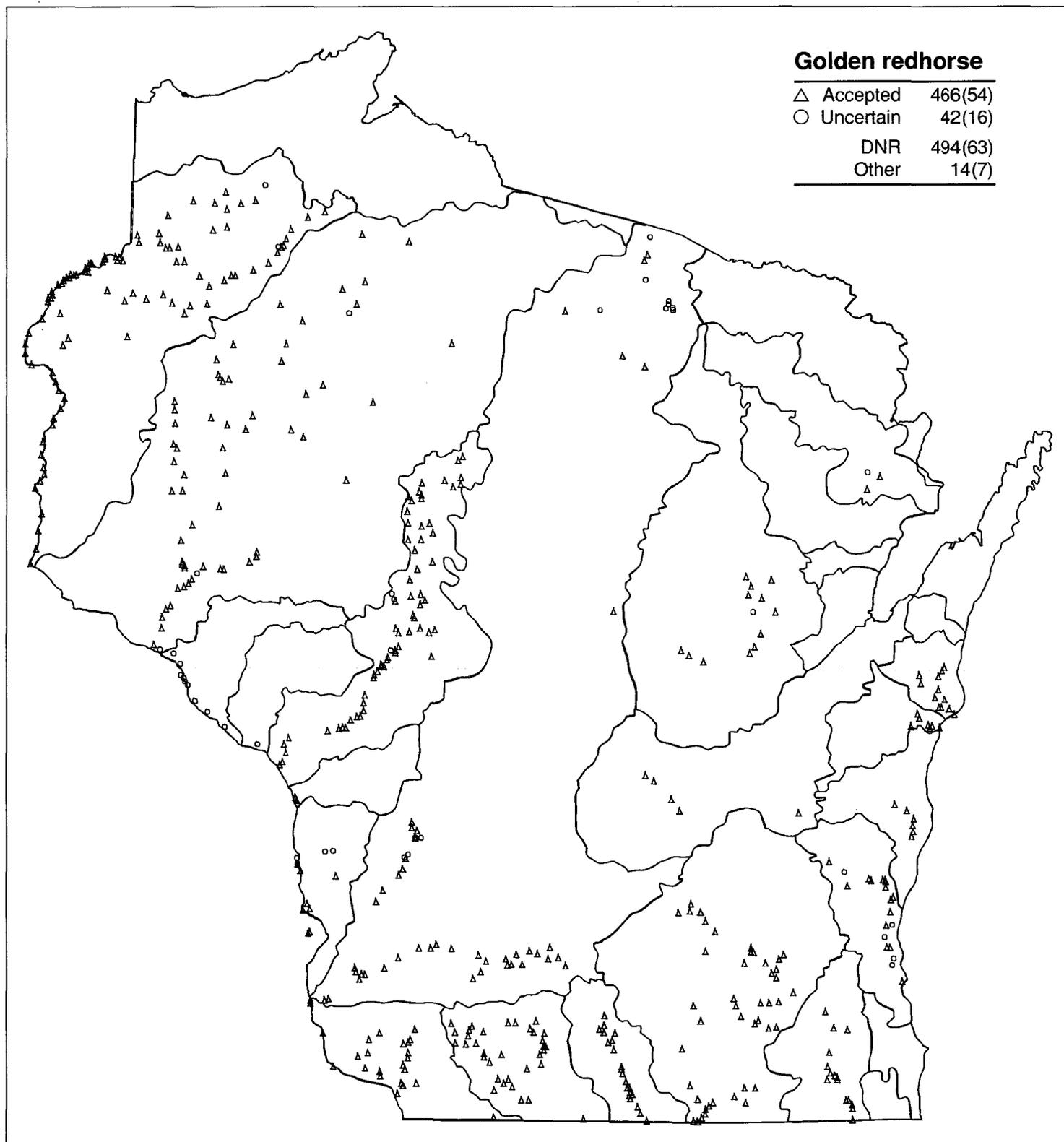
Map 90(L)



Map 91(E)

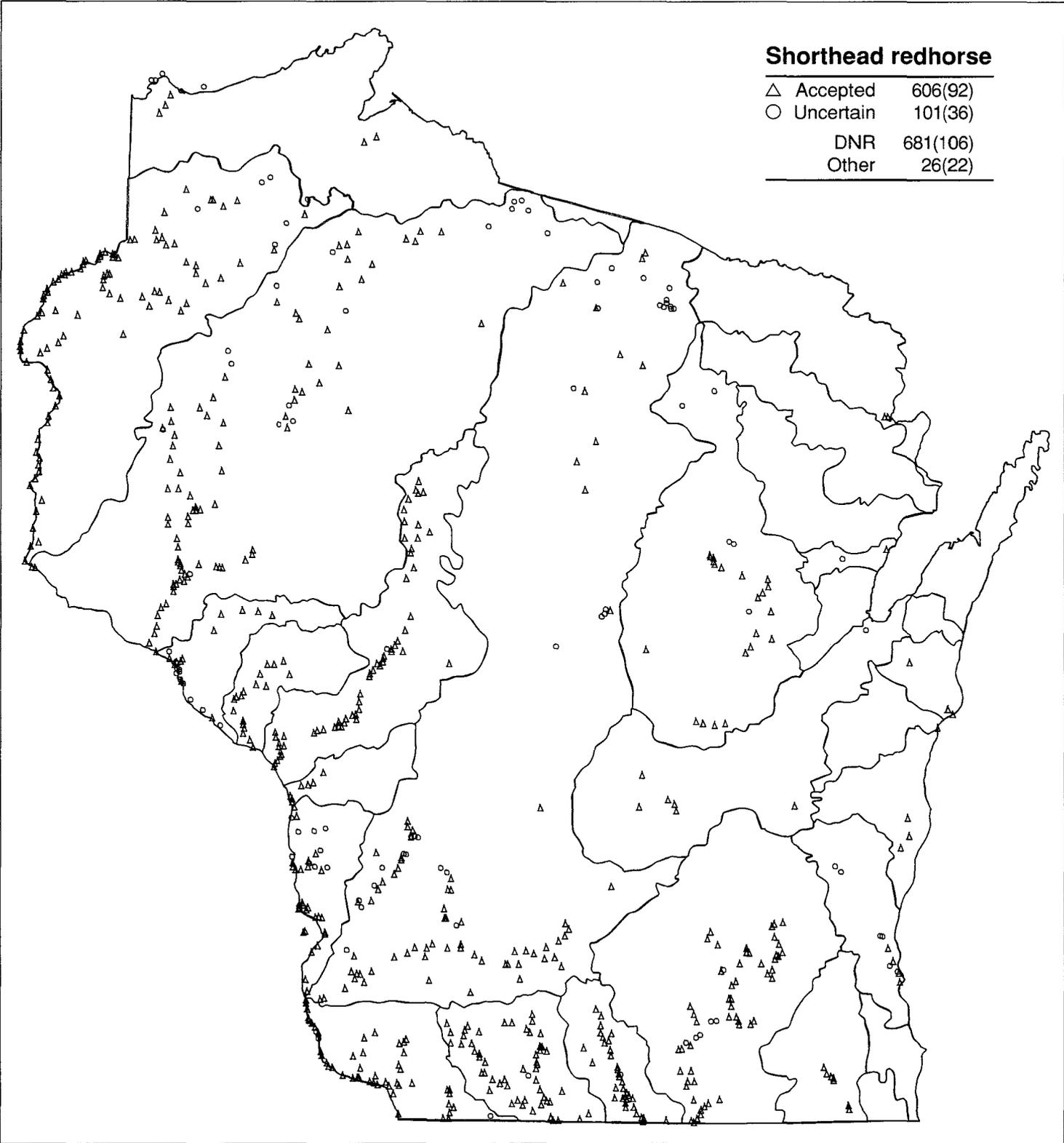


Map 91(L)



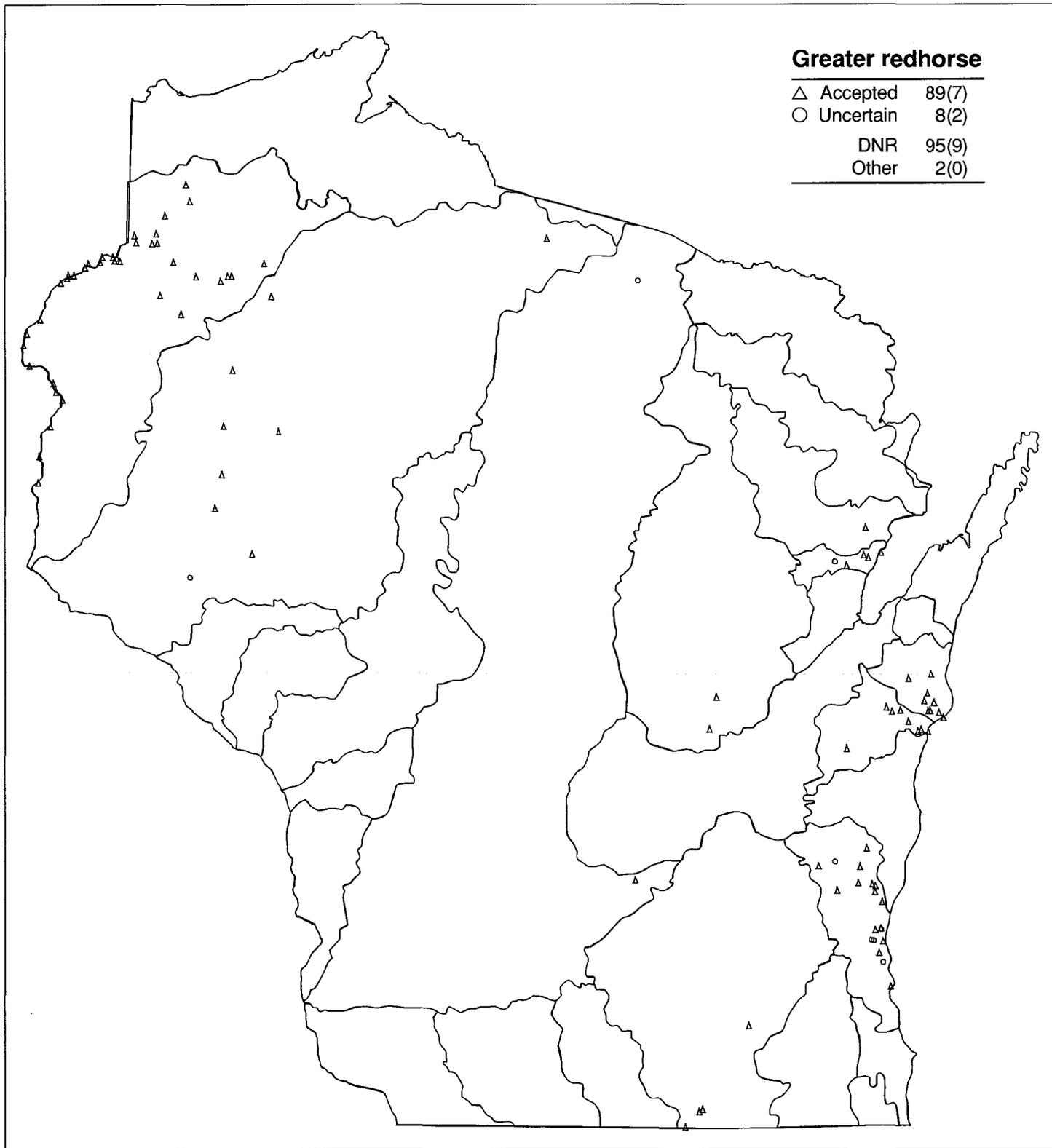
Map 92(E)



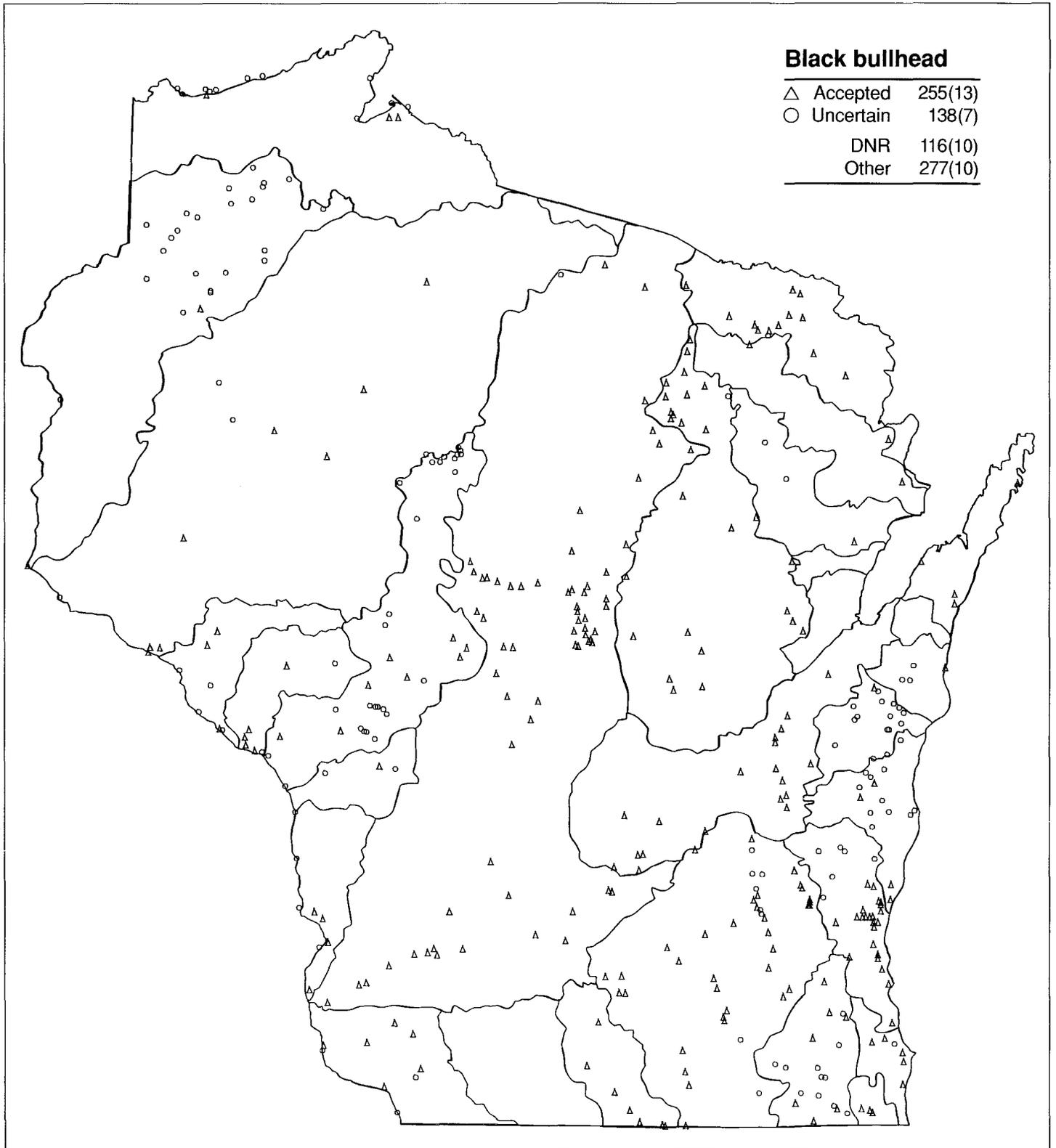


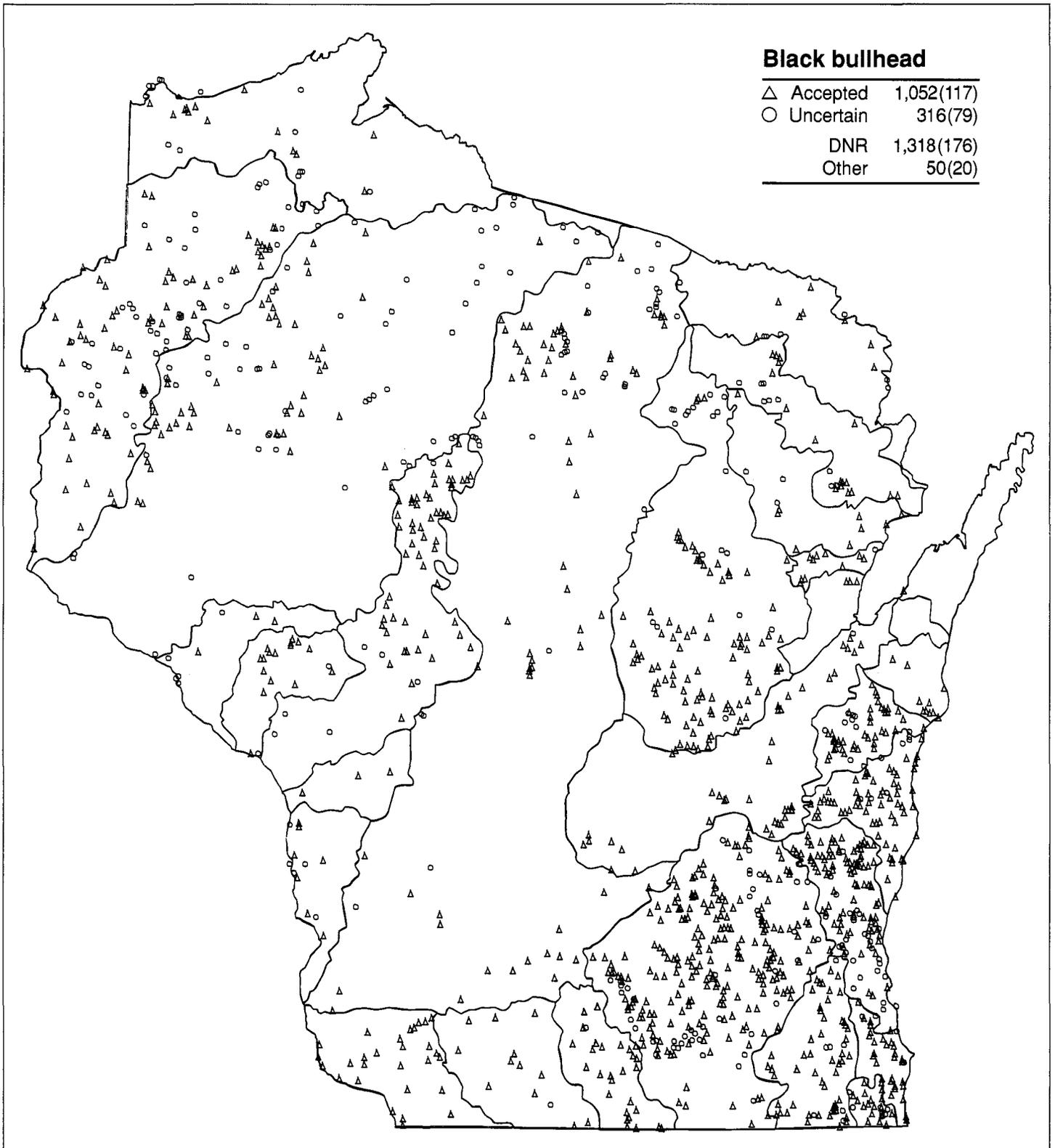
Map 93(E)



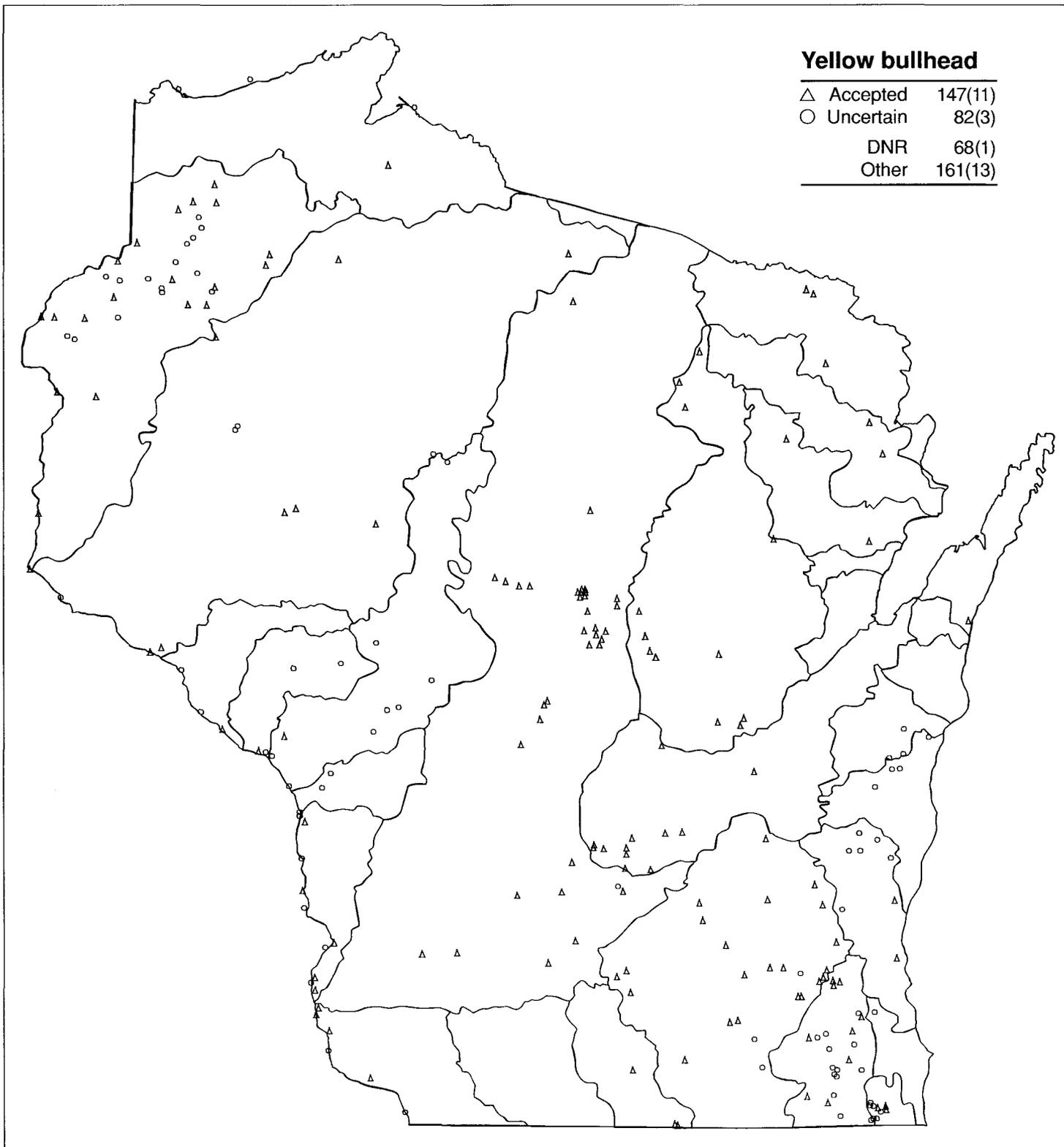


Map 94(E)





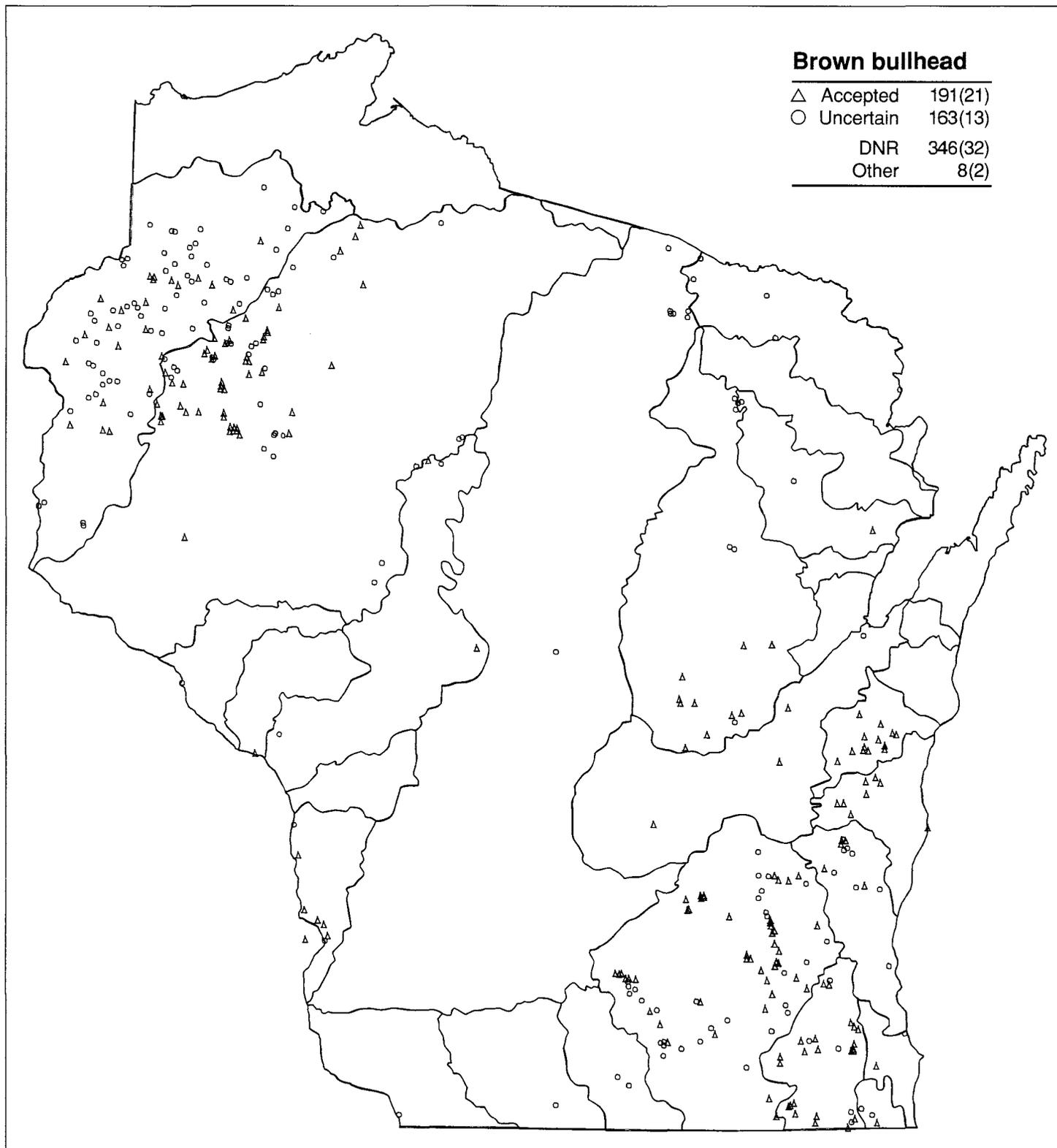
Map 95(E)



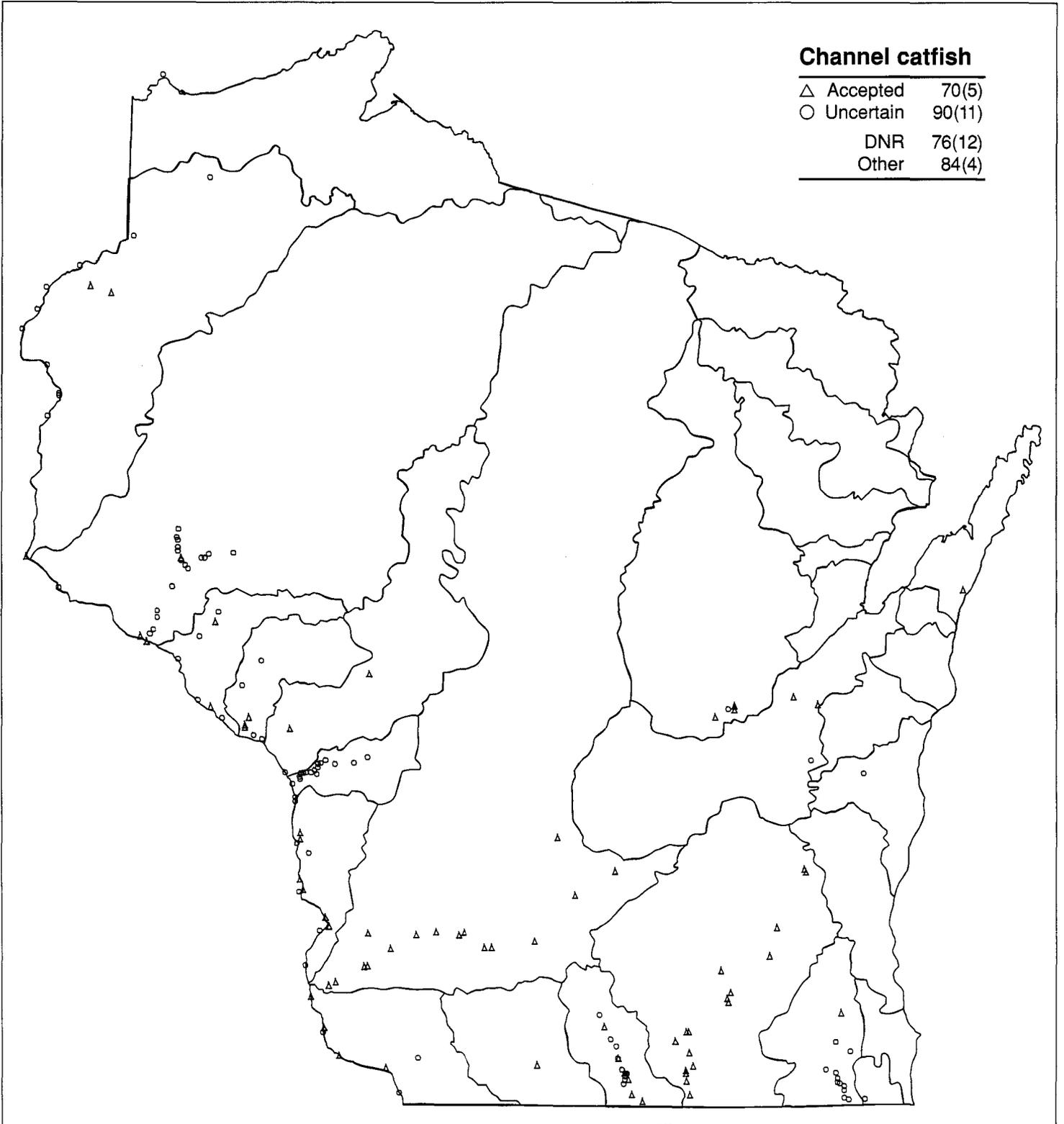


Map 96(E)

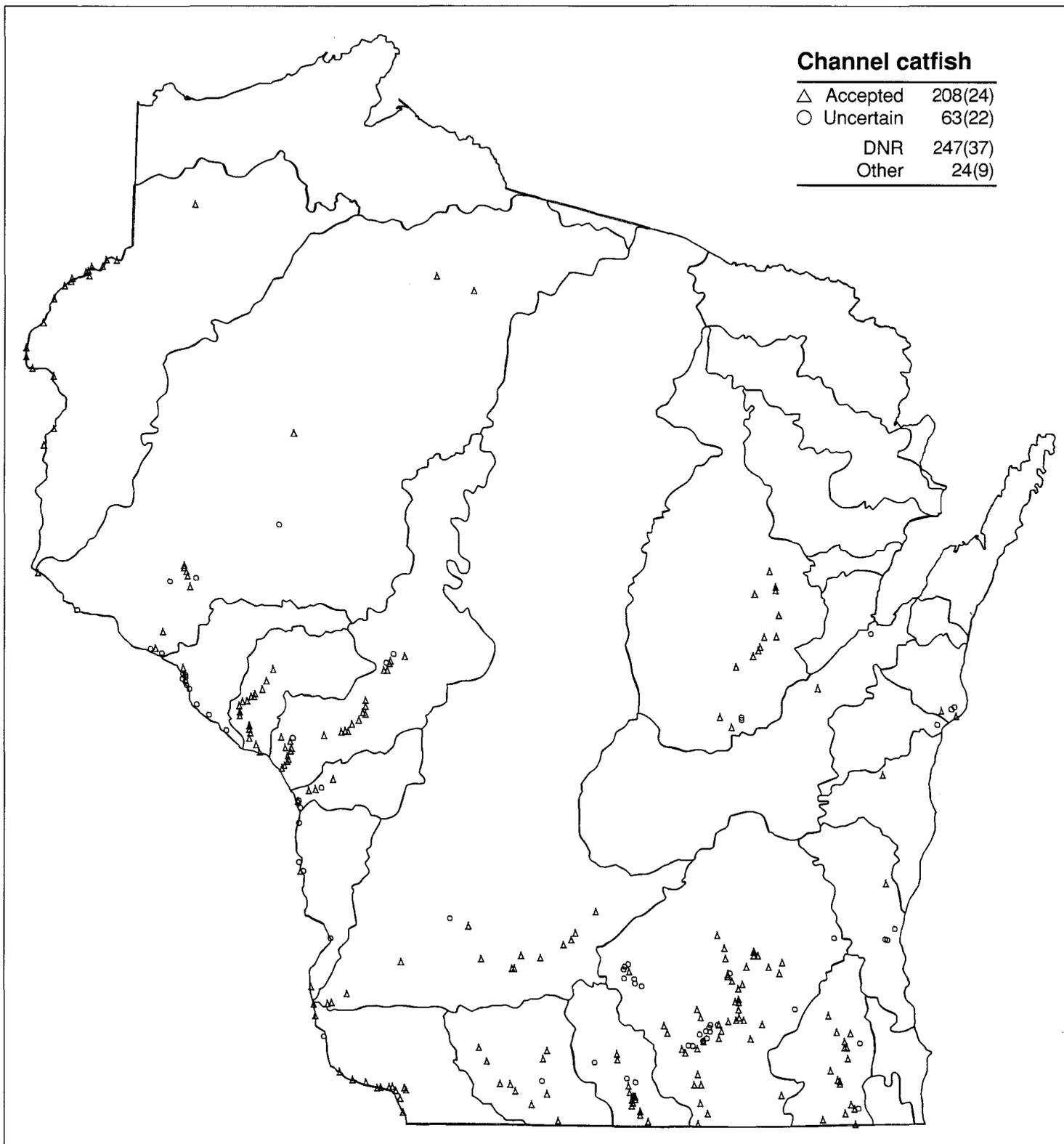




Map 97(E)



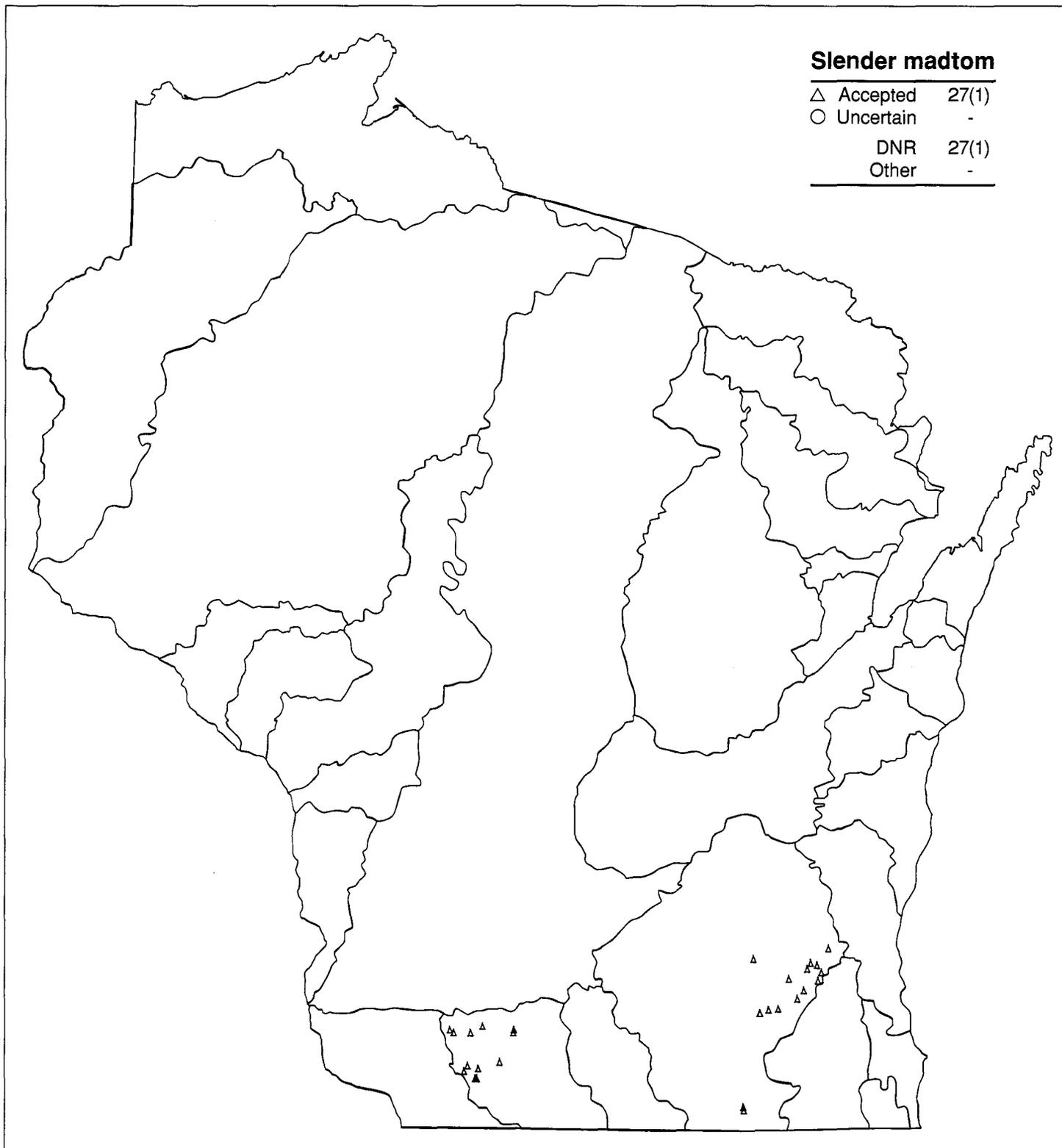
Map 97(L)



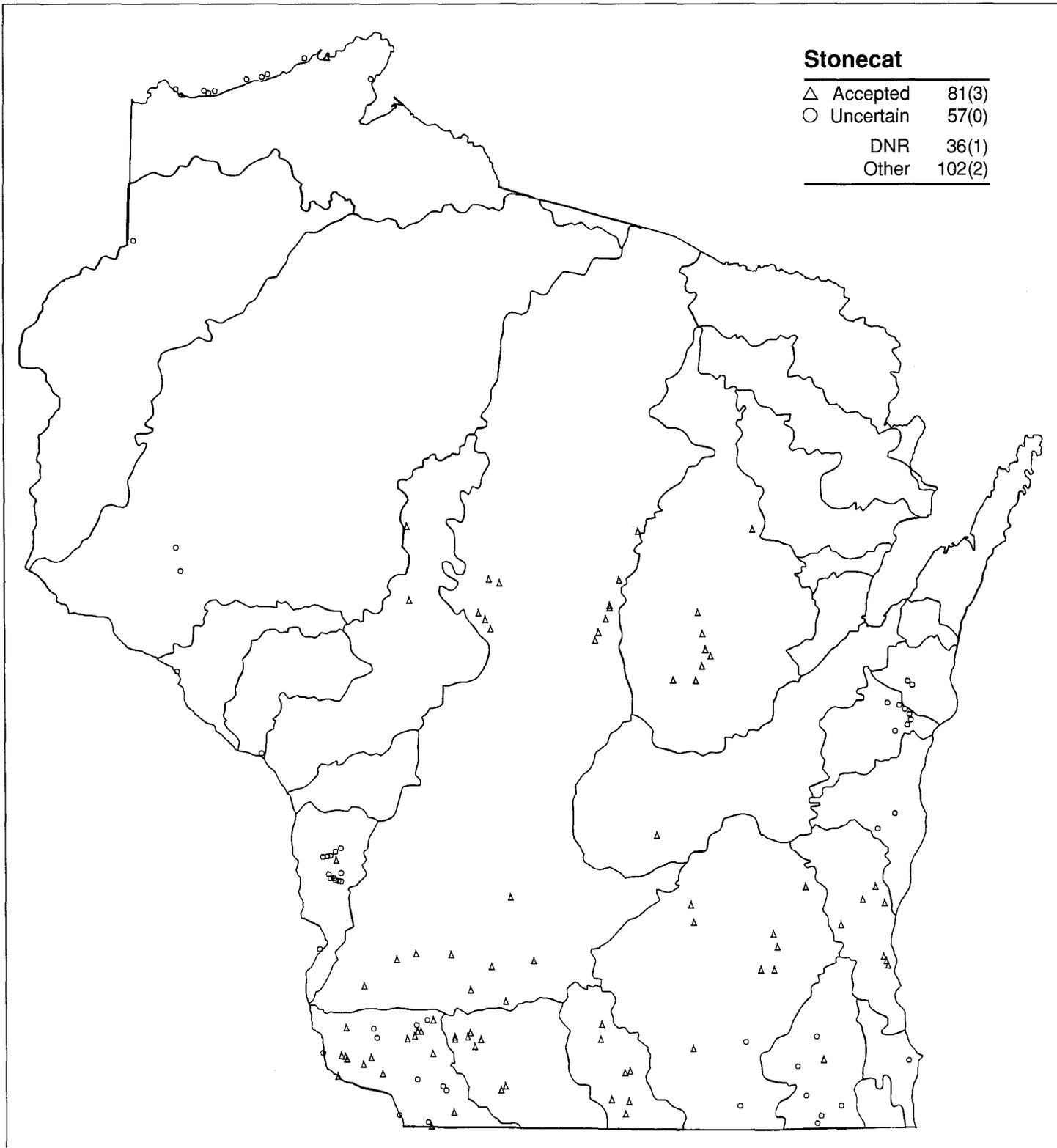
Map 98(E)

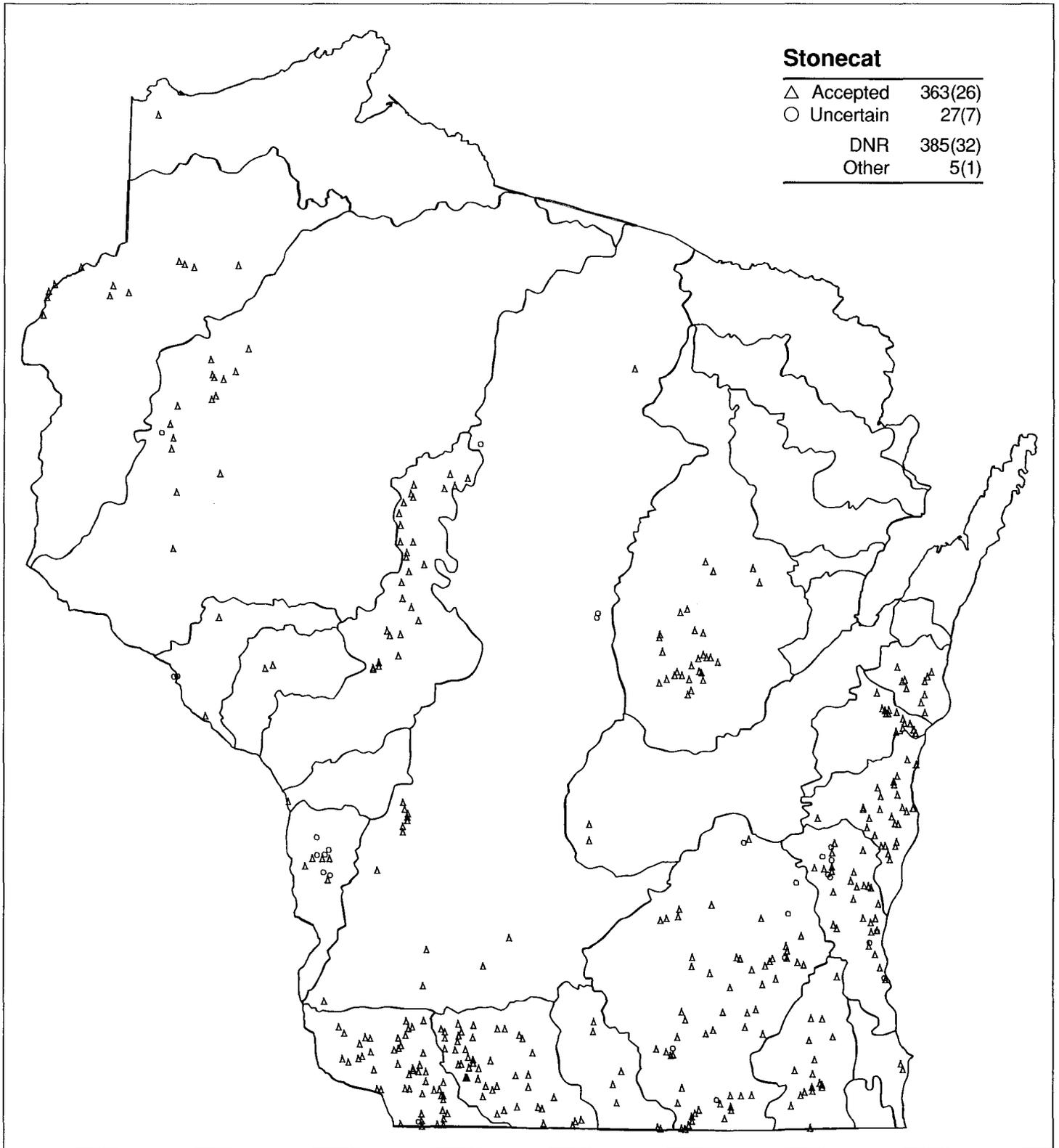


Map 98(L)

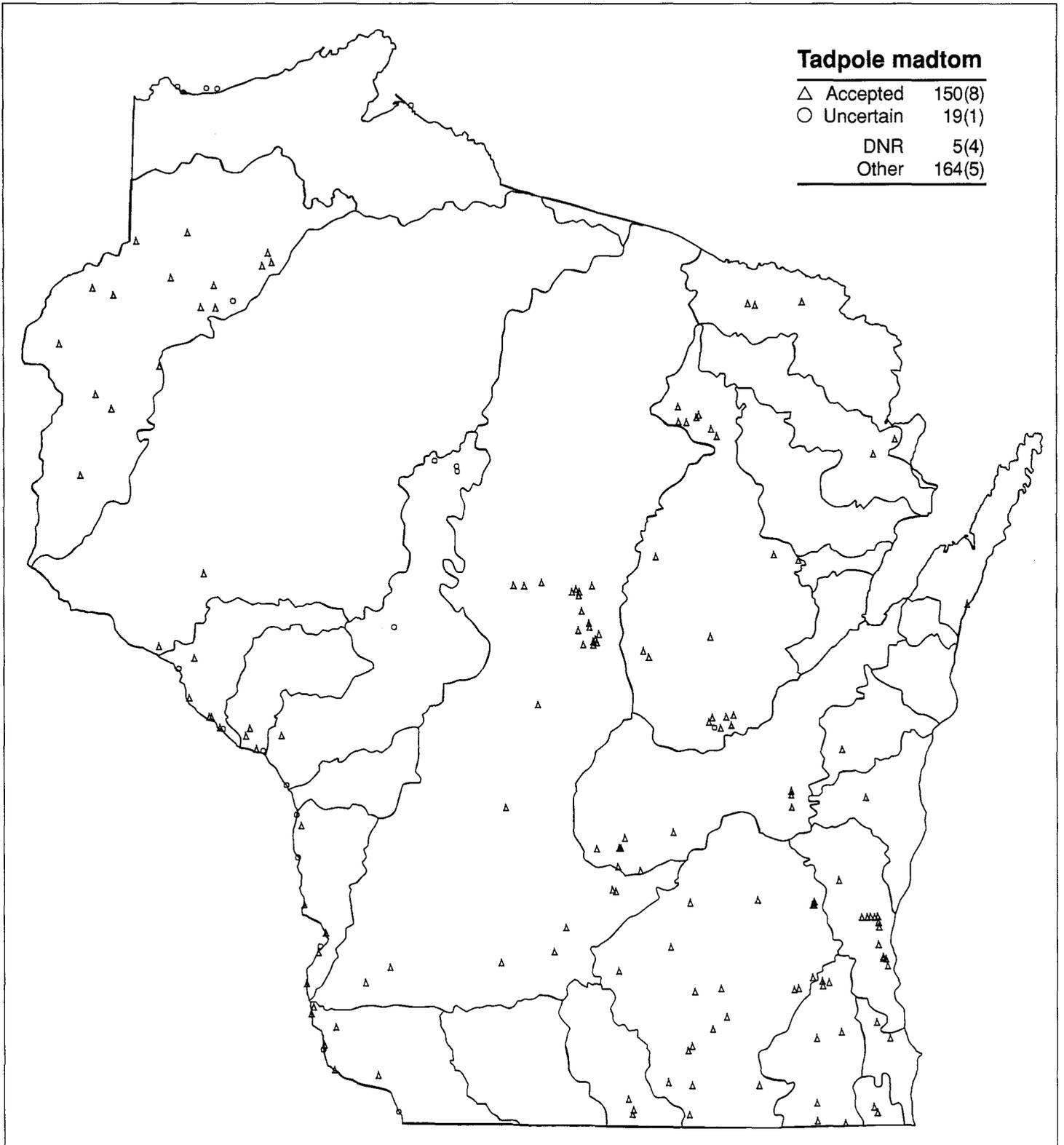


Map 99(E)



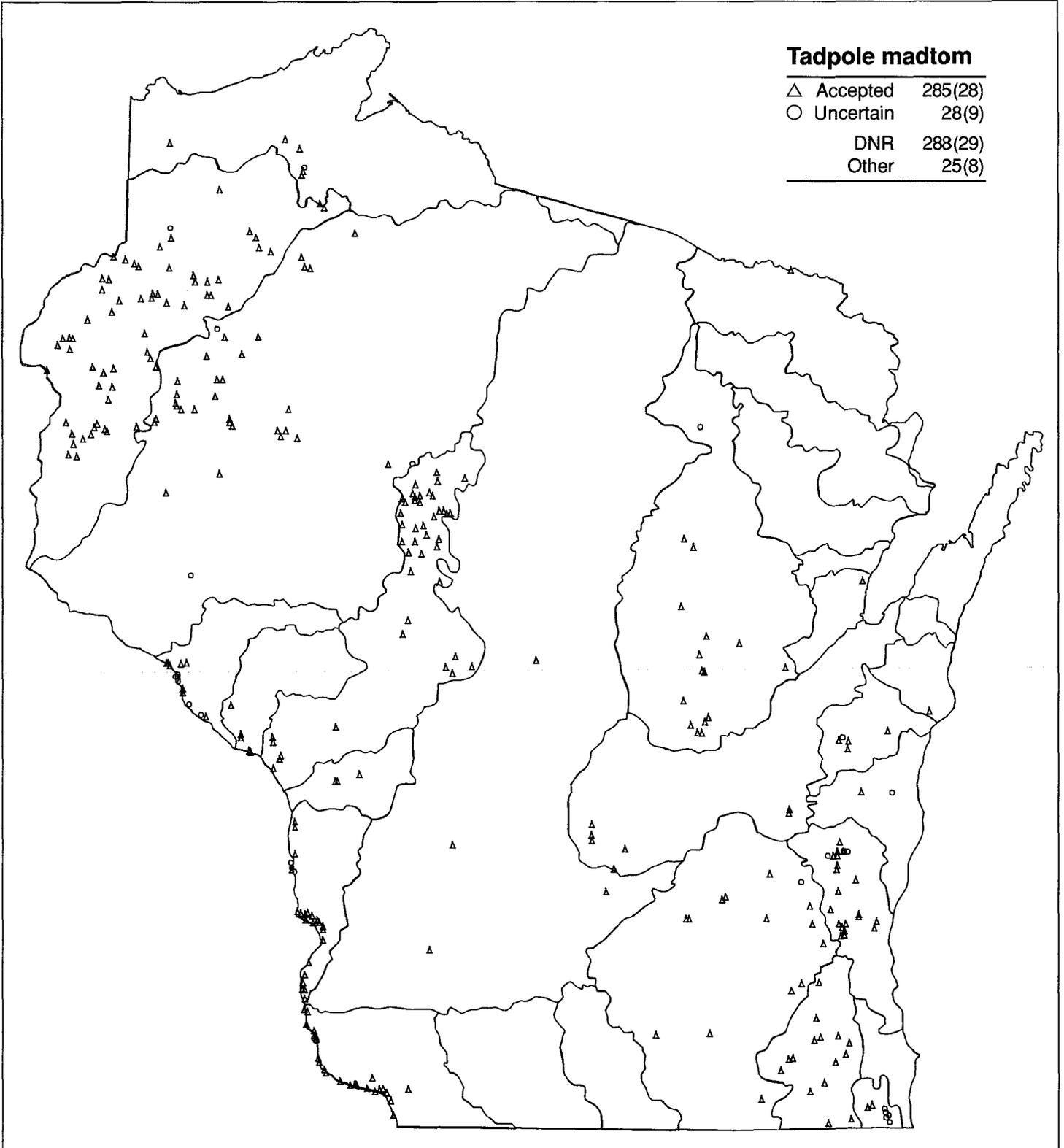


Map 100(E)

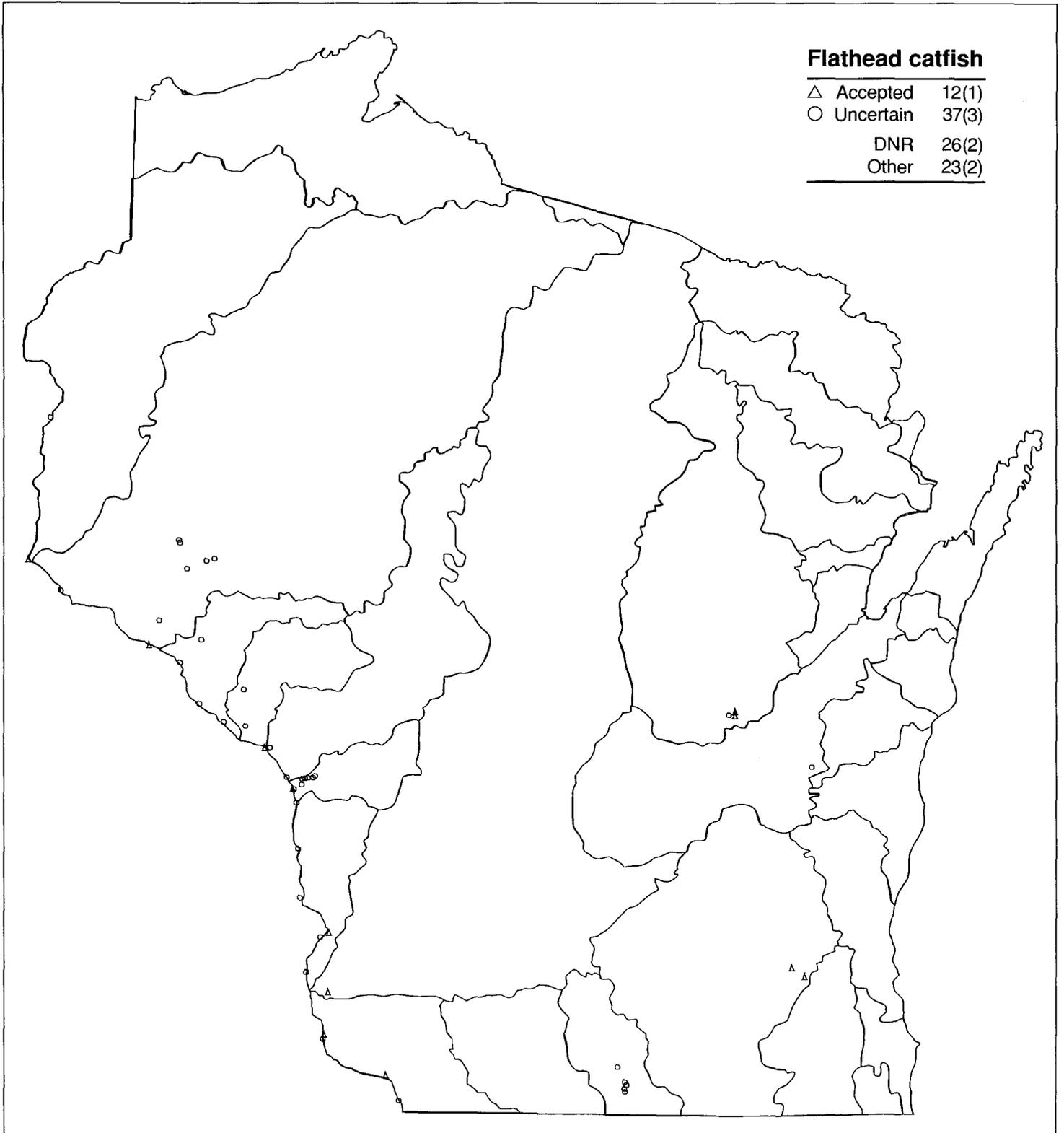


Tadpole madtom

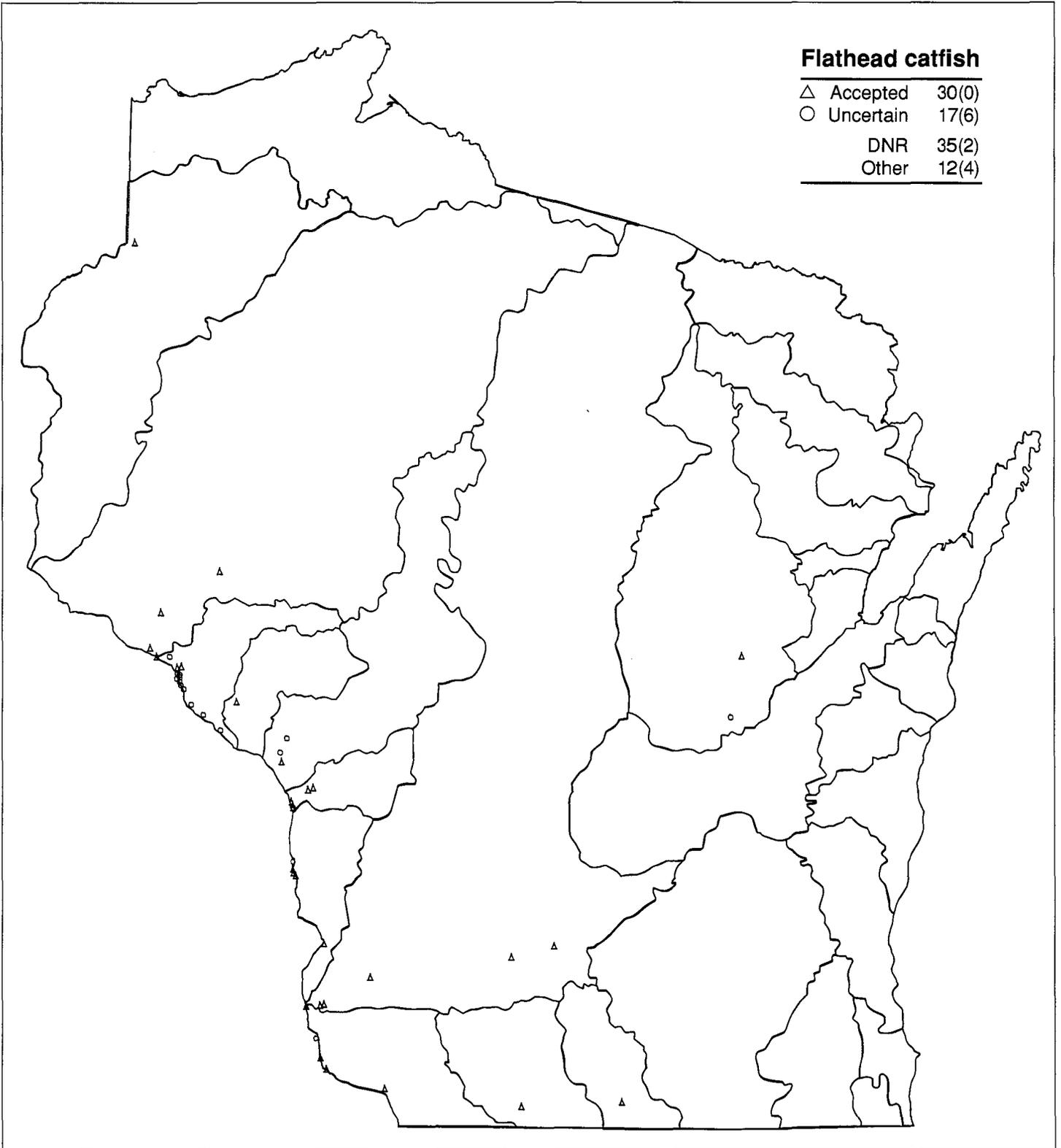
△	Accepted	285(28)
○	Uncertain	28(9)
	DNR	288(29)
	Other	25(8)



Map 101(E)



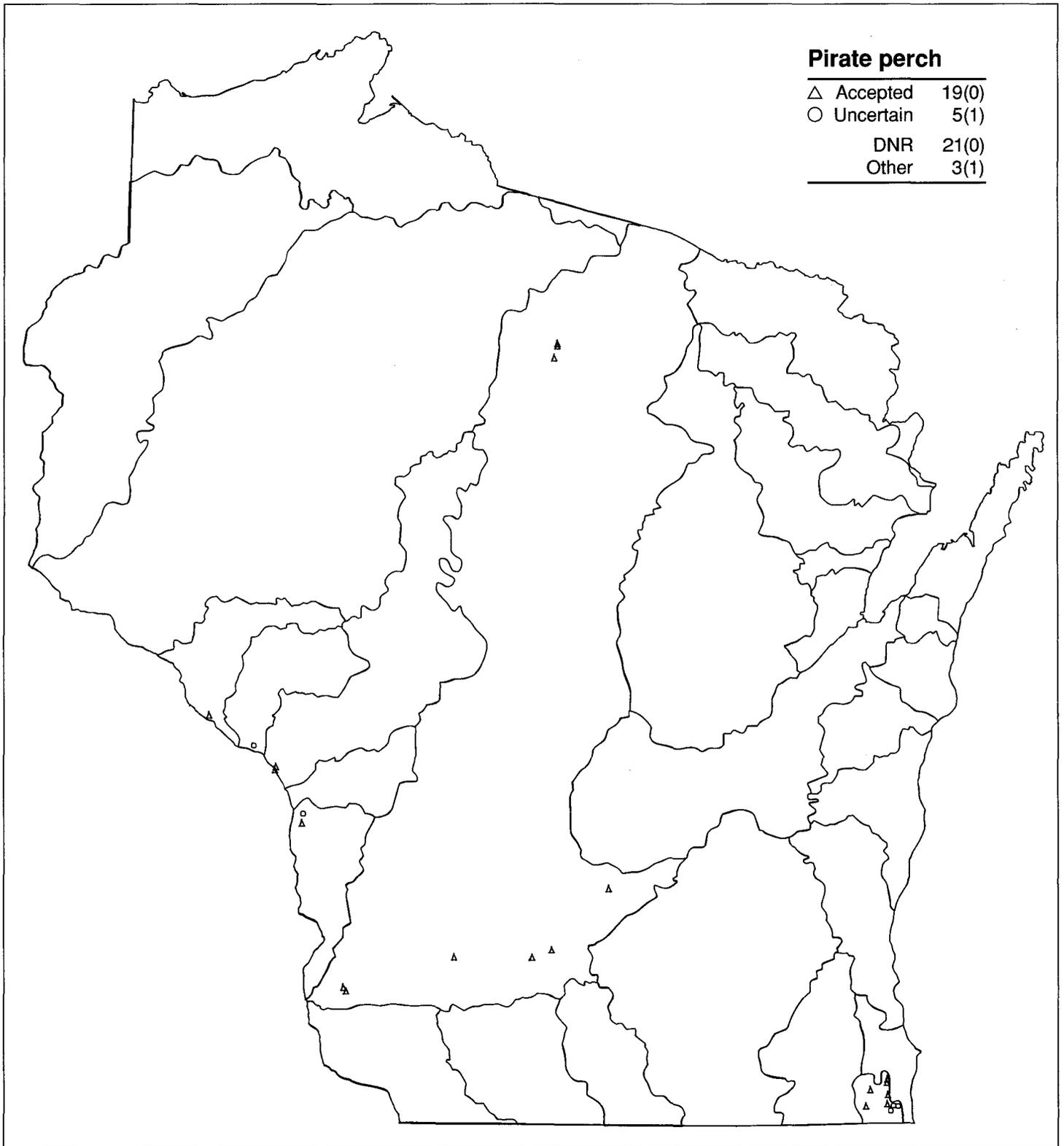
Map 101(L)



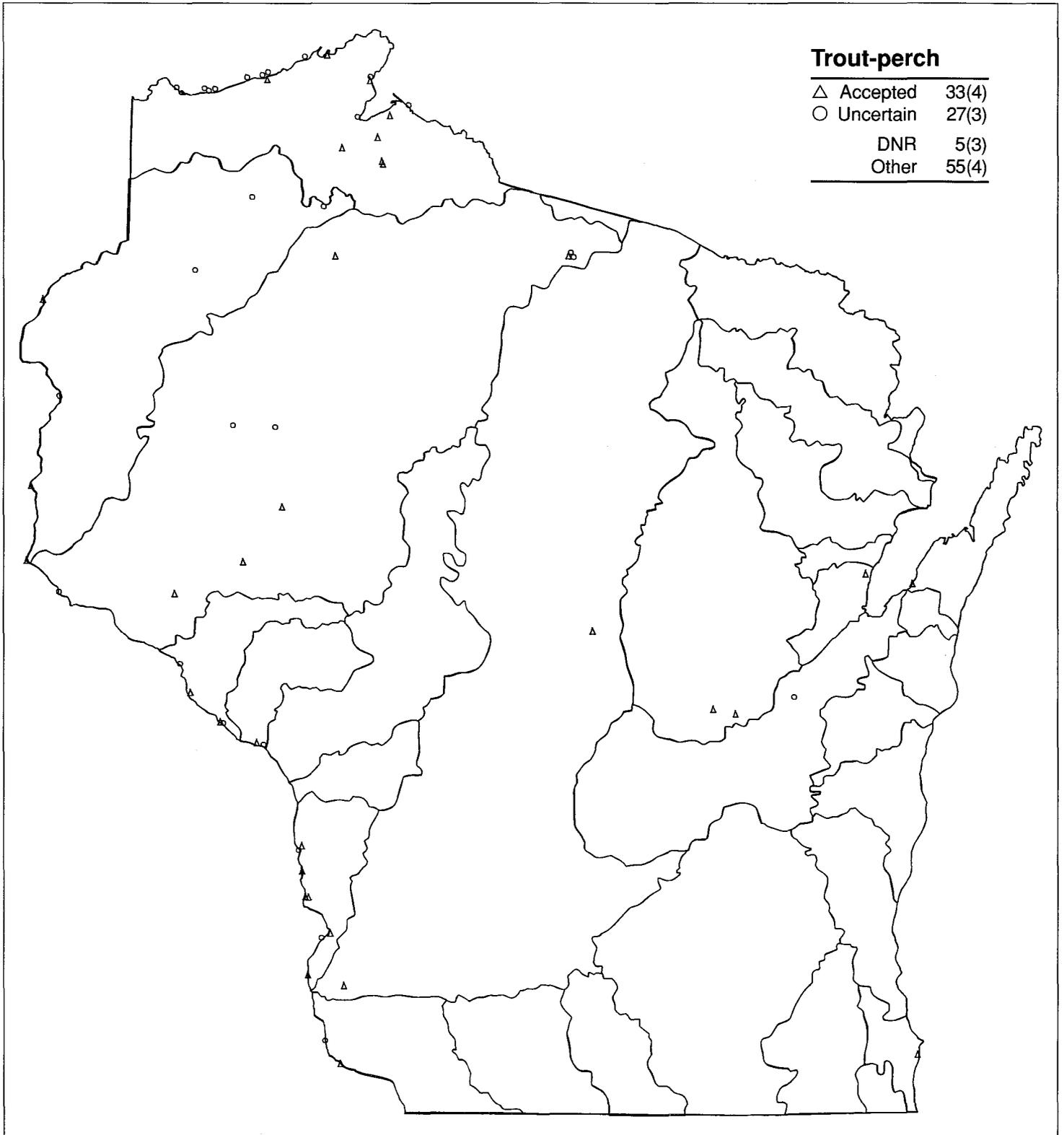
Map 102(E)



Map 102(L)



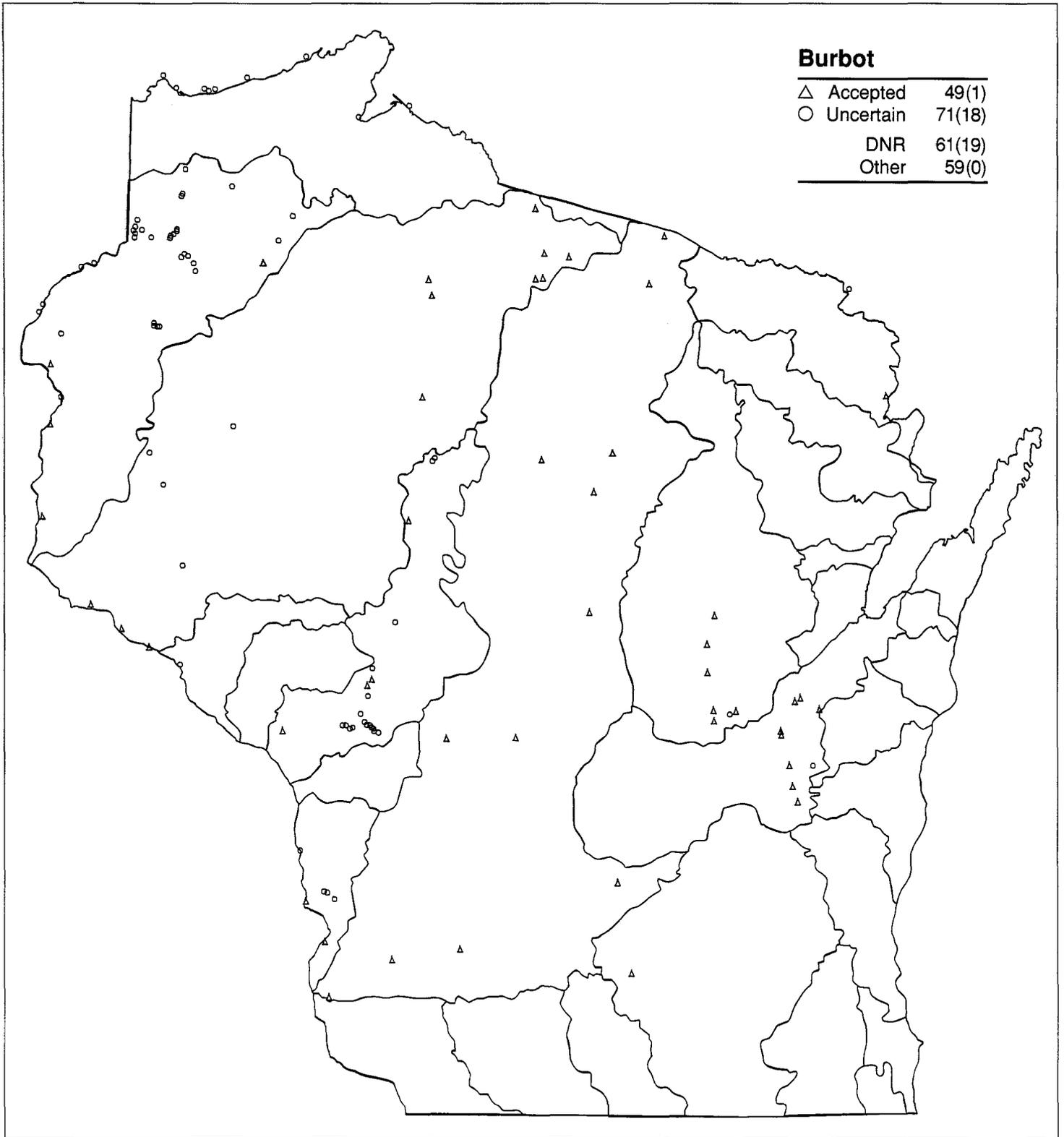
Map 103(E)



Map 103(L)



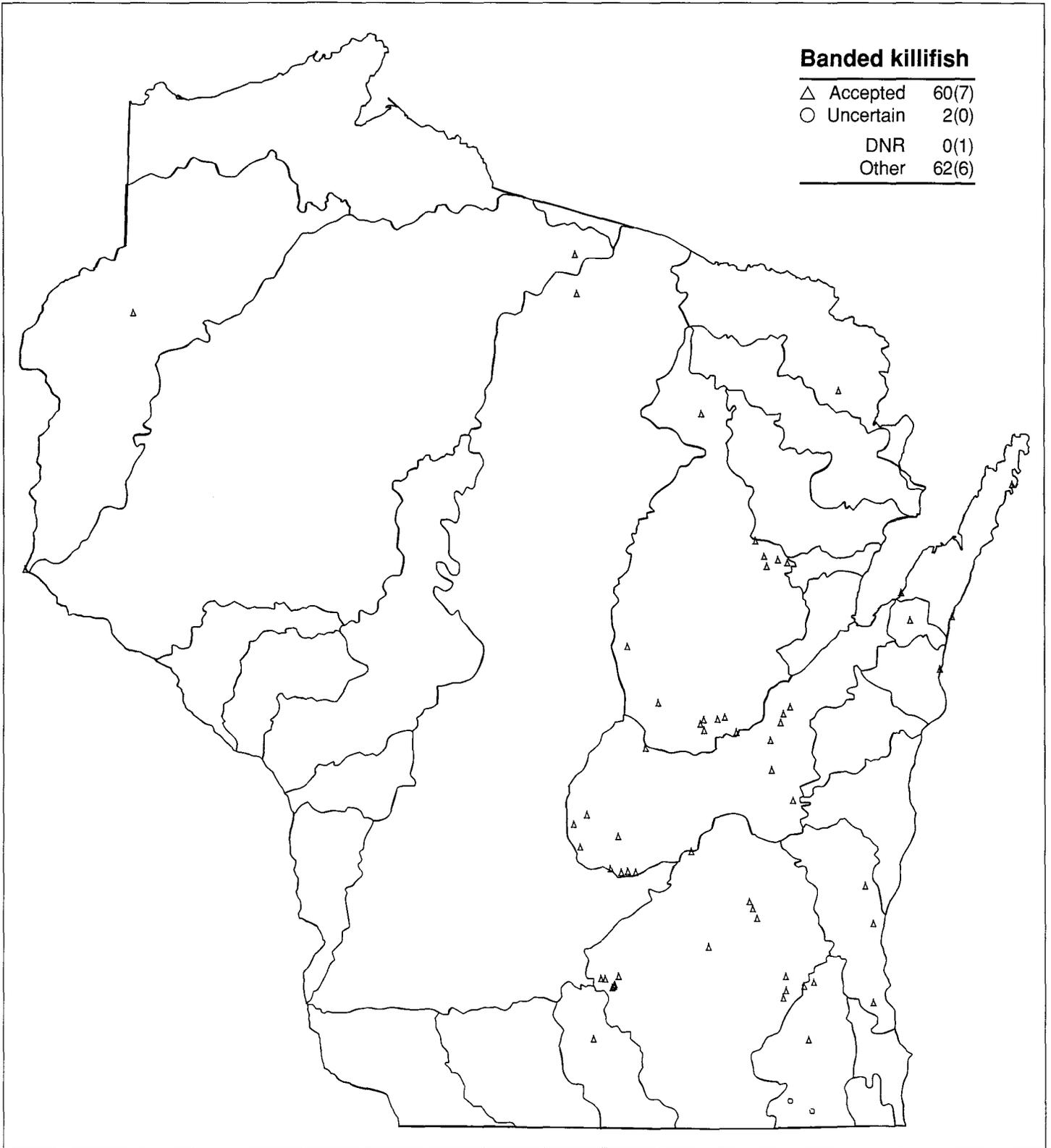
Map 104(E)

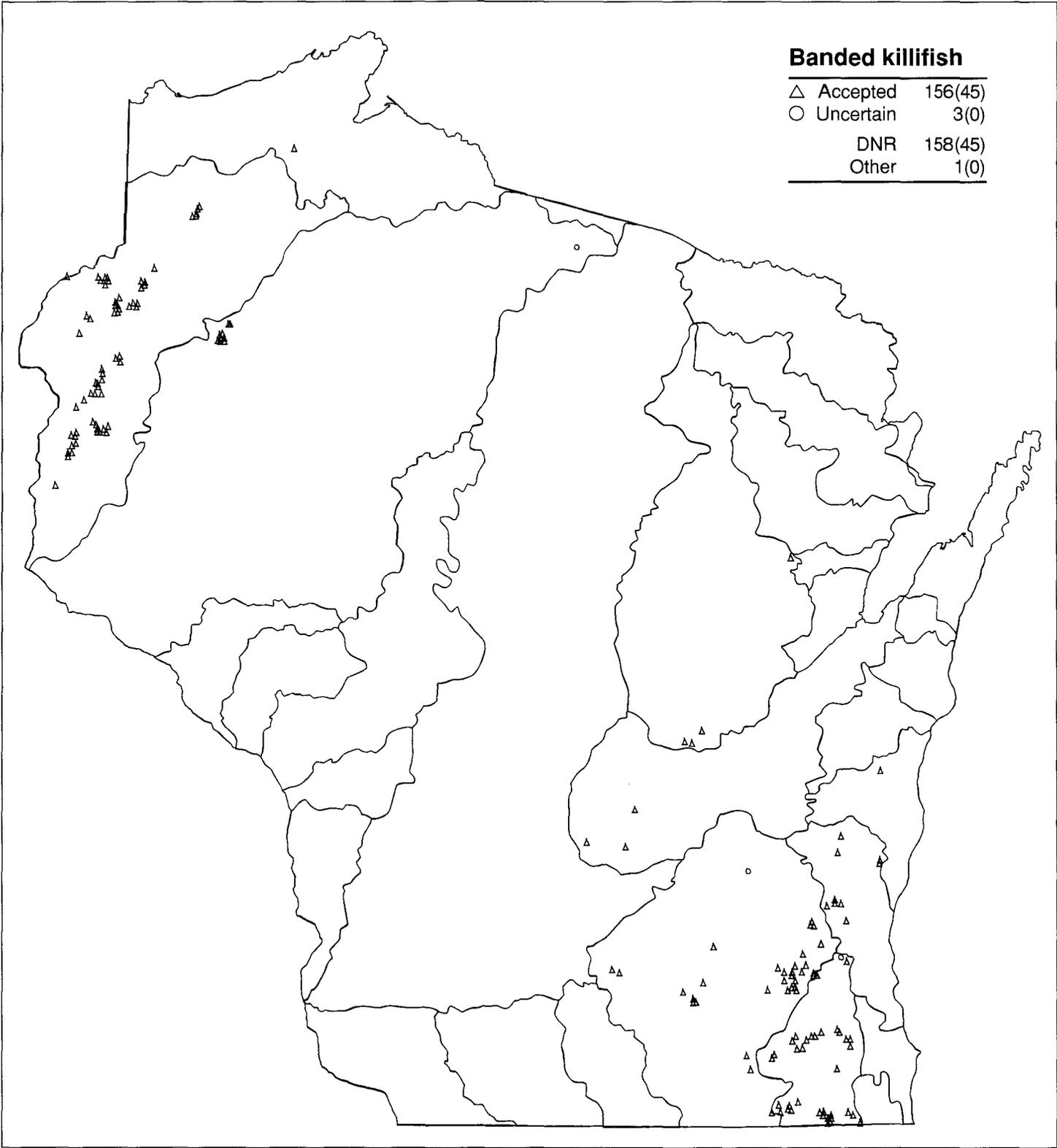


Map 104(L)



Map 105(E)



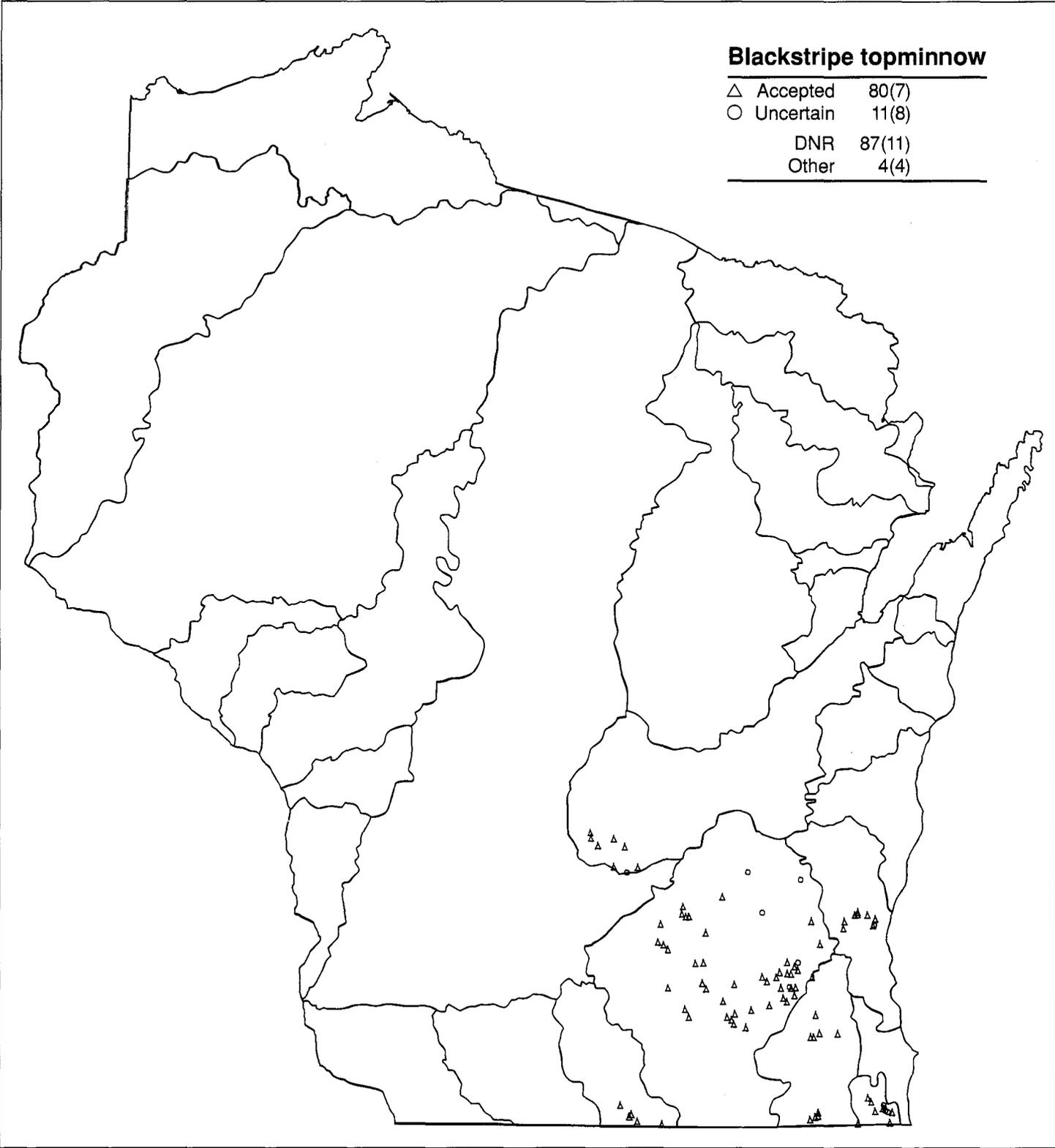


Map 106(E)



Blackstripe topminnow

△	Accepted	80(7)
○	Uncertain	11(8)
	DNR	87(11)
	Other	4(4)



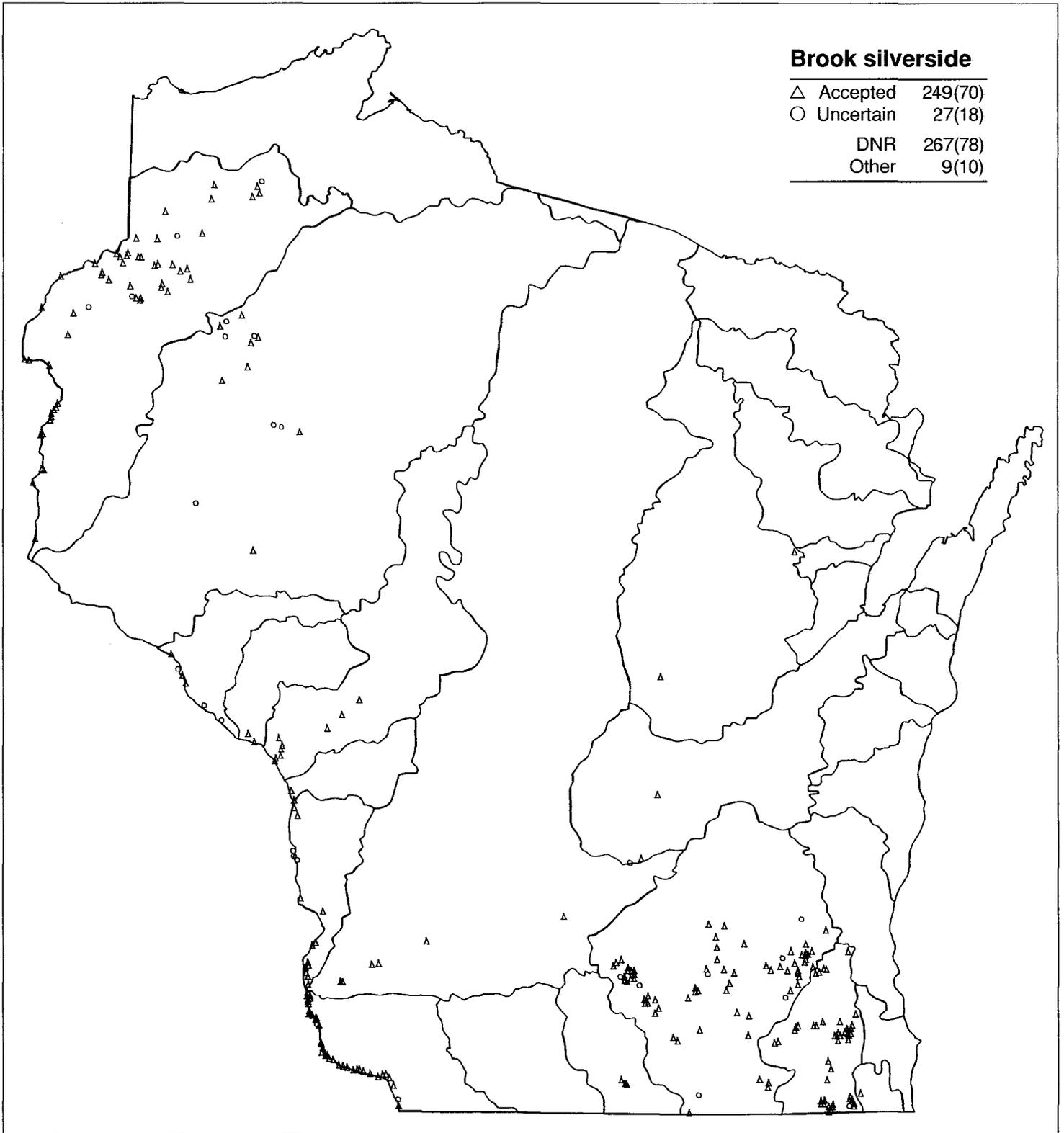
Map 107(E)



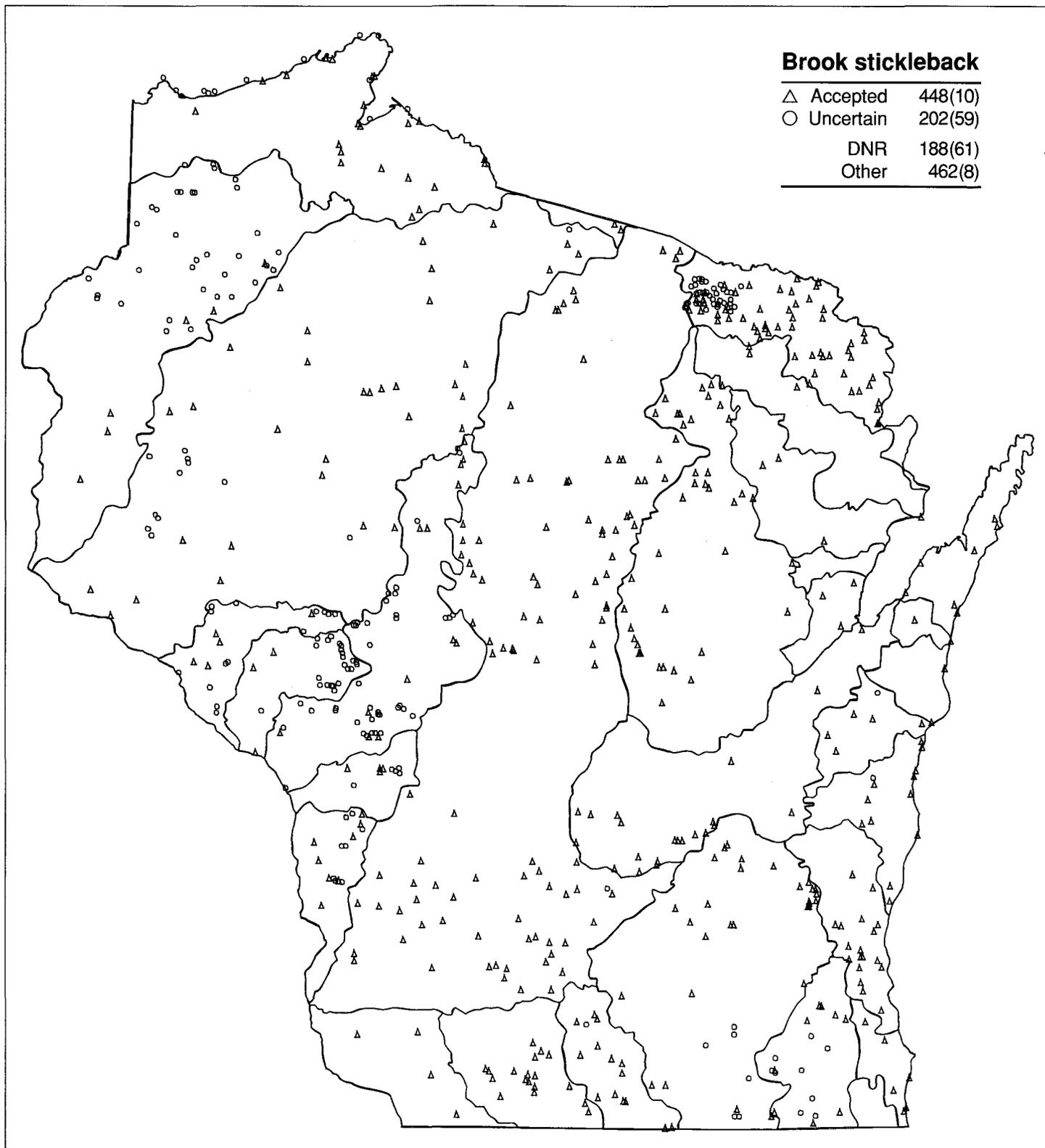


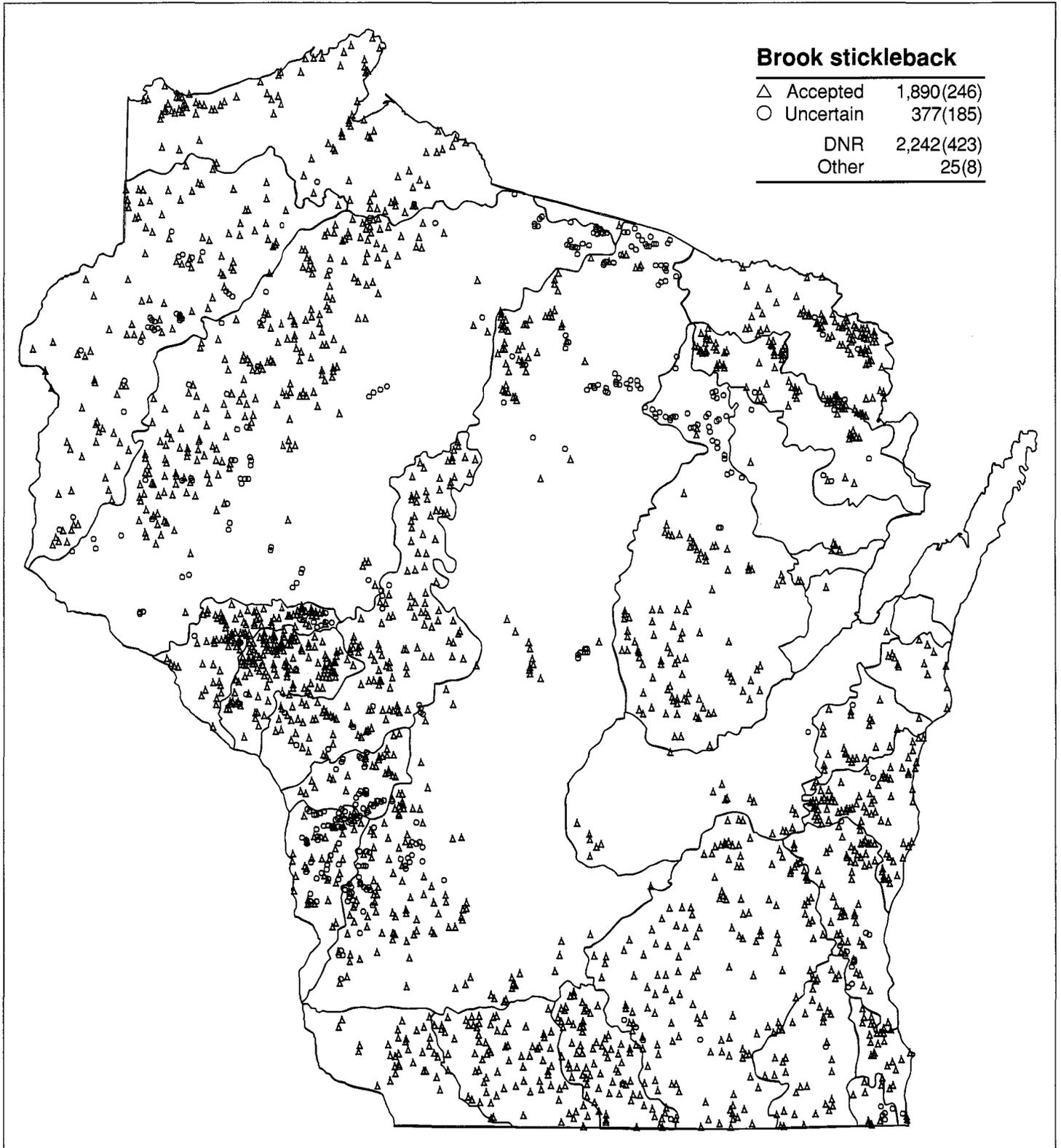
Map 108(E)





Map 109(E)





Map 110(E)

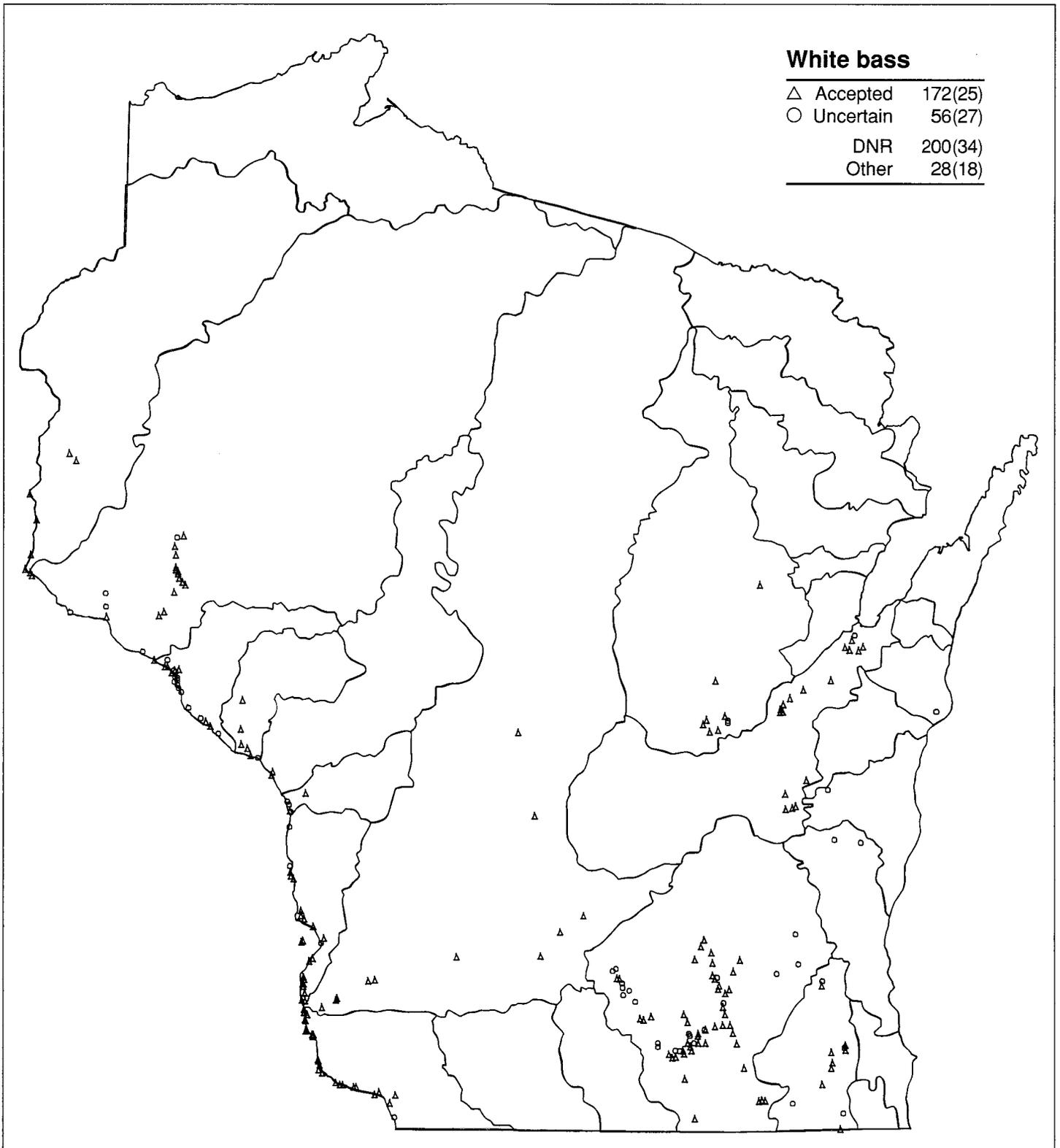




Map 111(E)



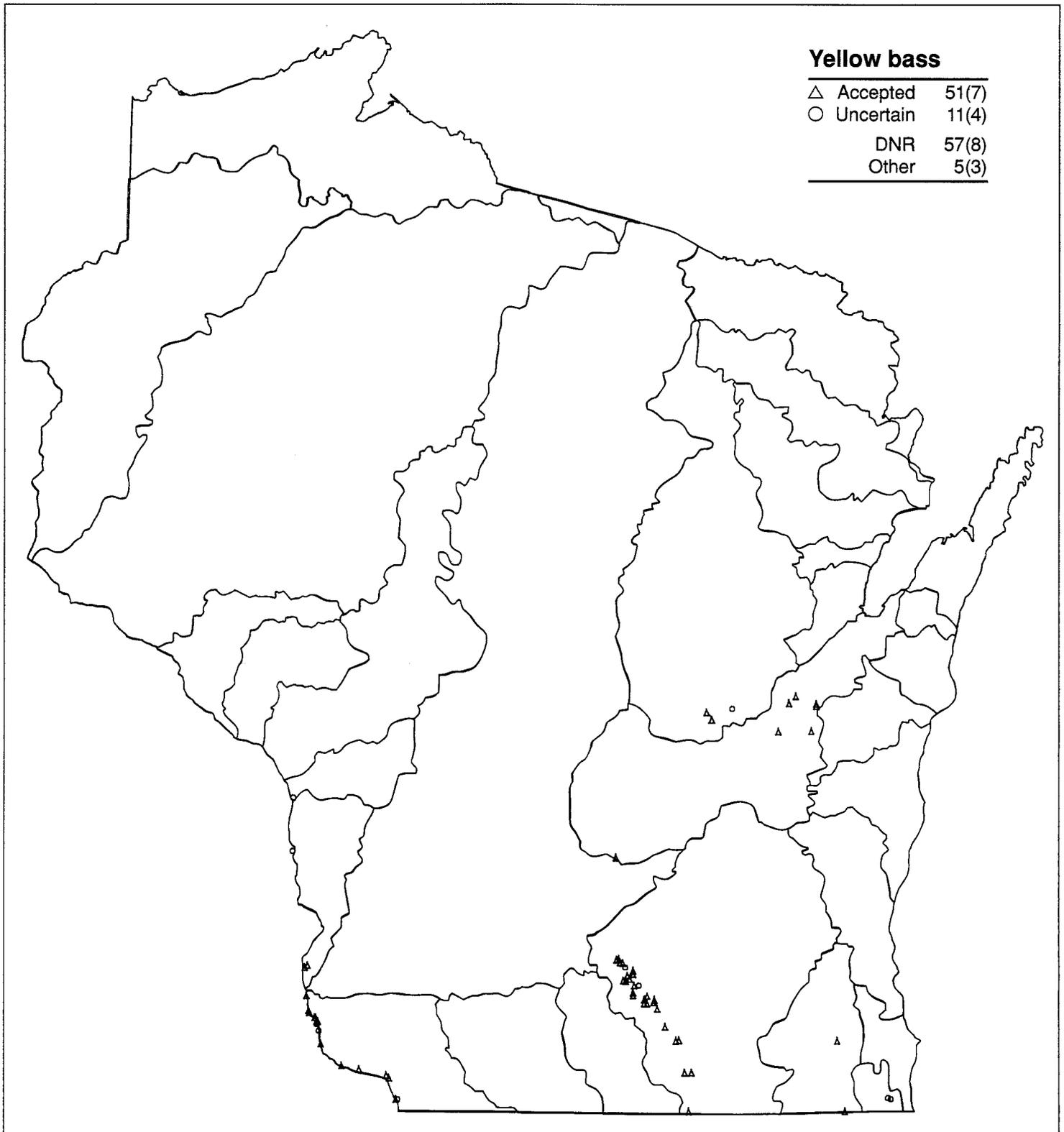
Map 111(L)



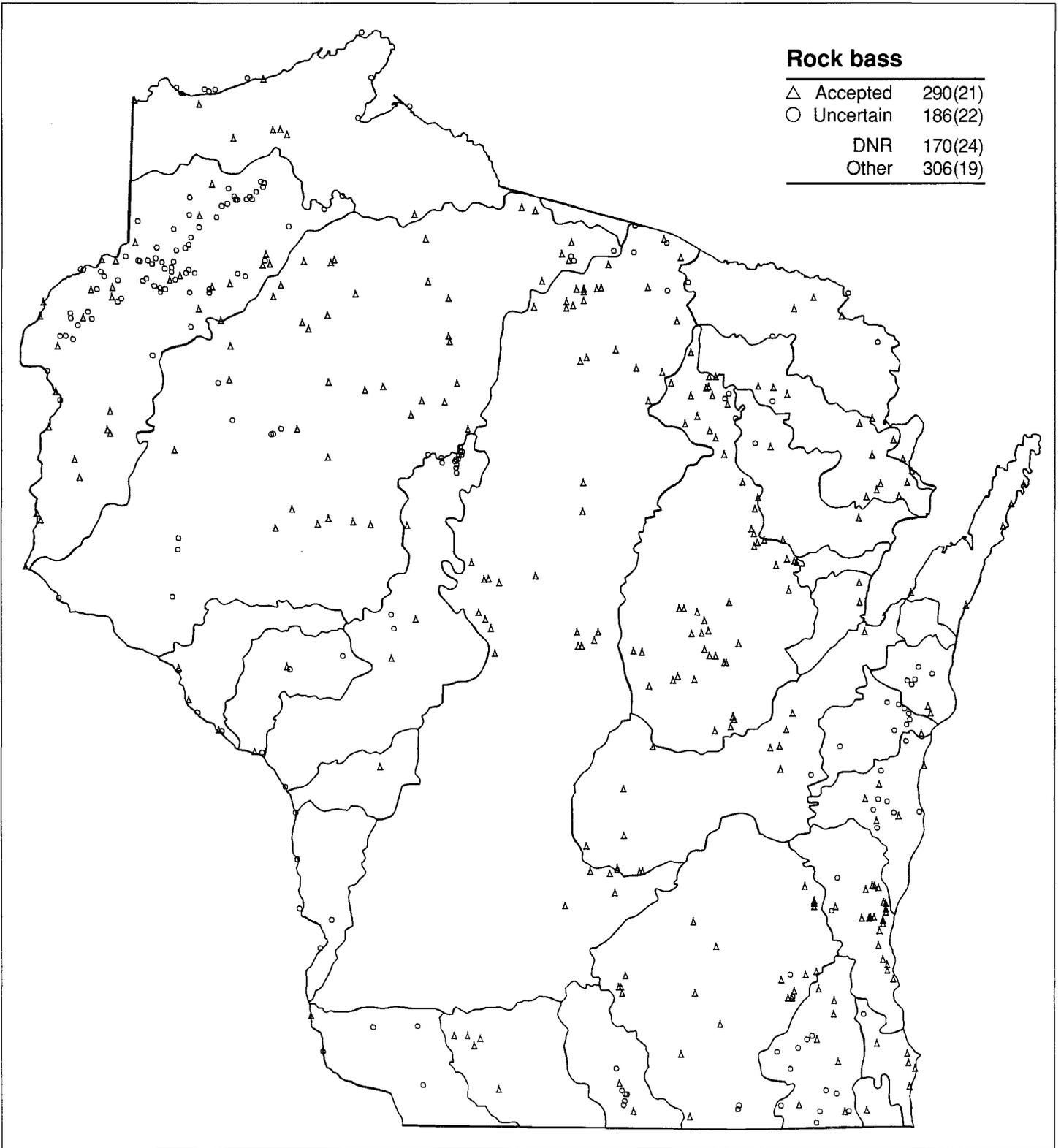
Map 112(E)



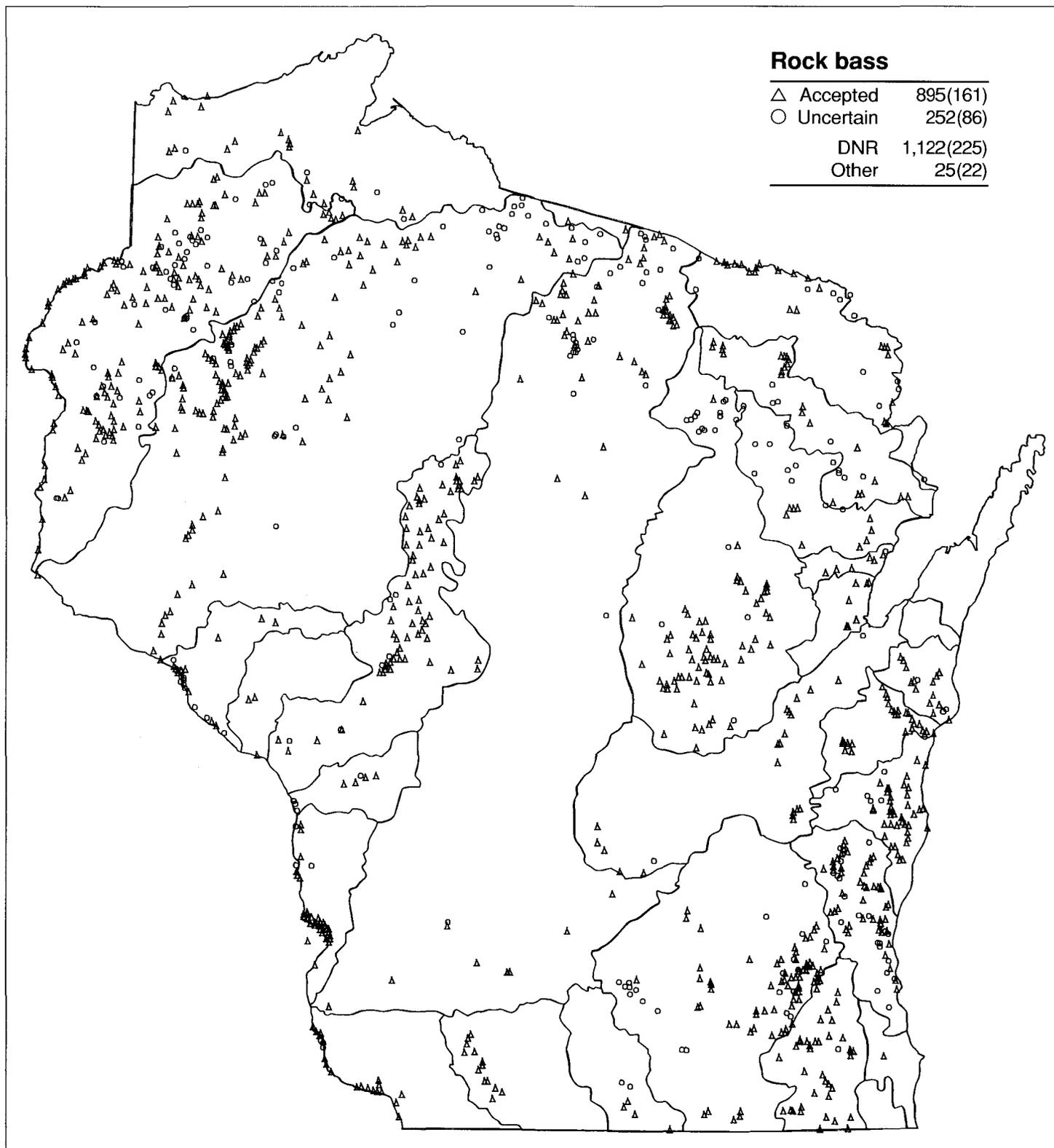
Map 112(L)



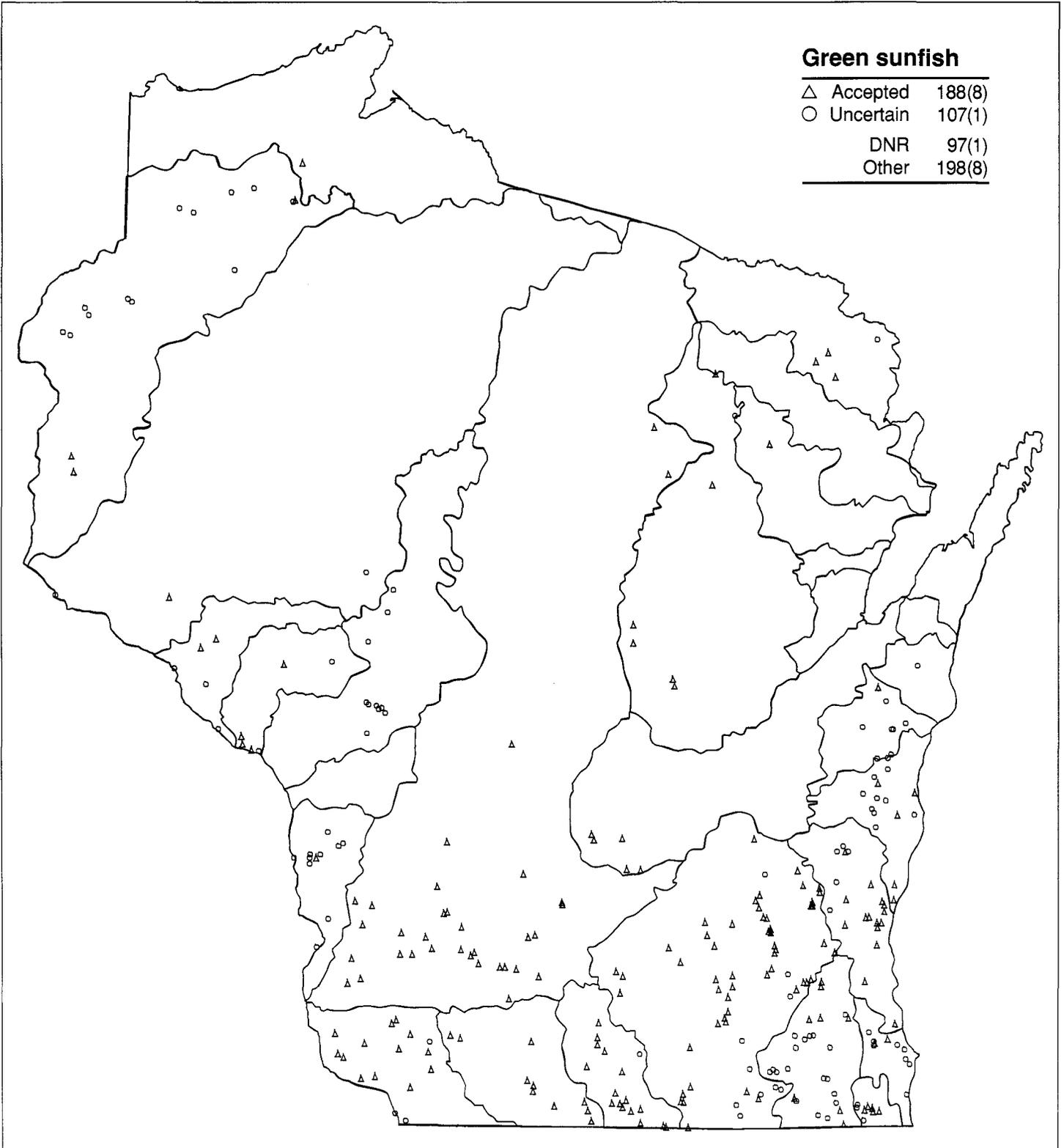
Map 113(E)

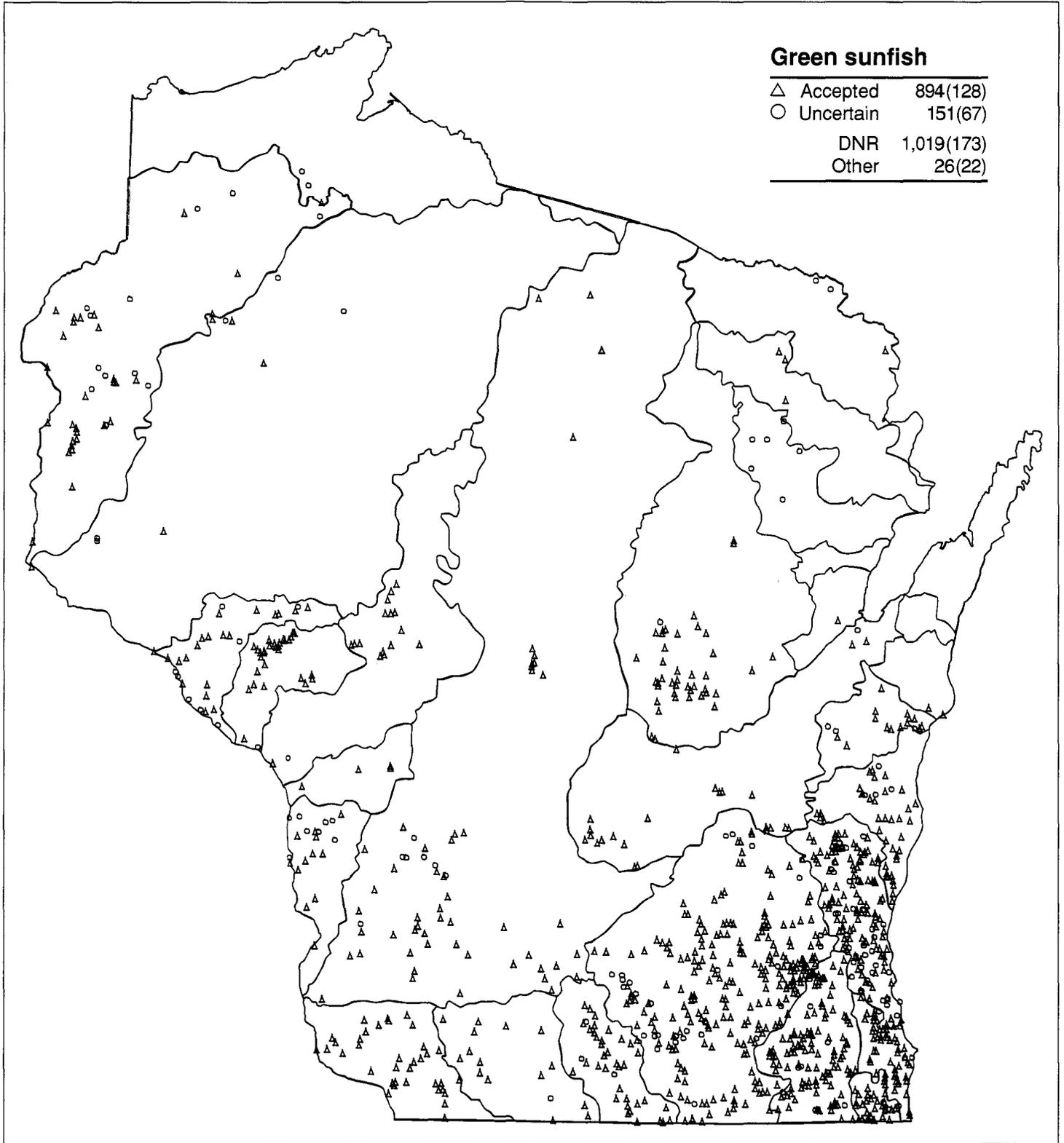


Map 113(L)

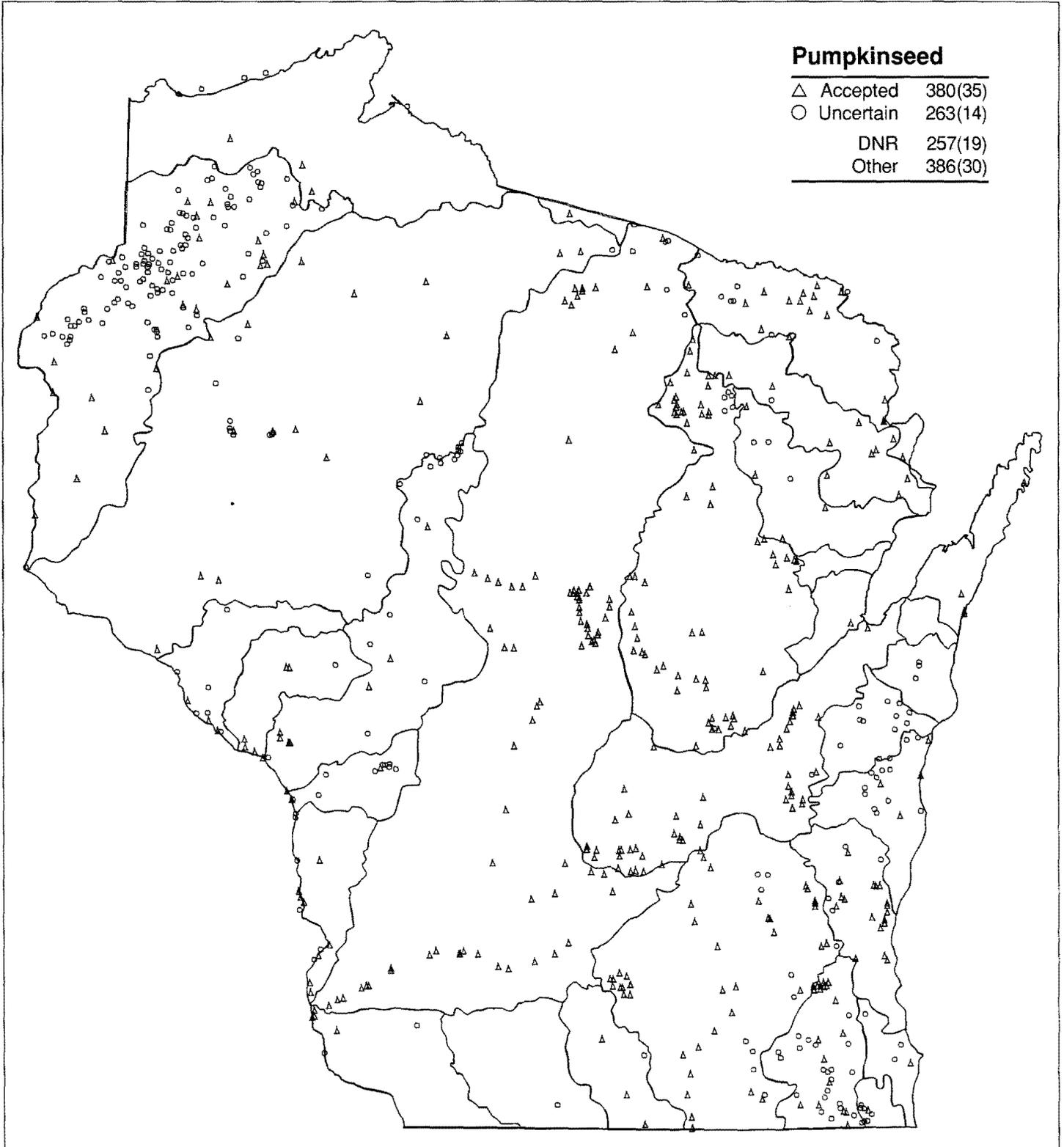


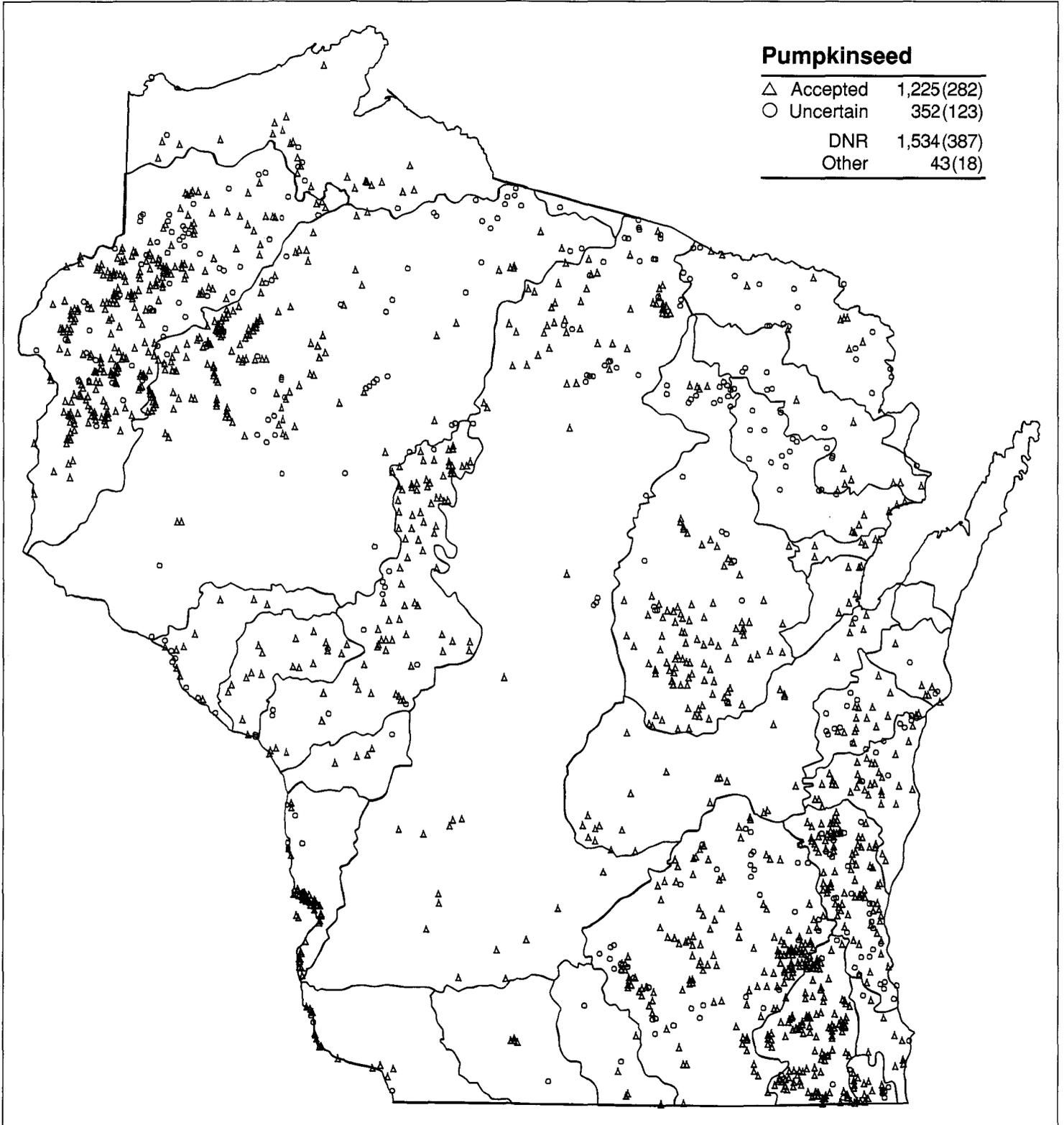
Map 114(E)





Map 115(E)

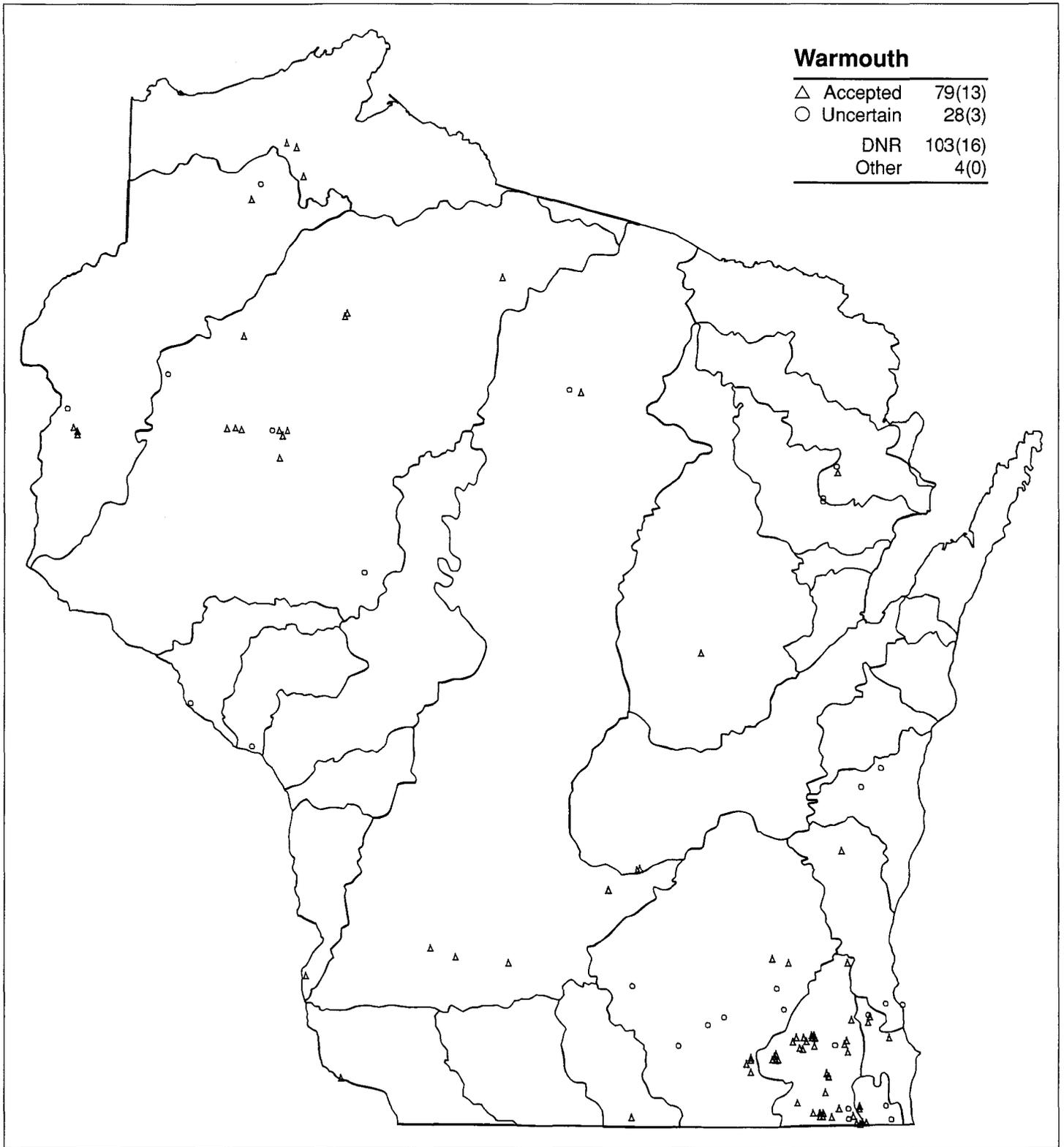




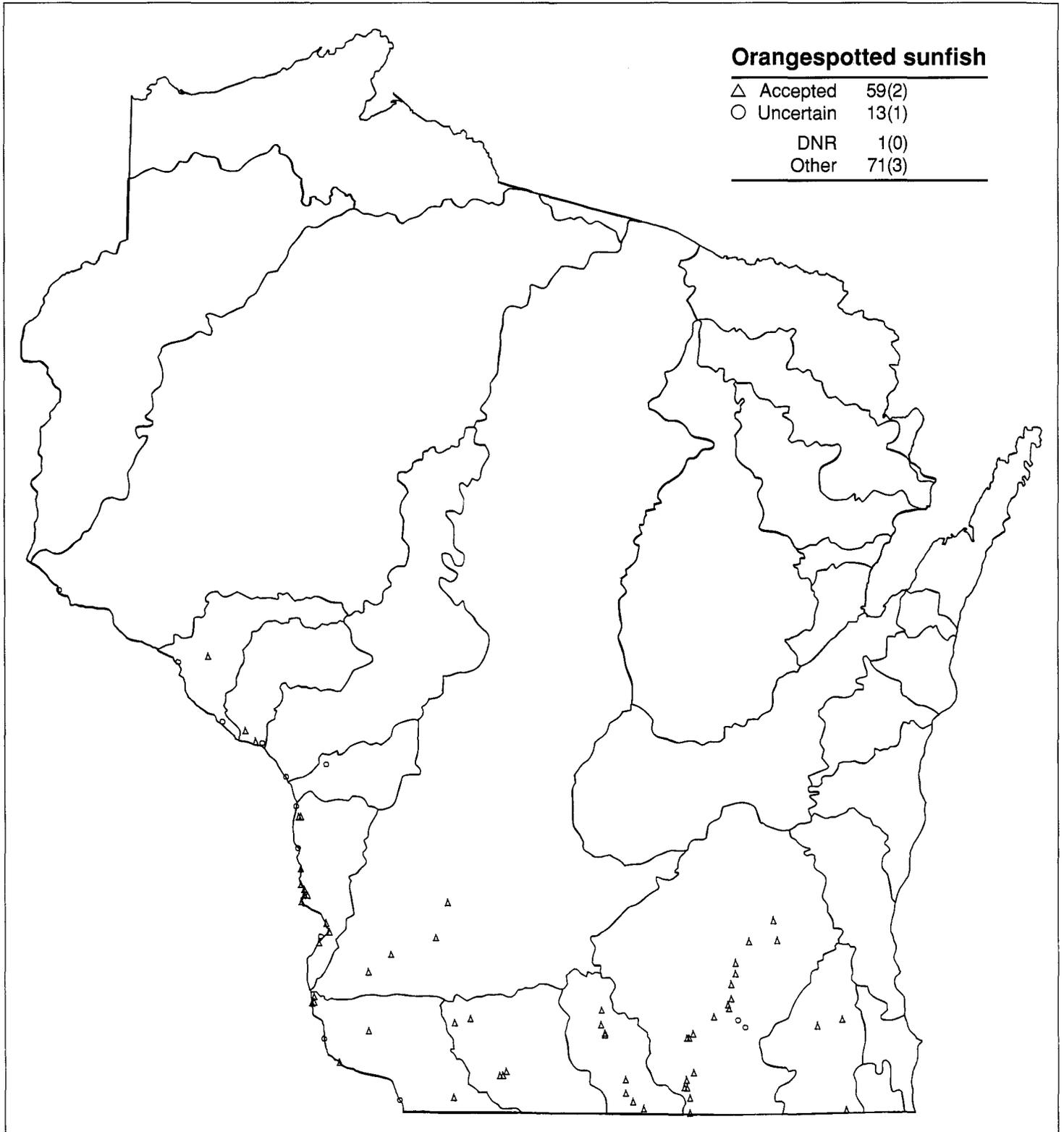
Map 116(E)

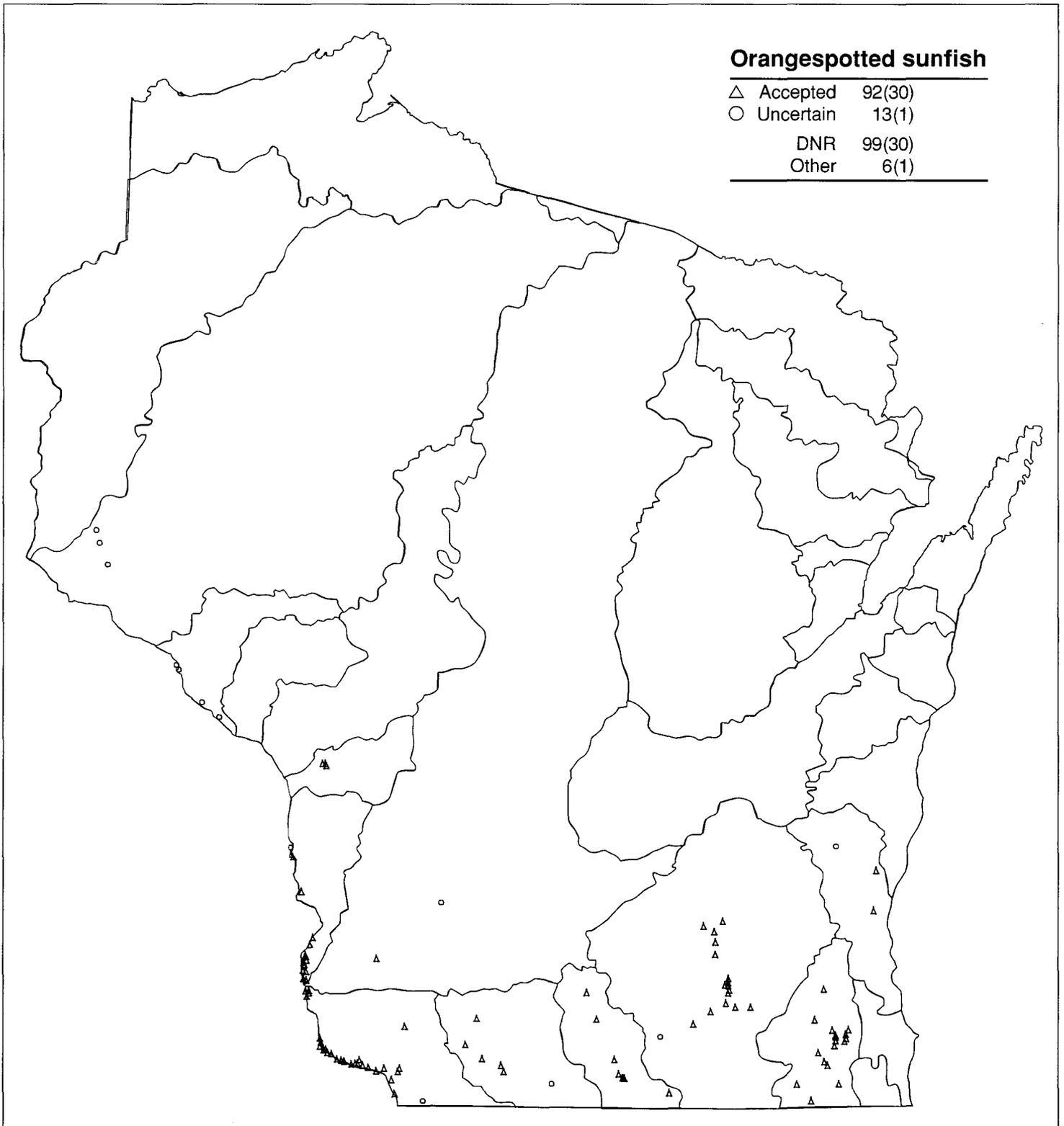


Map 116(L)

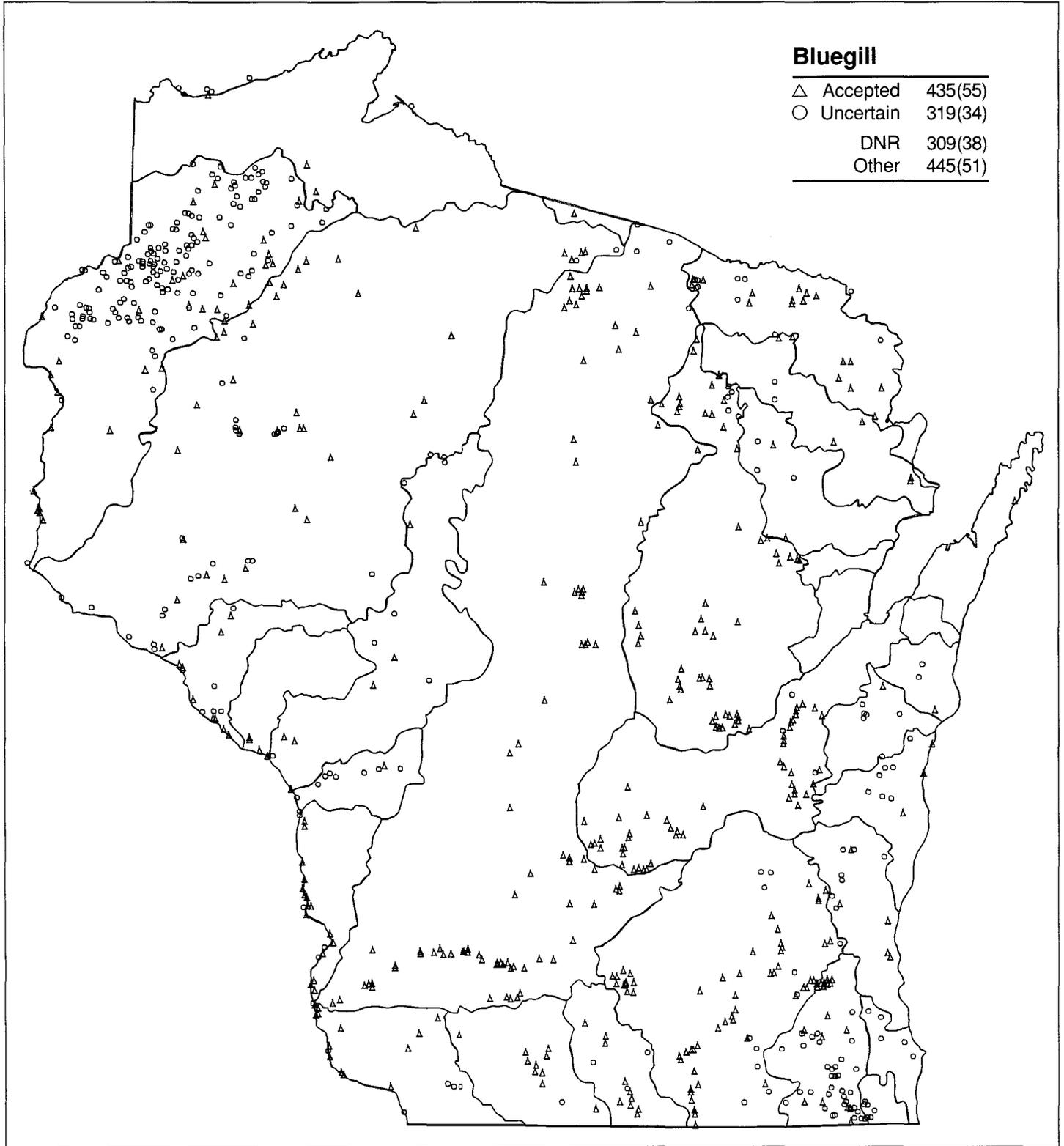


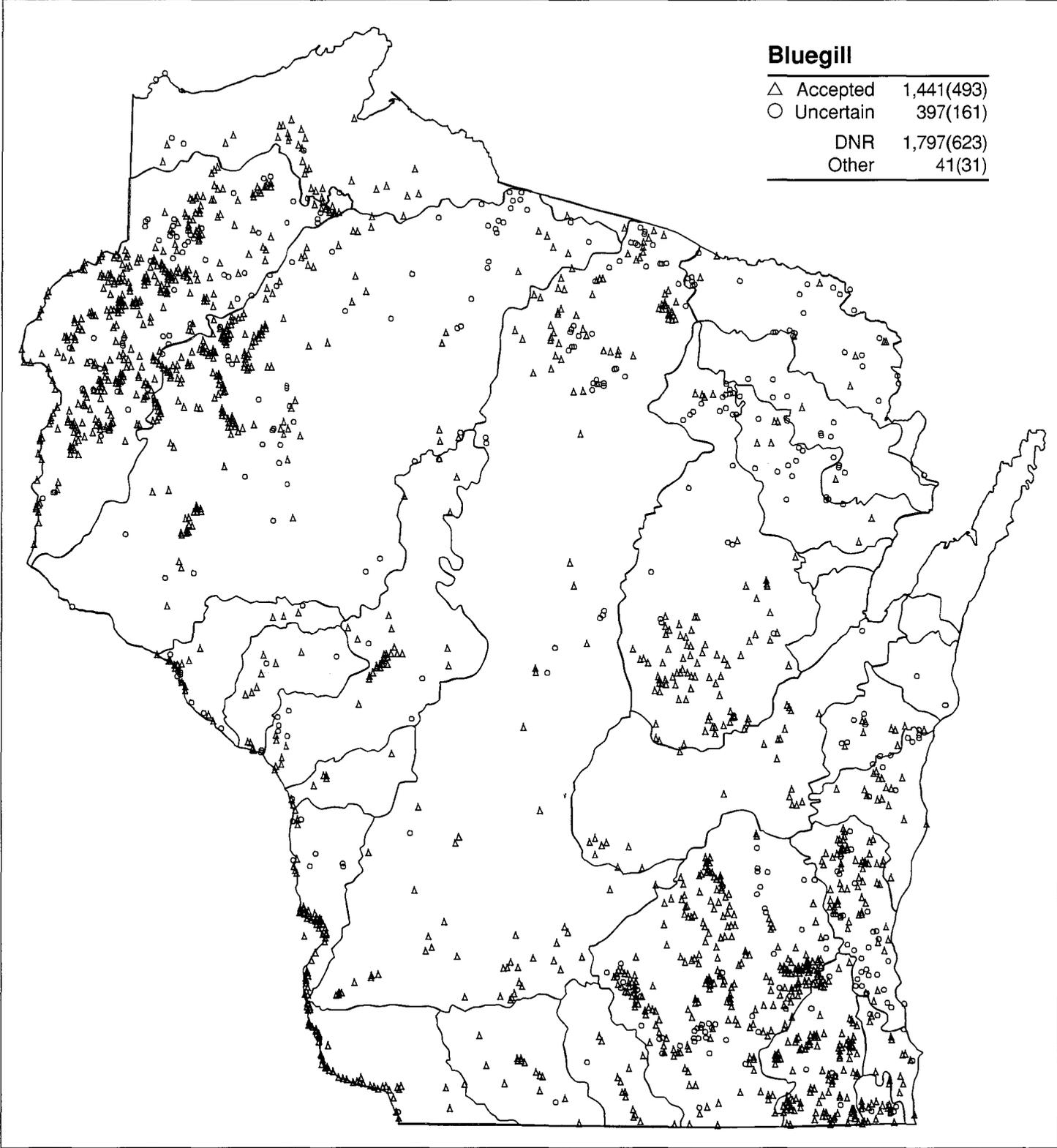
Map 117(E)



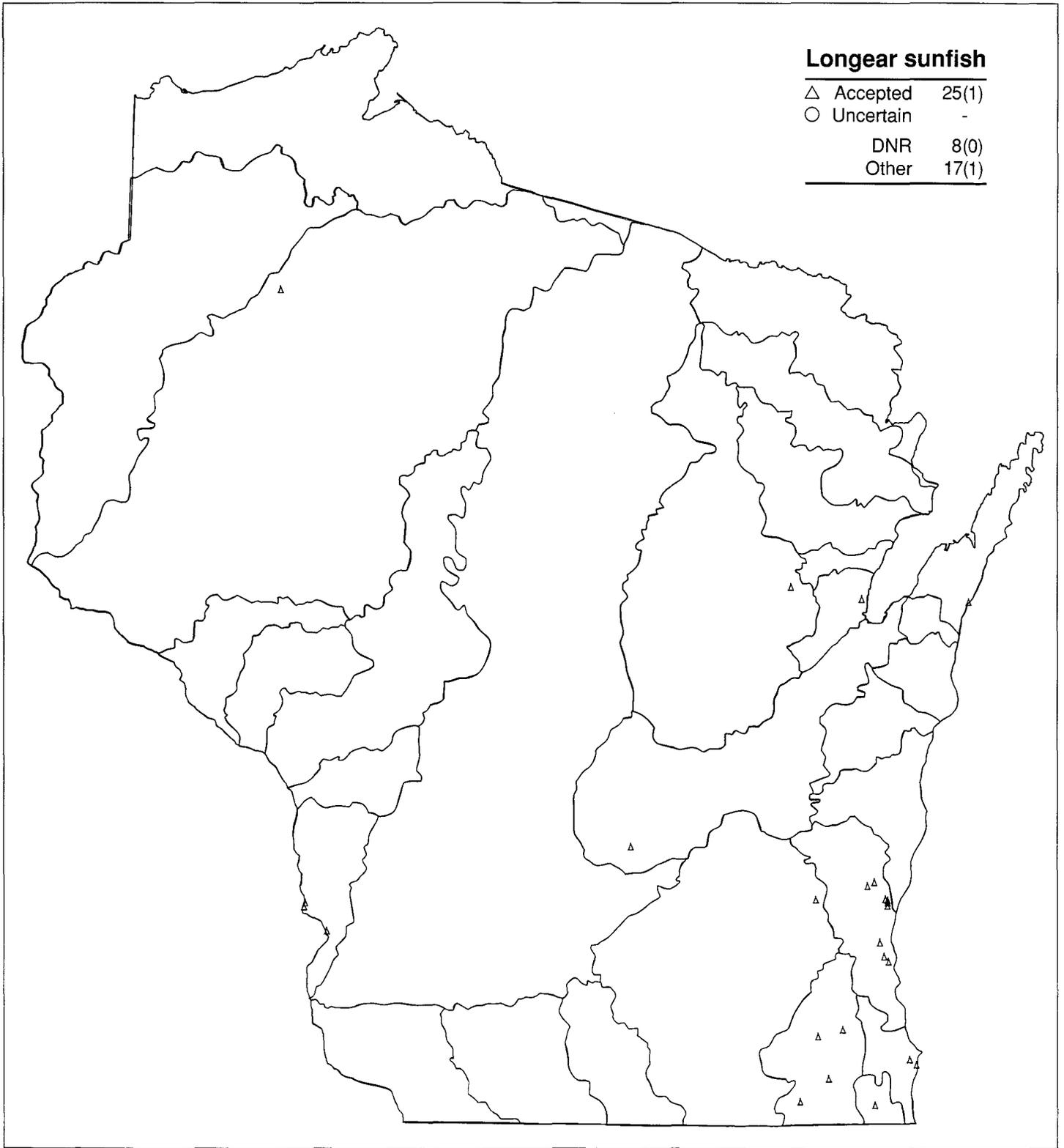


Map 118(E)

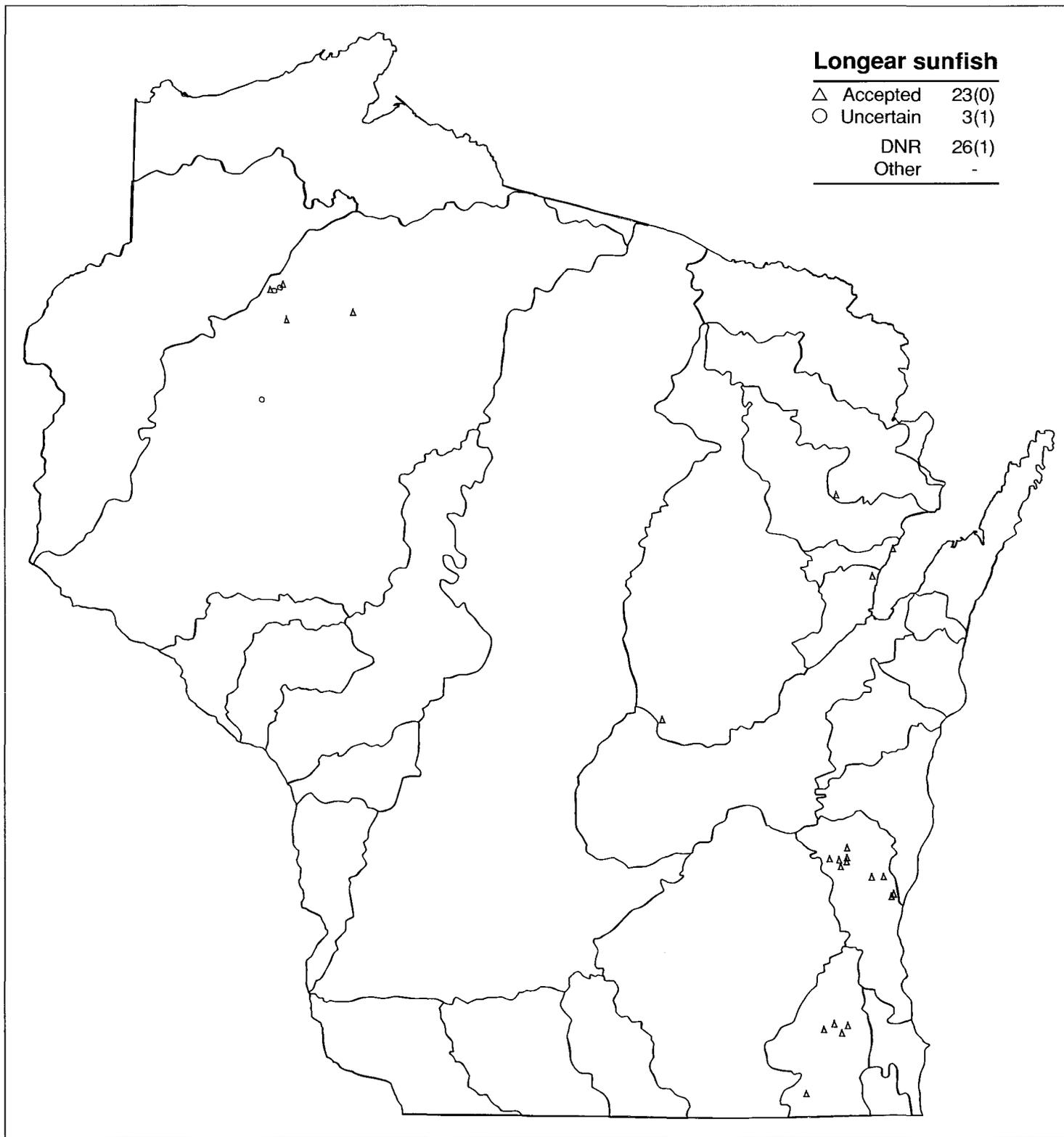




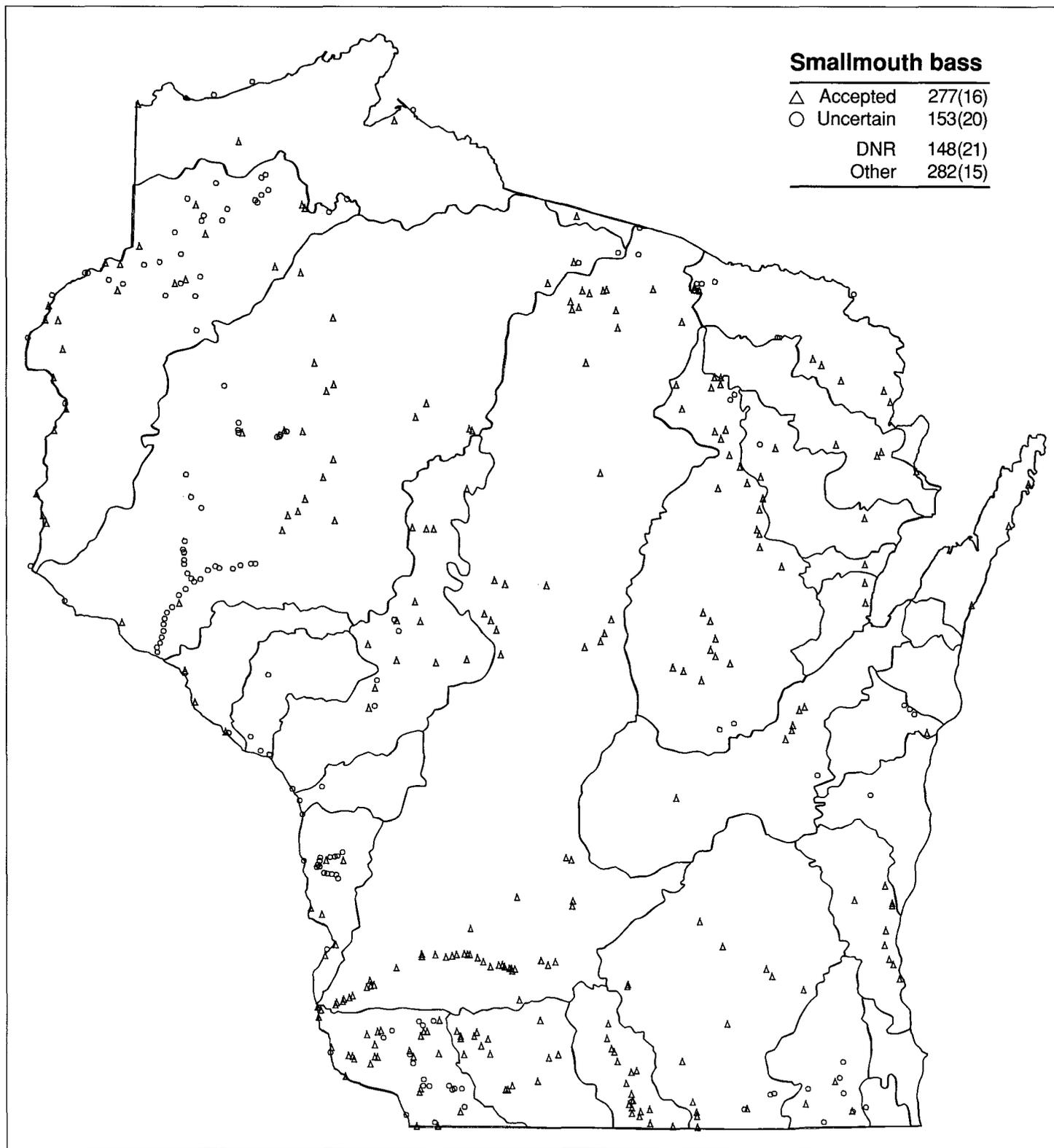
Map 119(E)

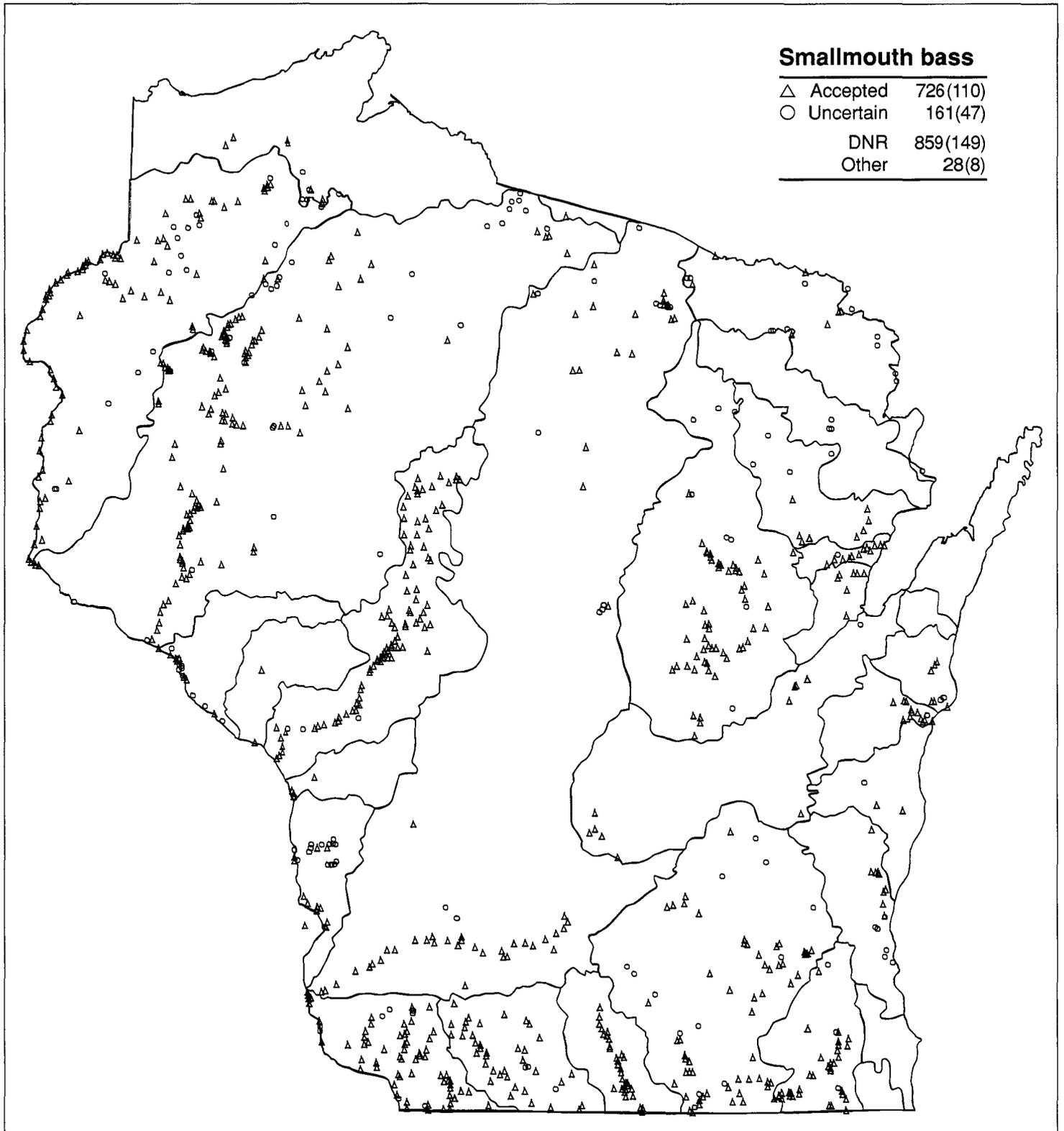


Map 119(L)



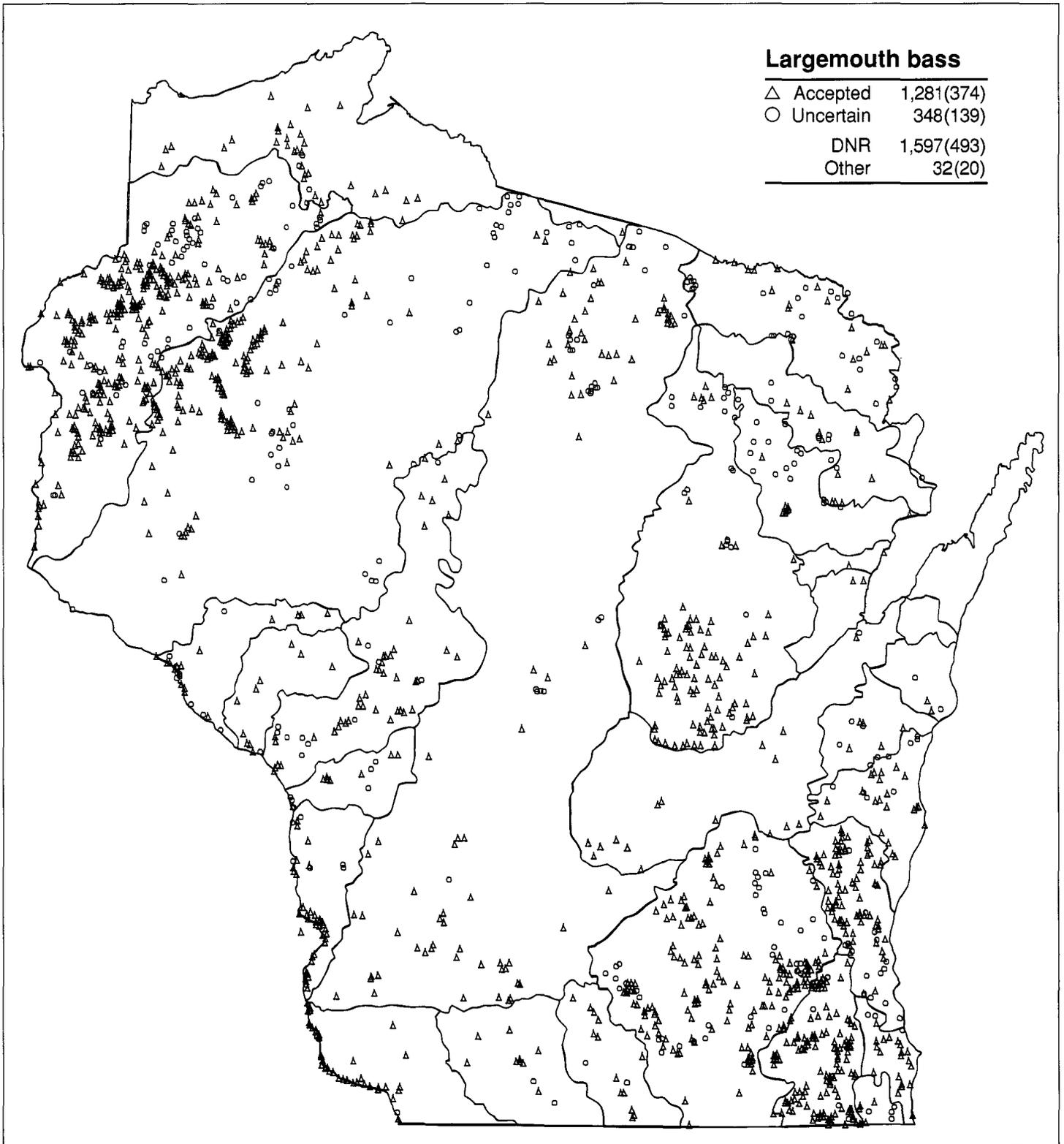
Map 120(E)



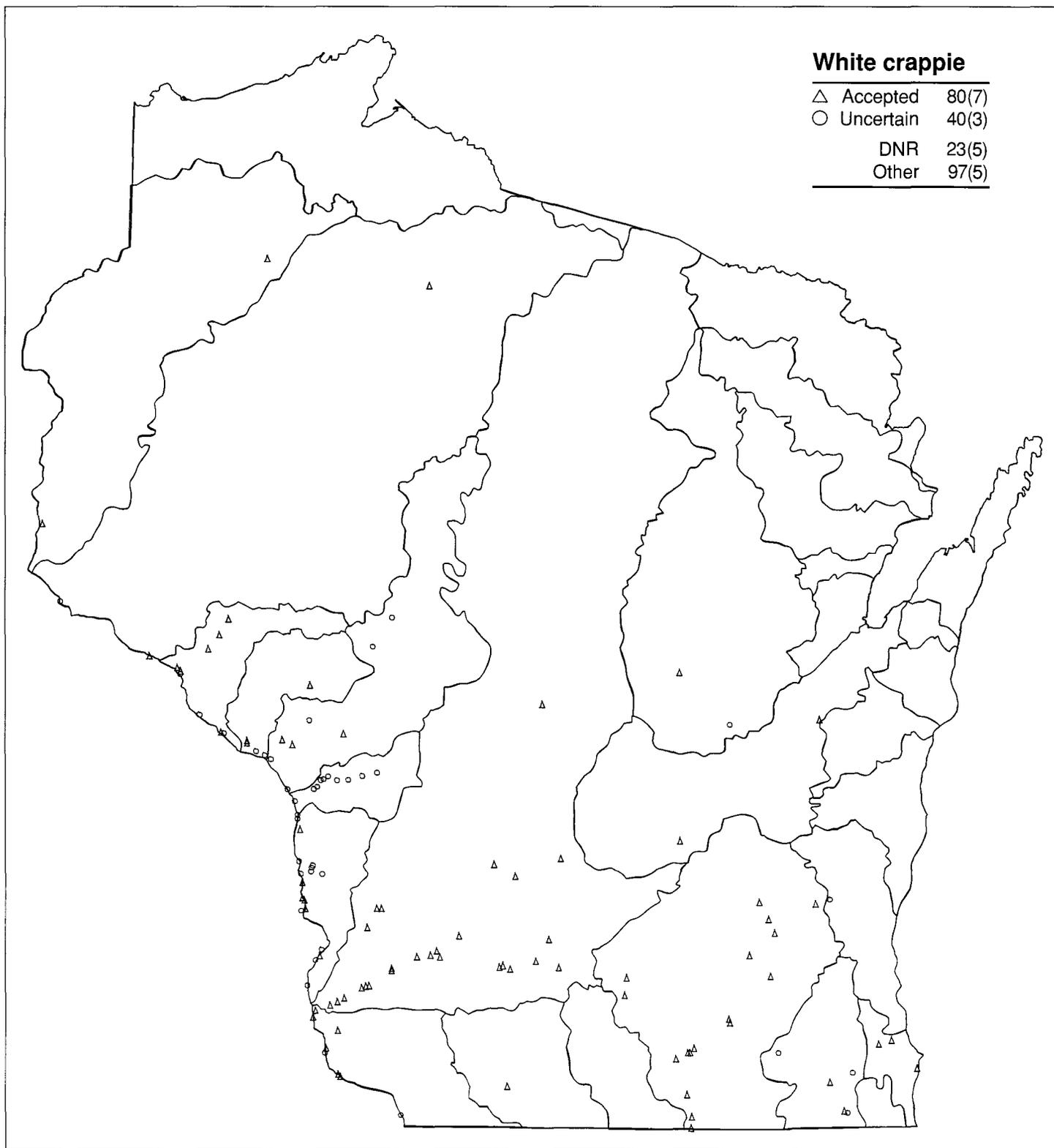


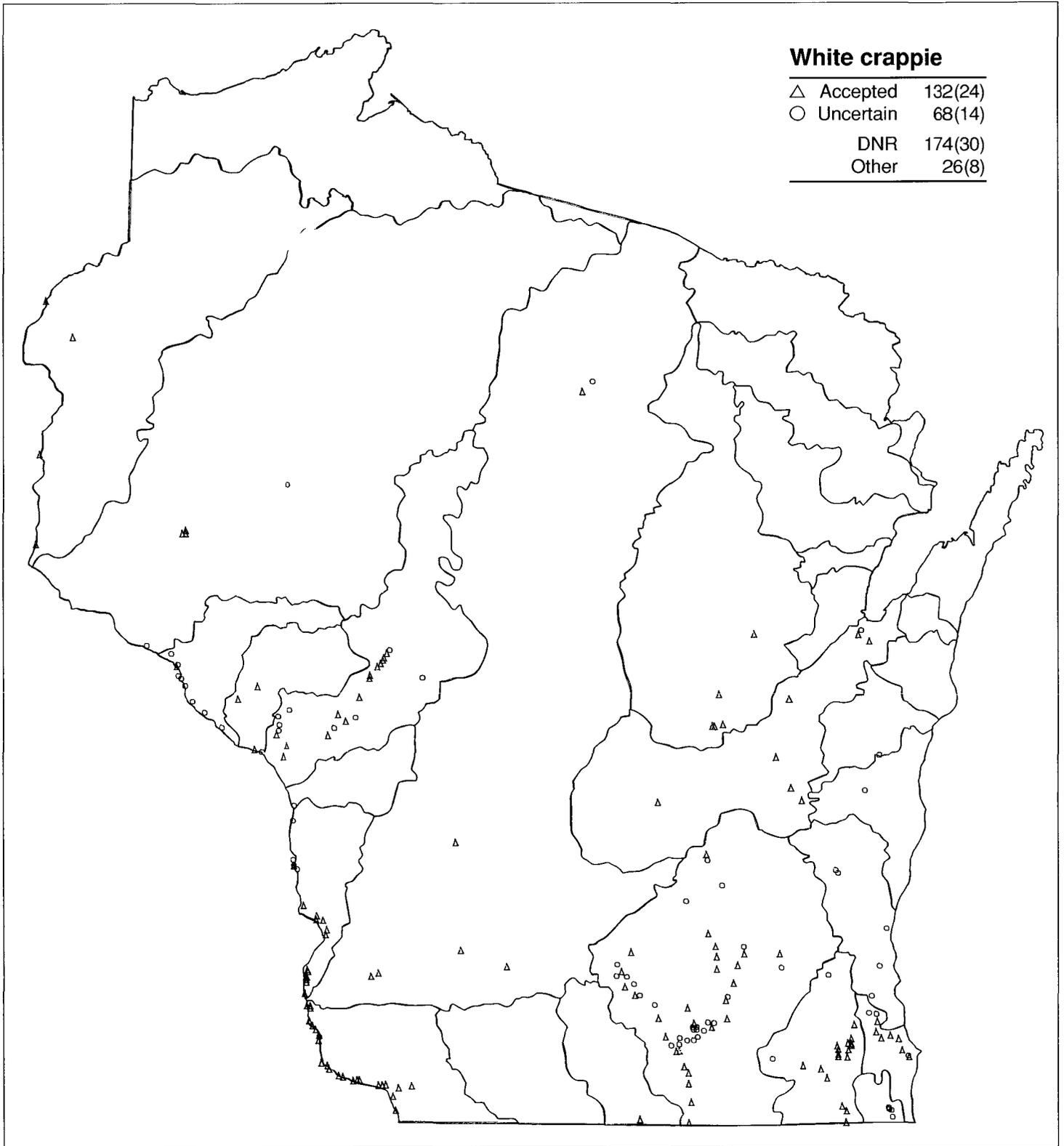
Map 121(E)



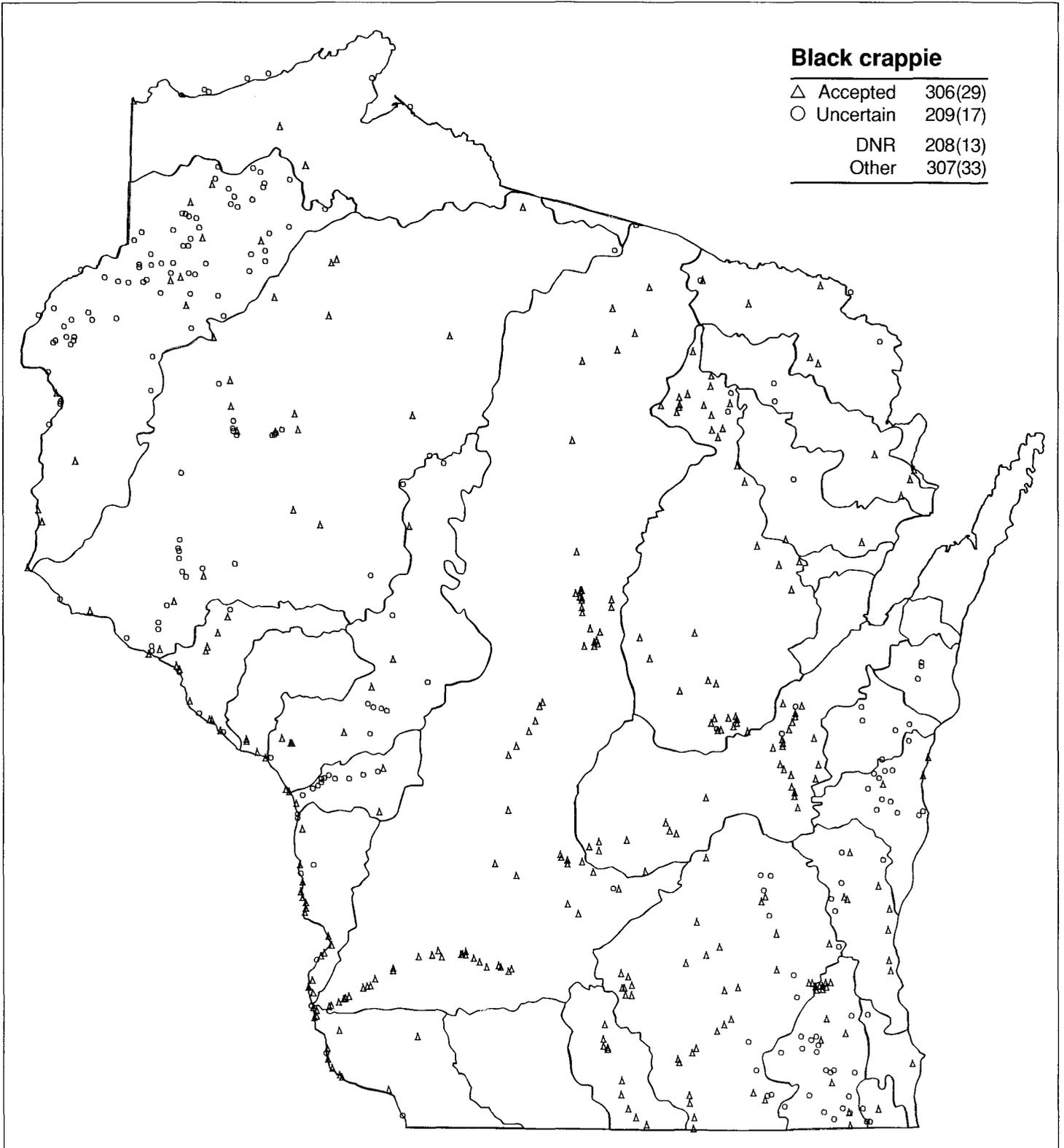


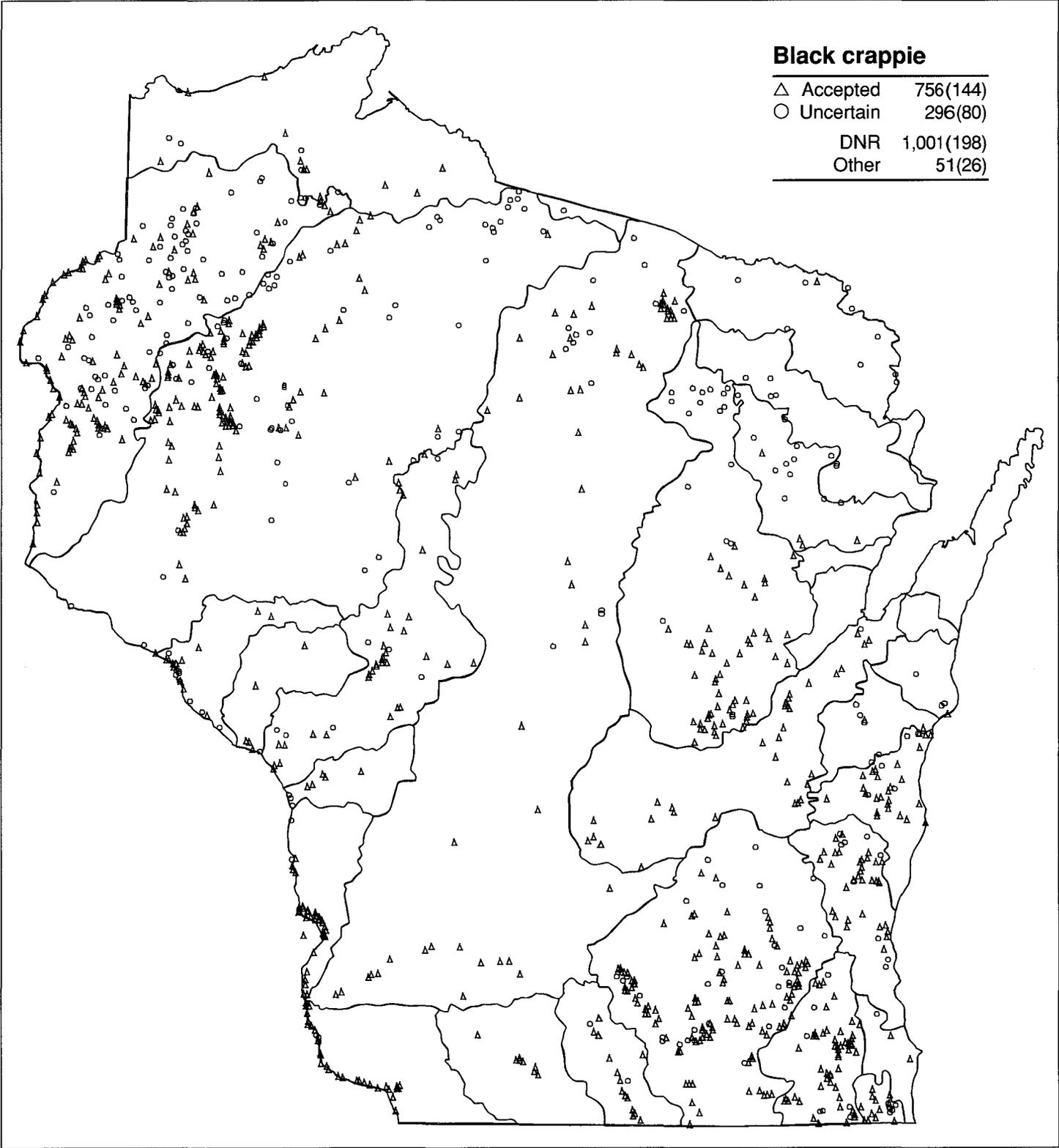
Map 122(E)



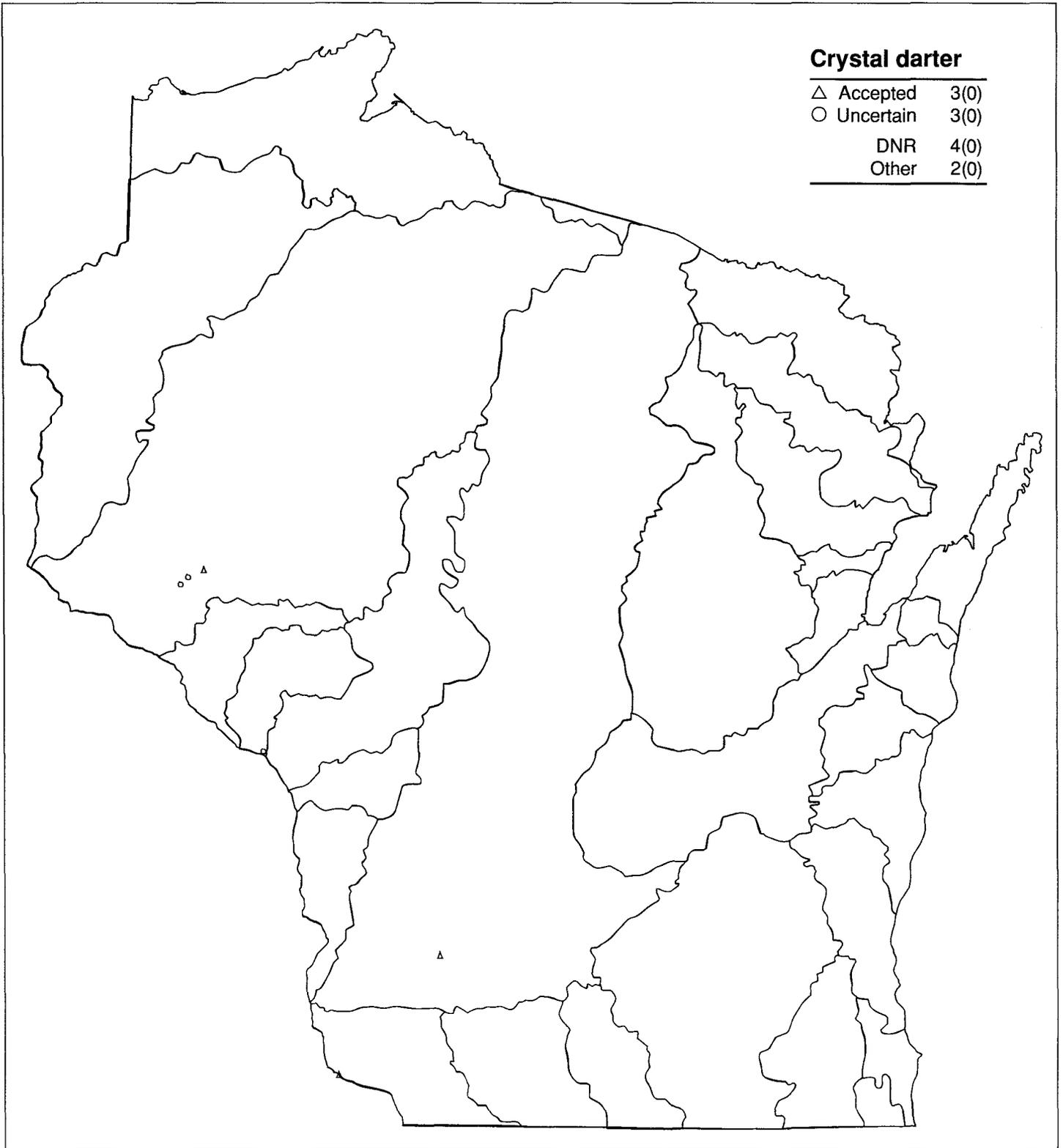


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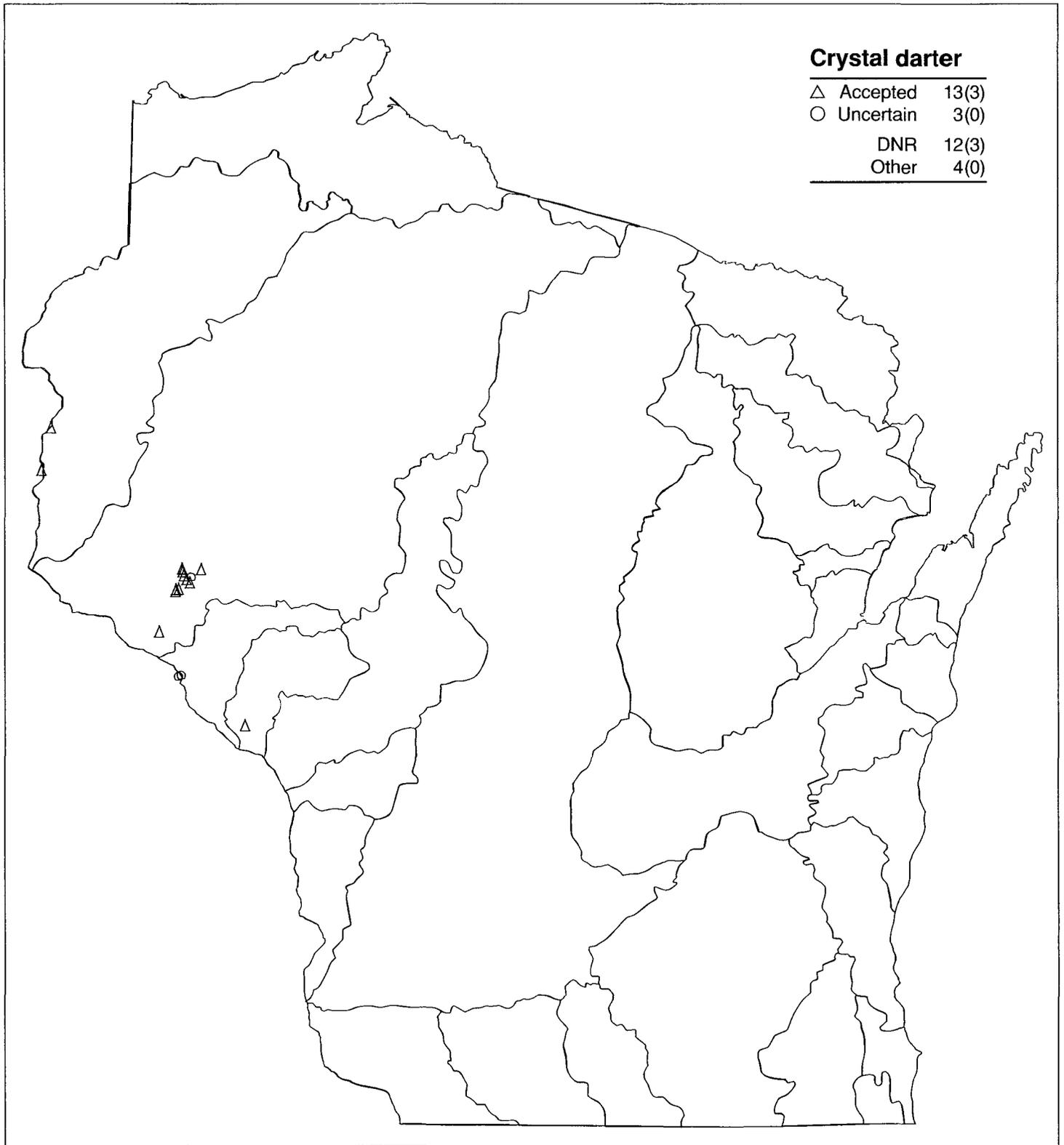




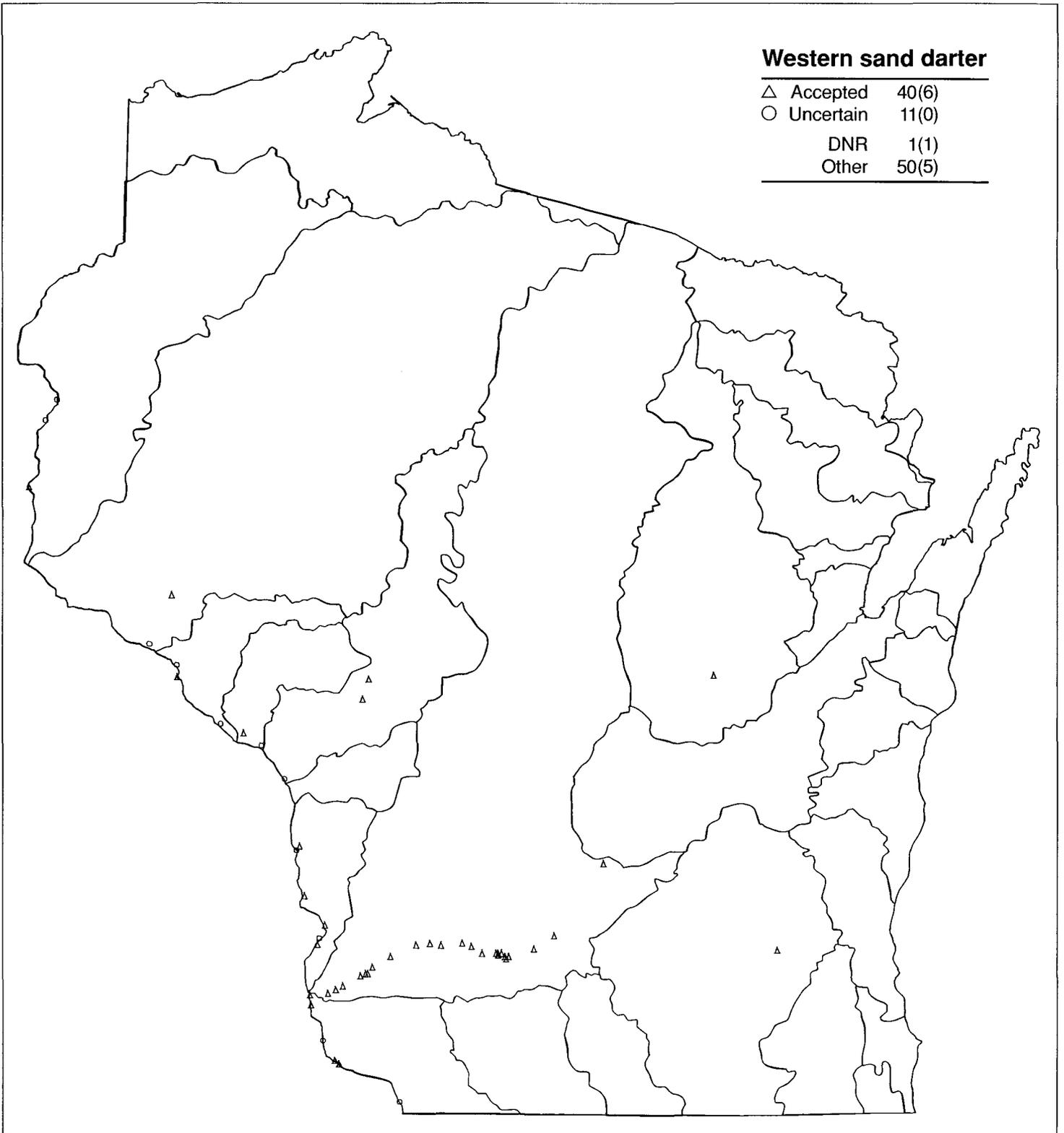
Map 124(E)

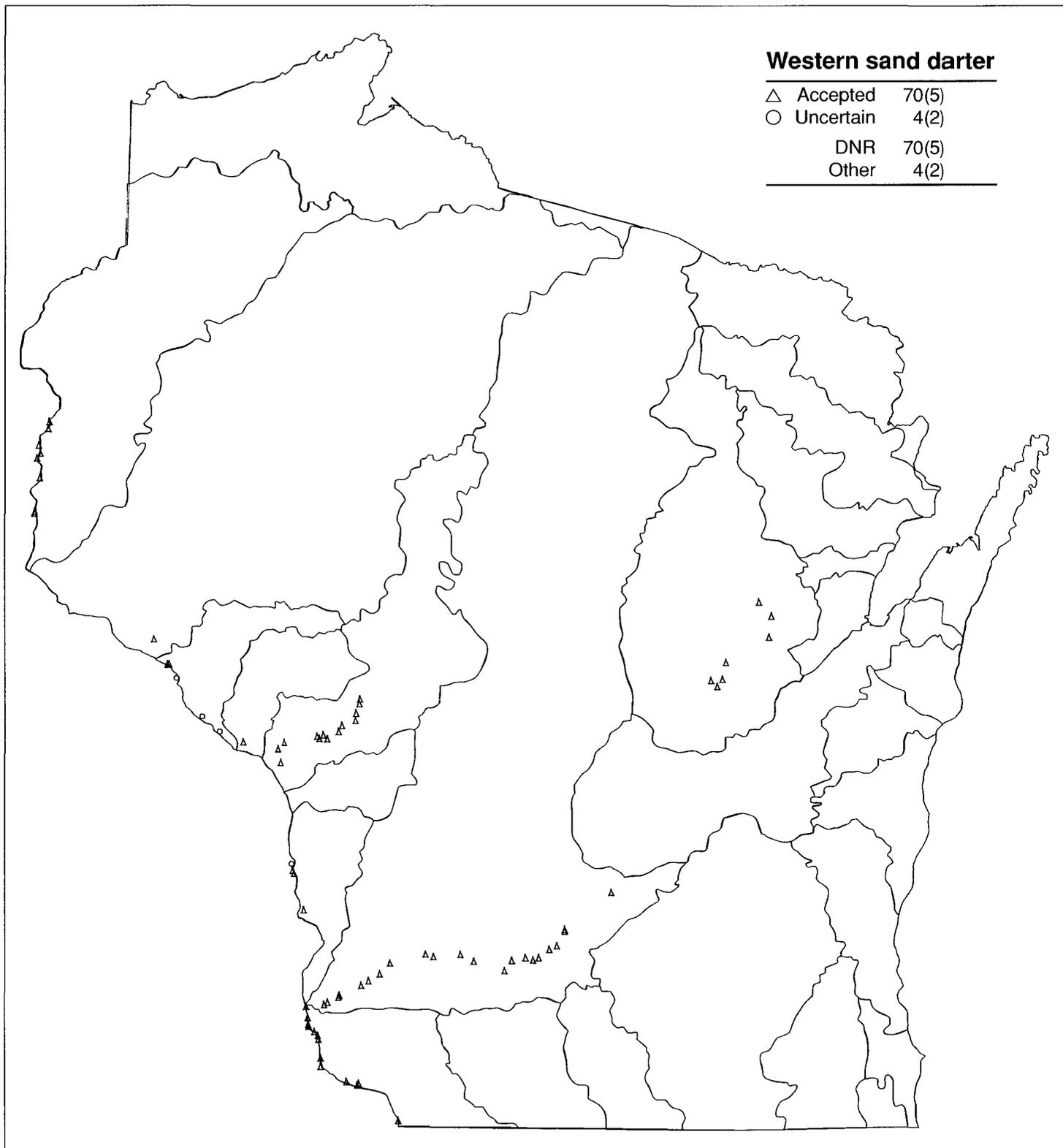


Map 124(L)

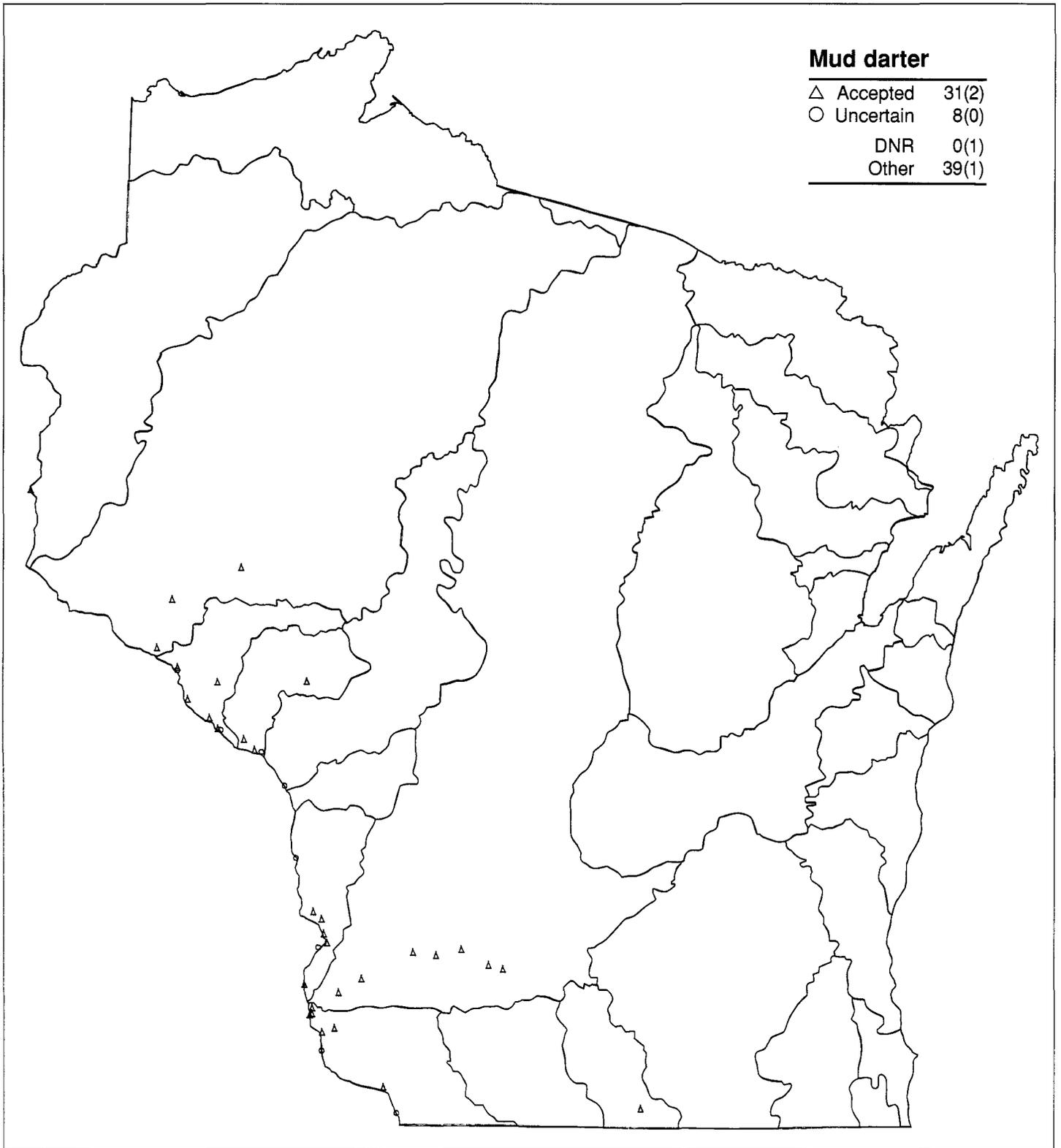


Map 125(E)





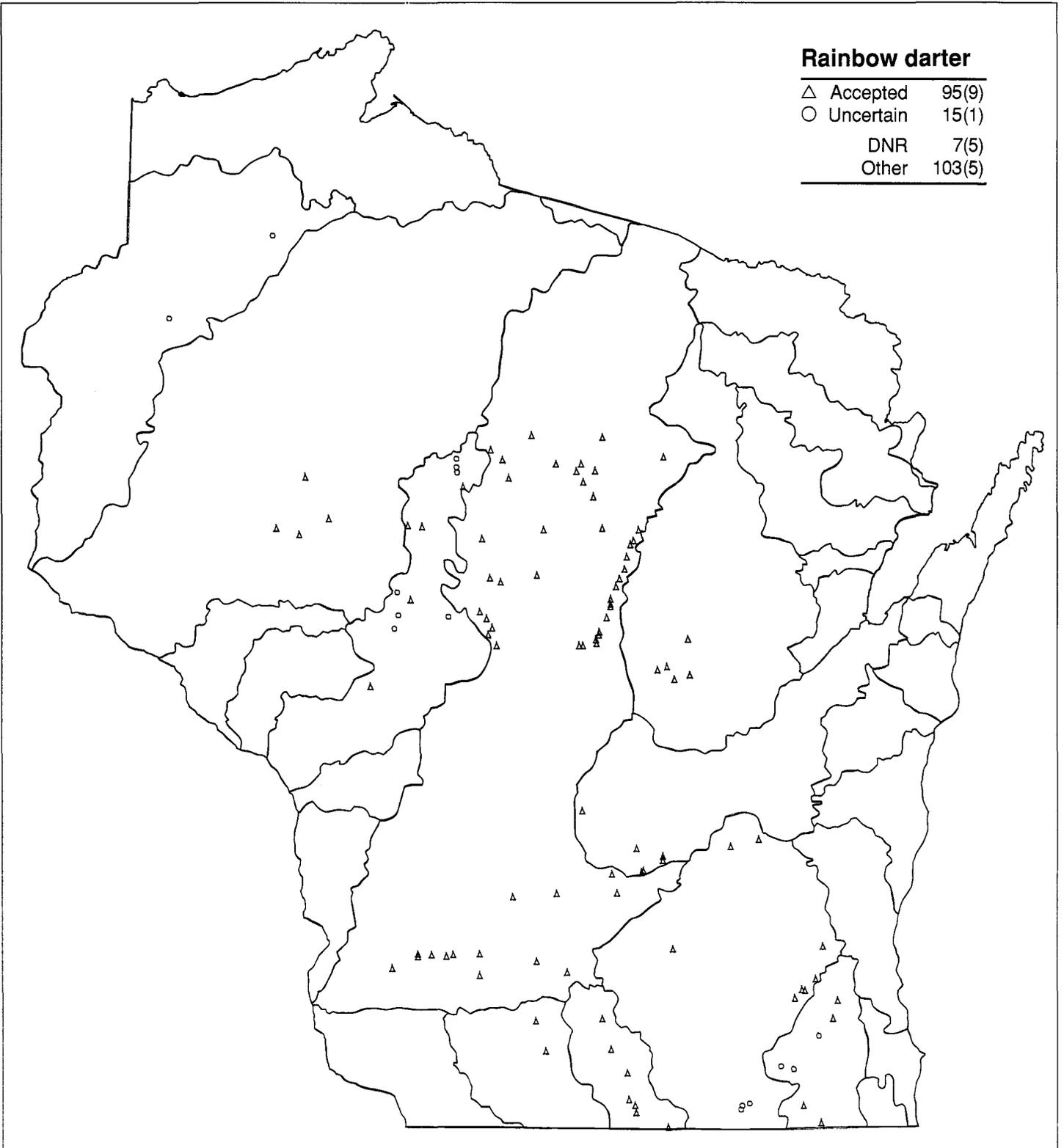
Map 126(E)

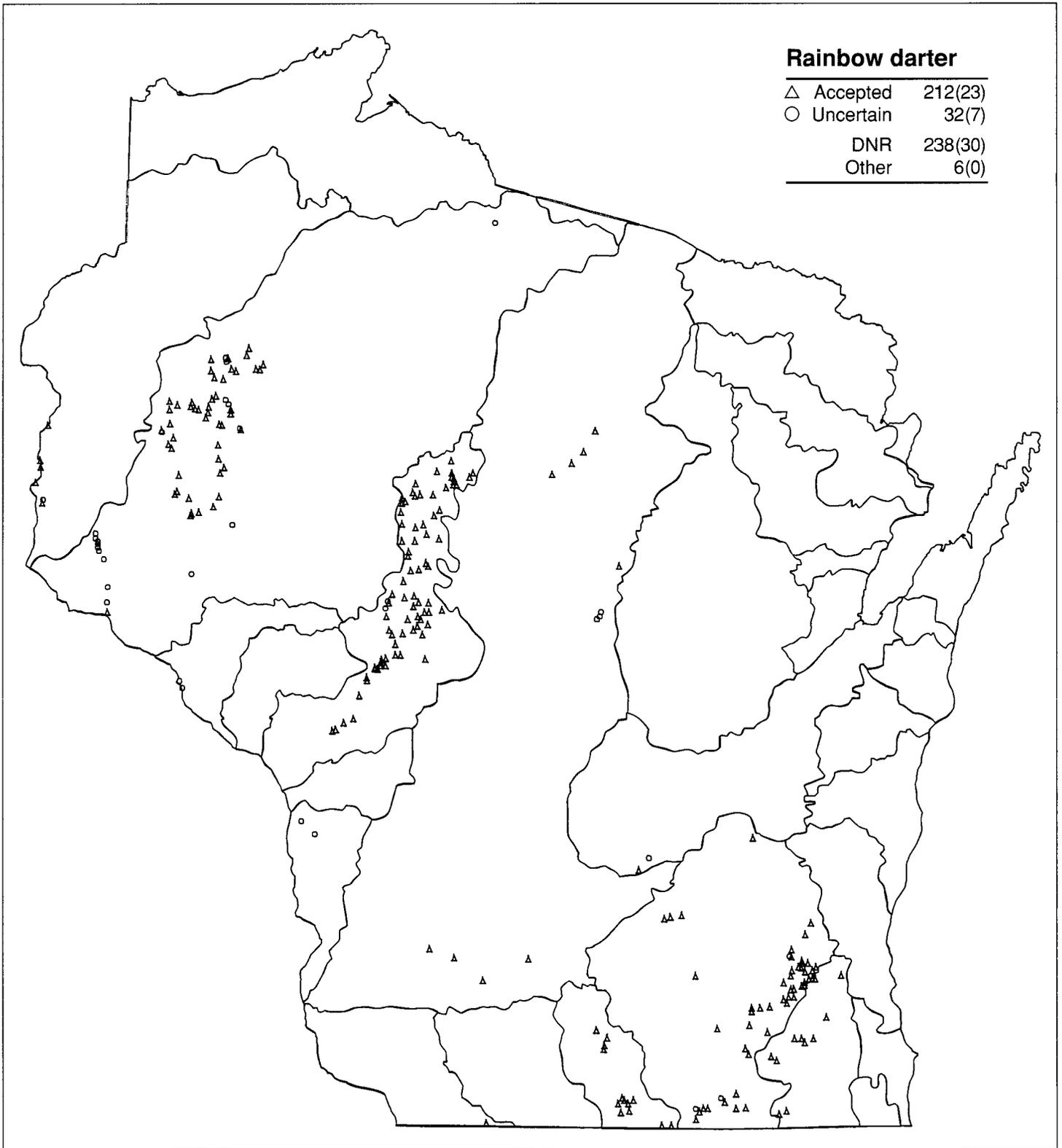


Map 126(L)

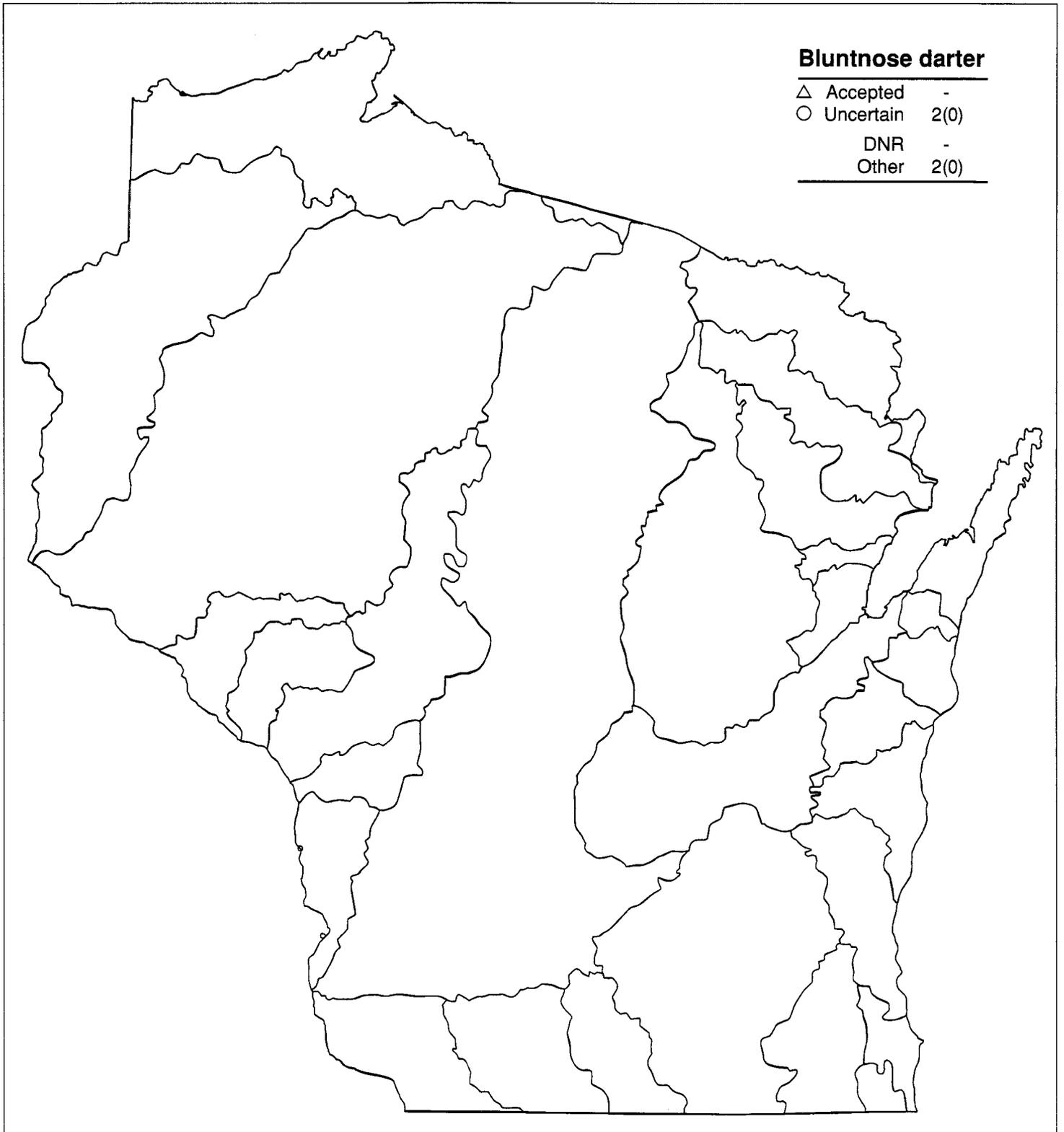


Map 127(E)



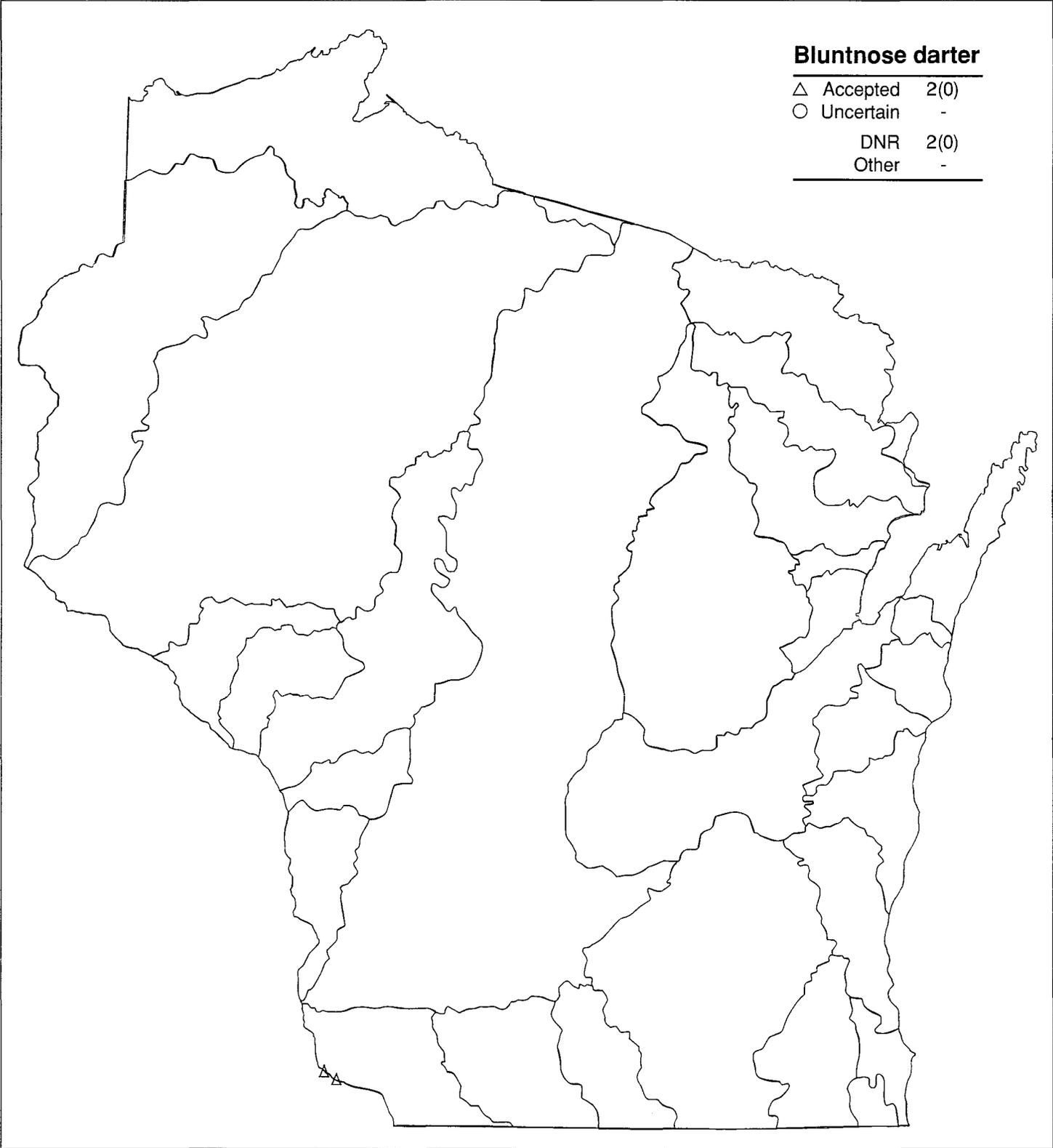


Map 128(E)



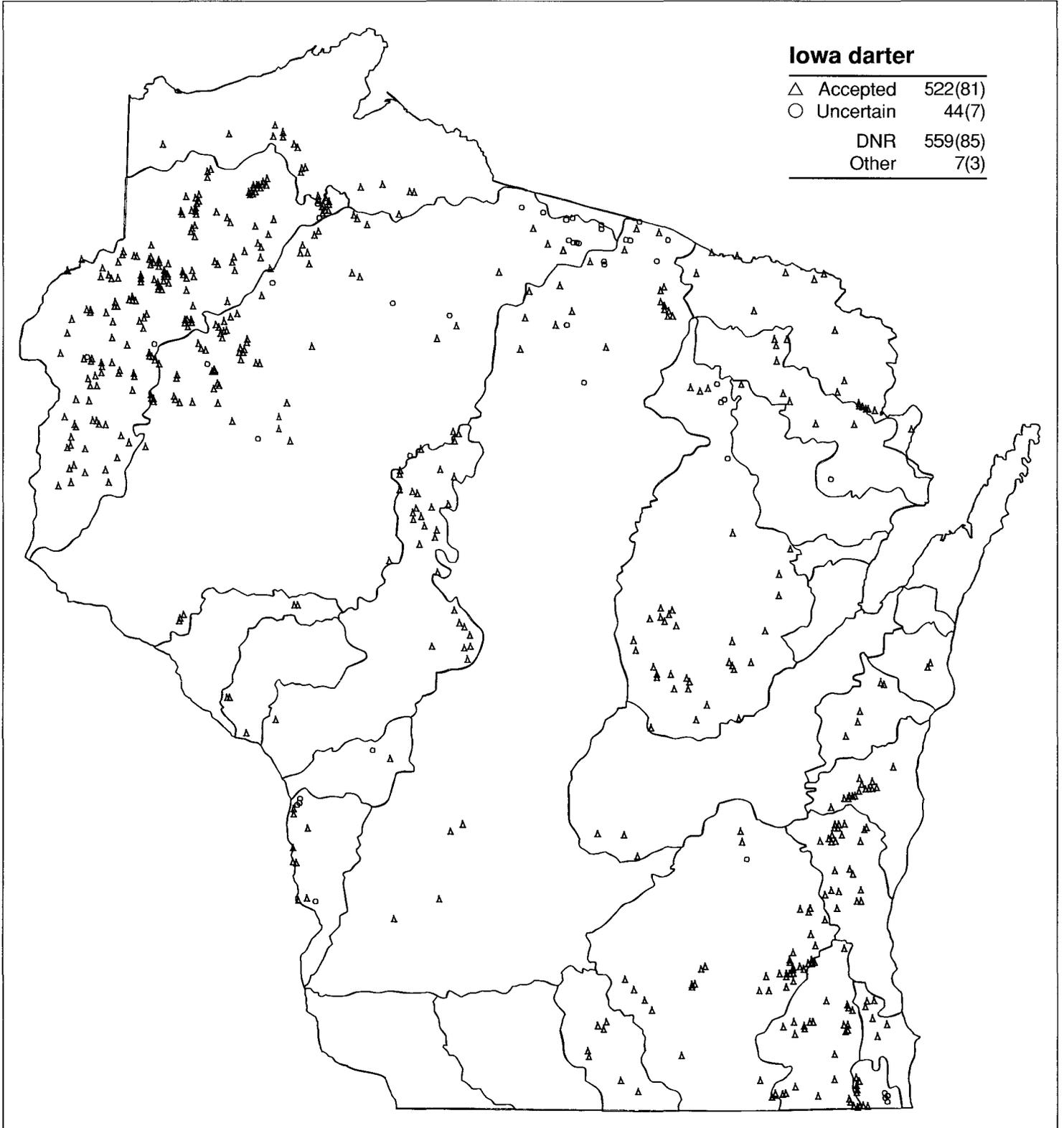
Bluntnose darter

△	Accepted	2(0)
○	Uncertain	-
	DNR	2(0)
	Other	-

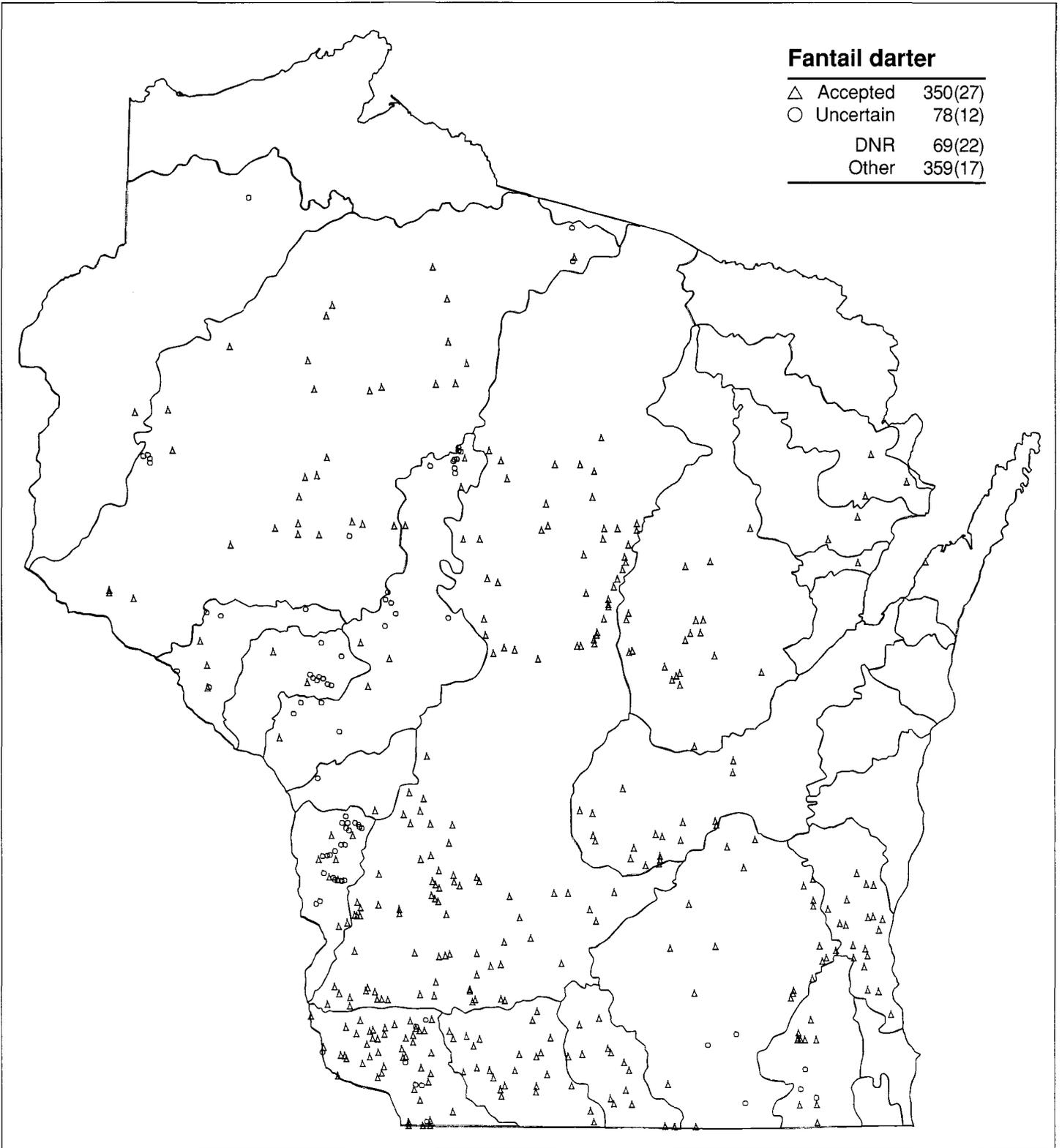


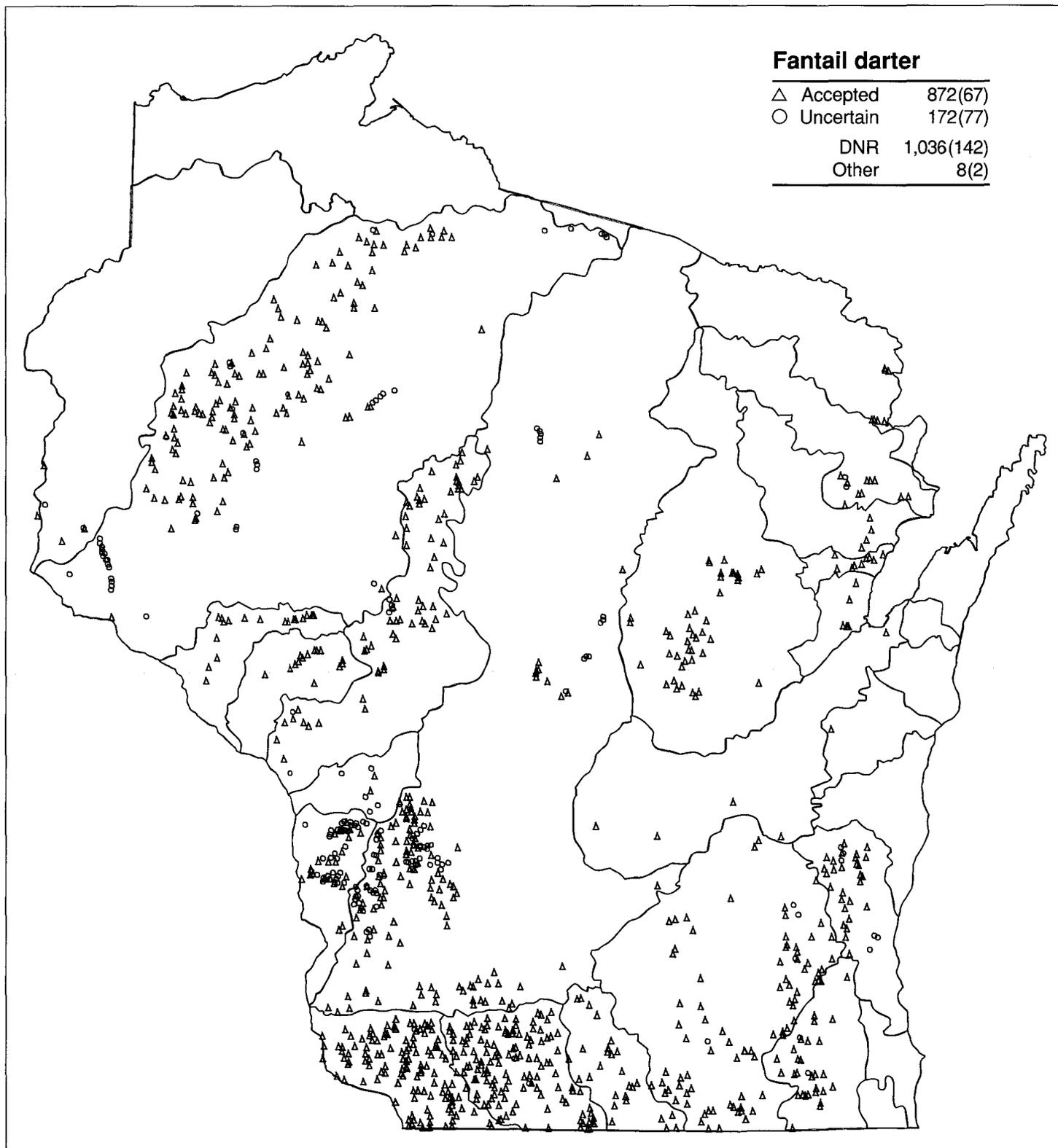
Map 129(E)





Map 130(E)

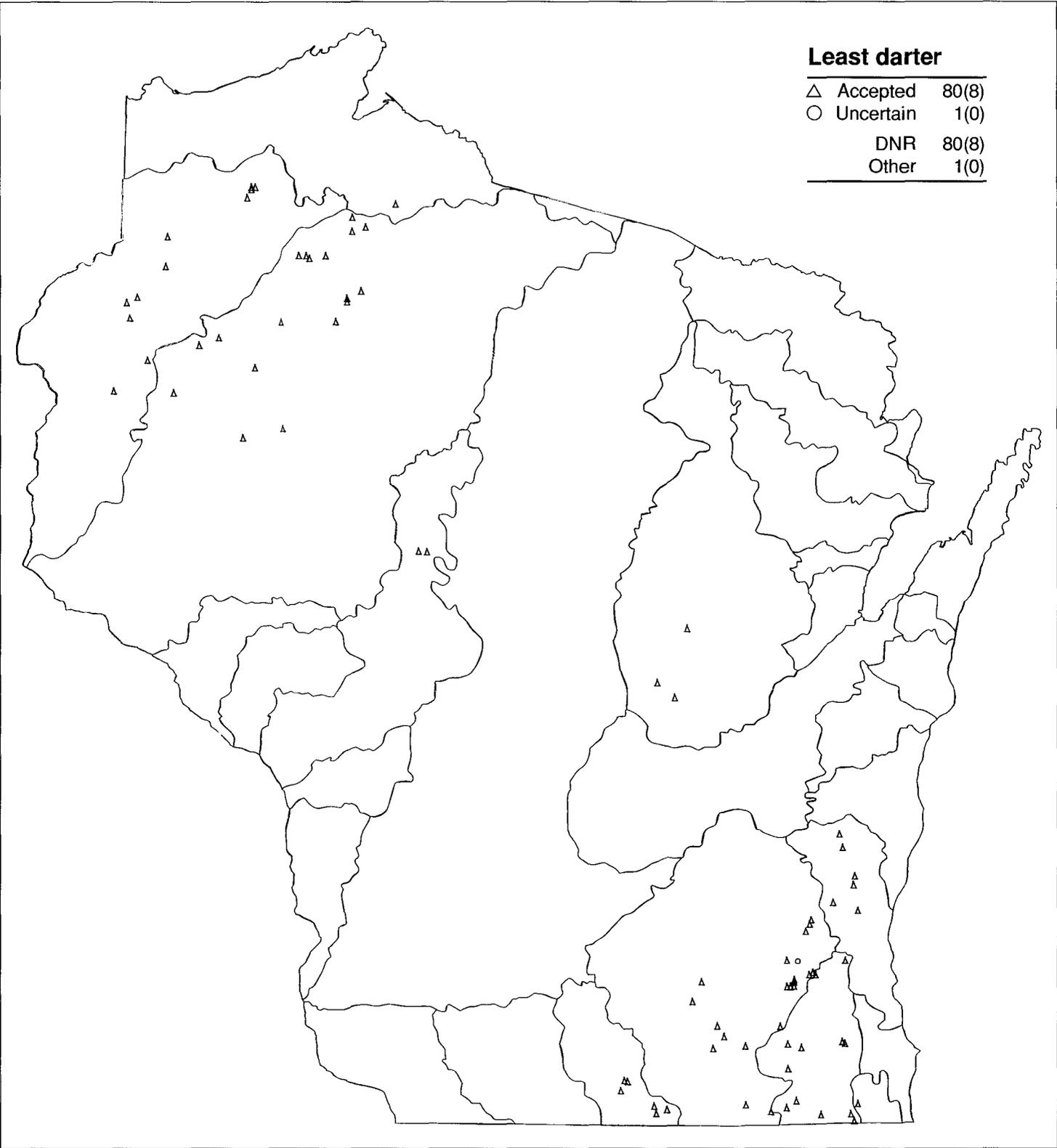




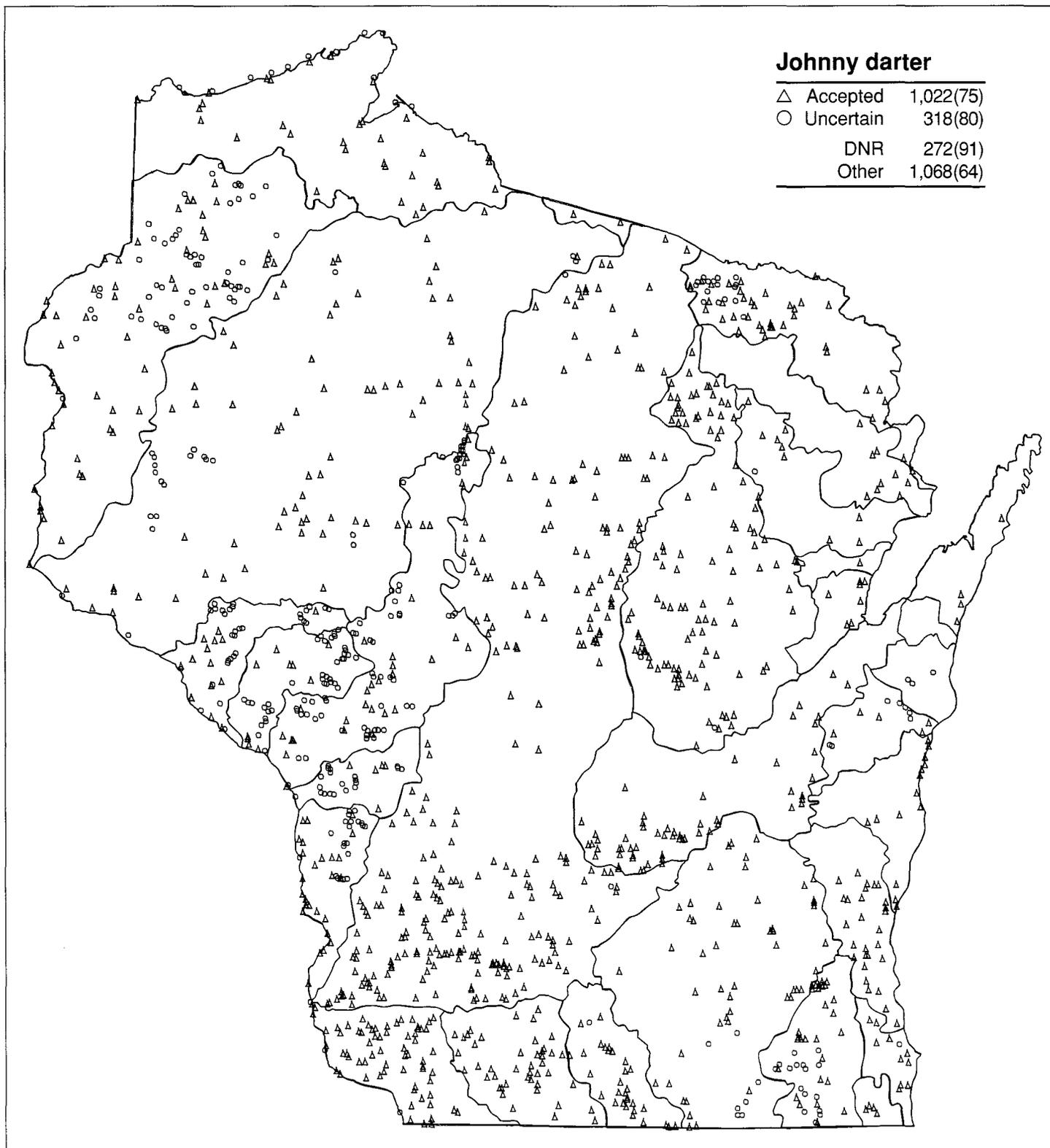
Map 131(E)

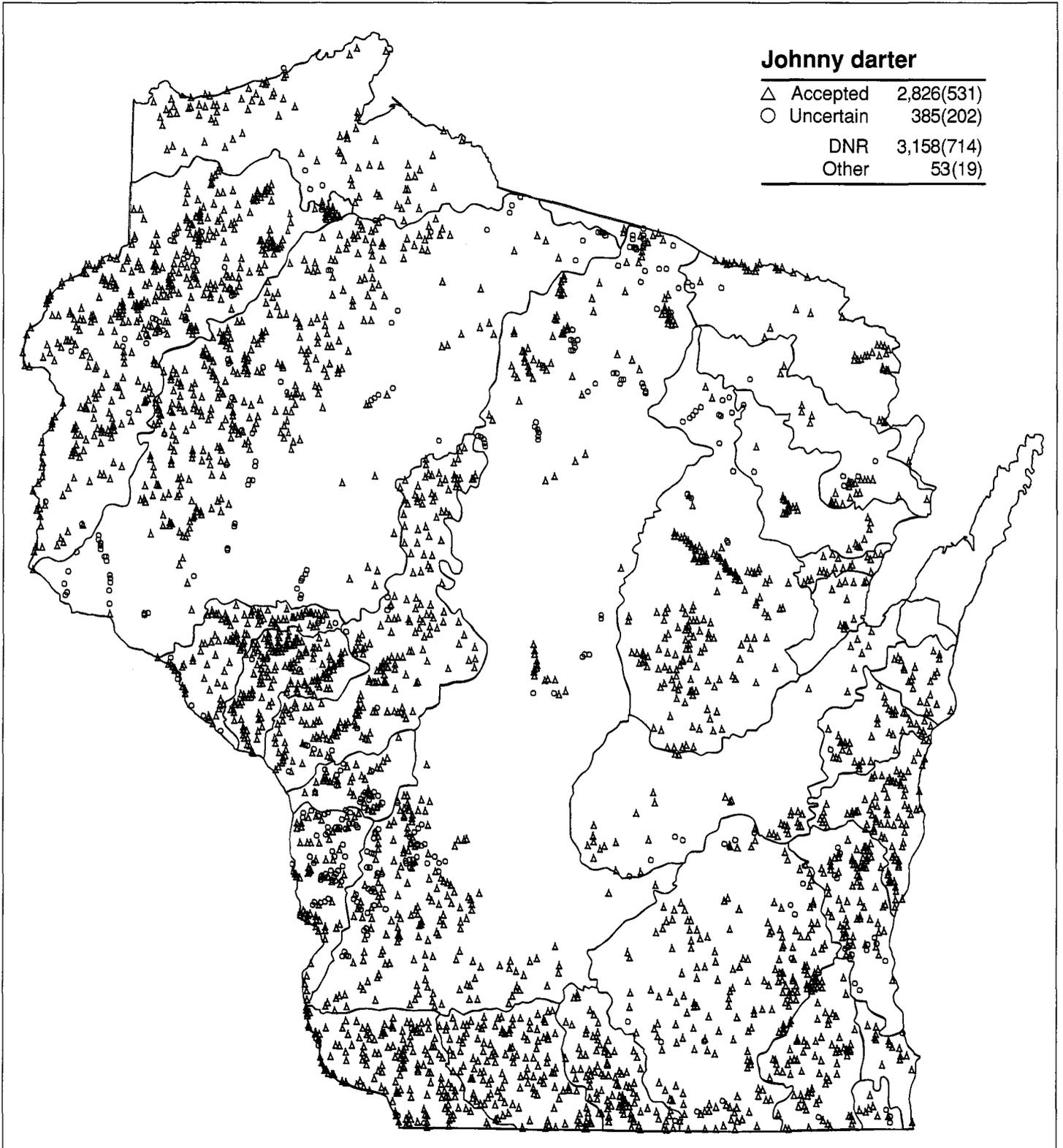


Map 131(L)

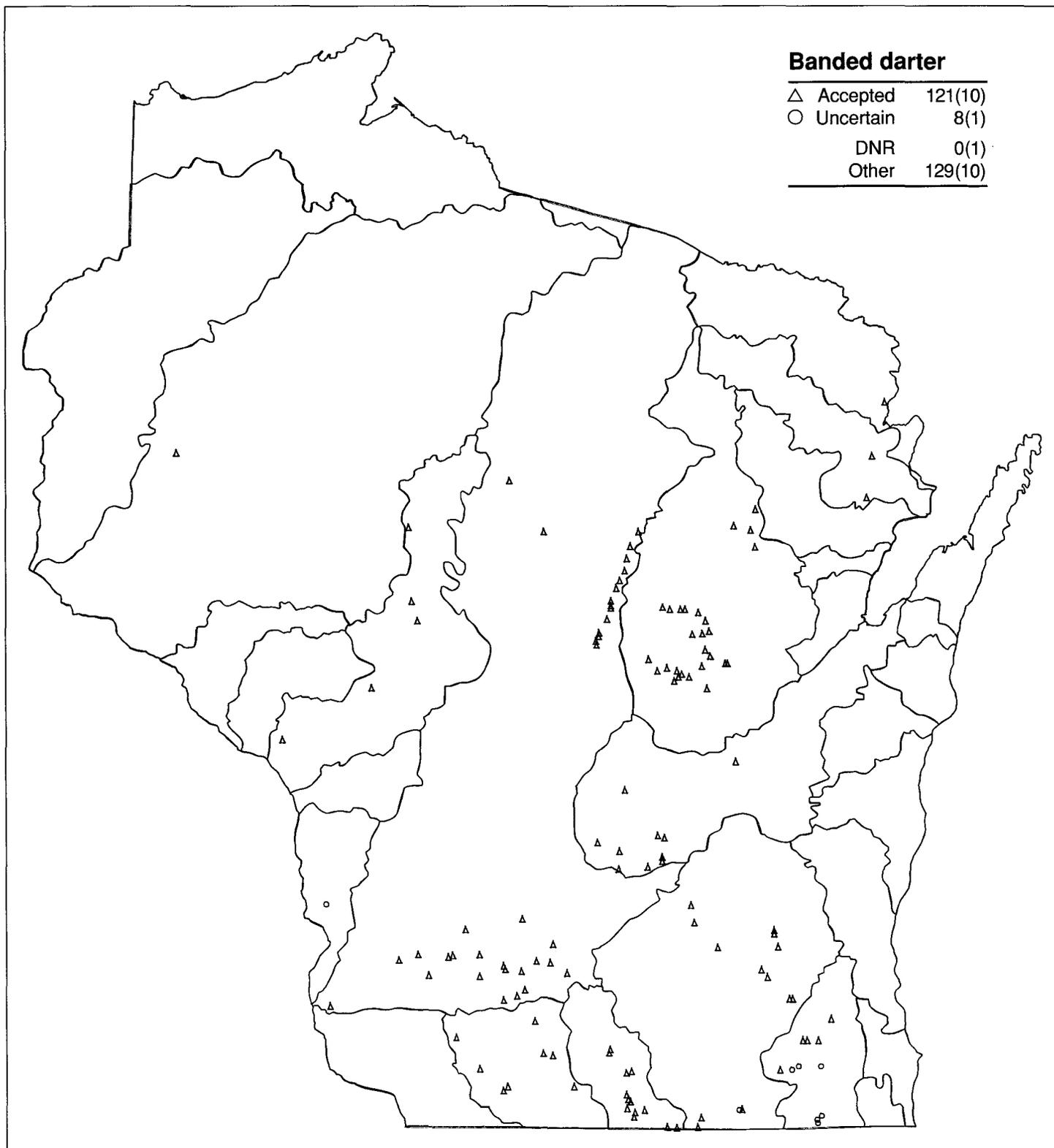


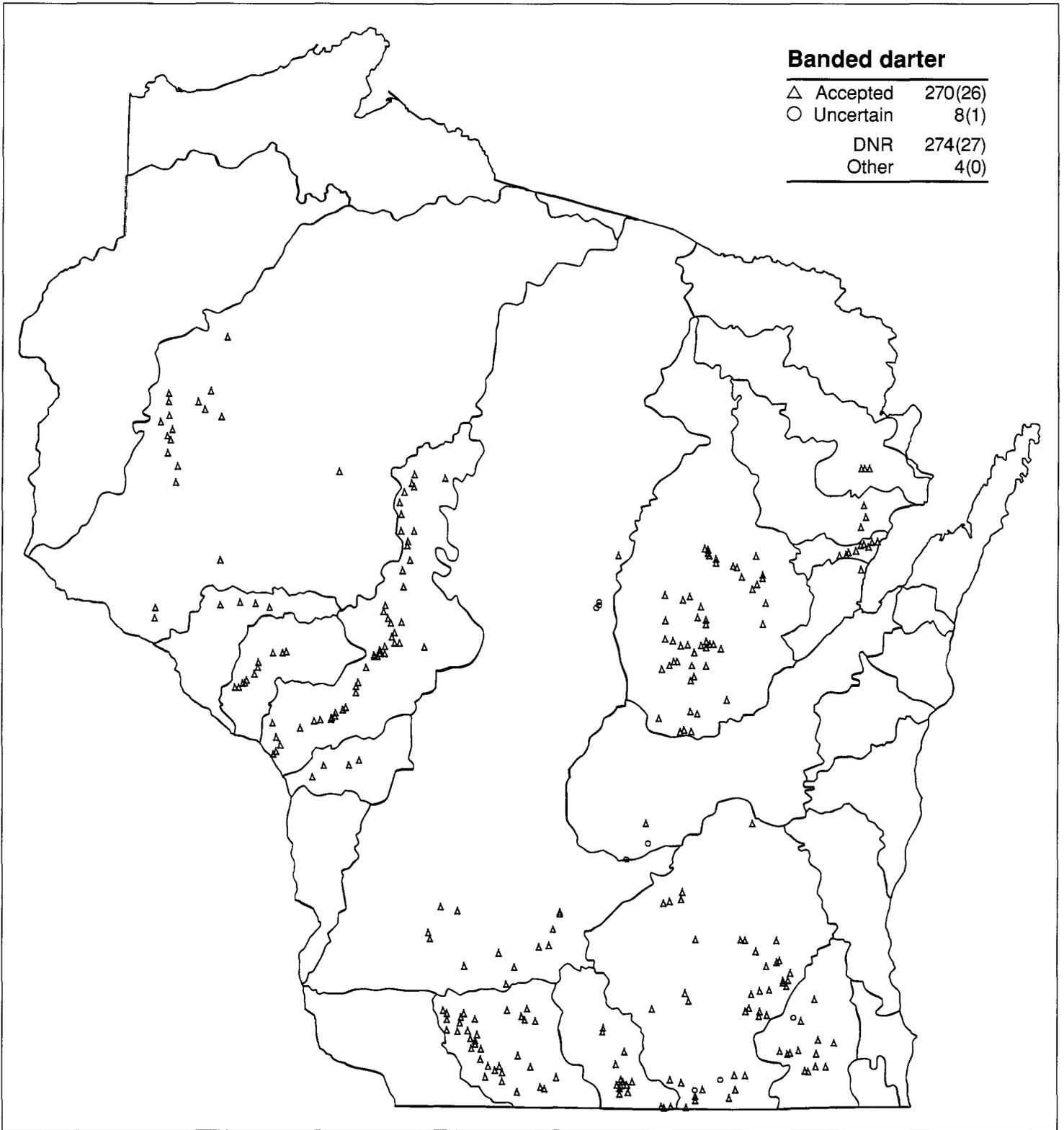
Map 132(E)



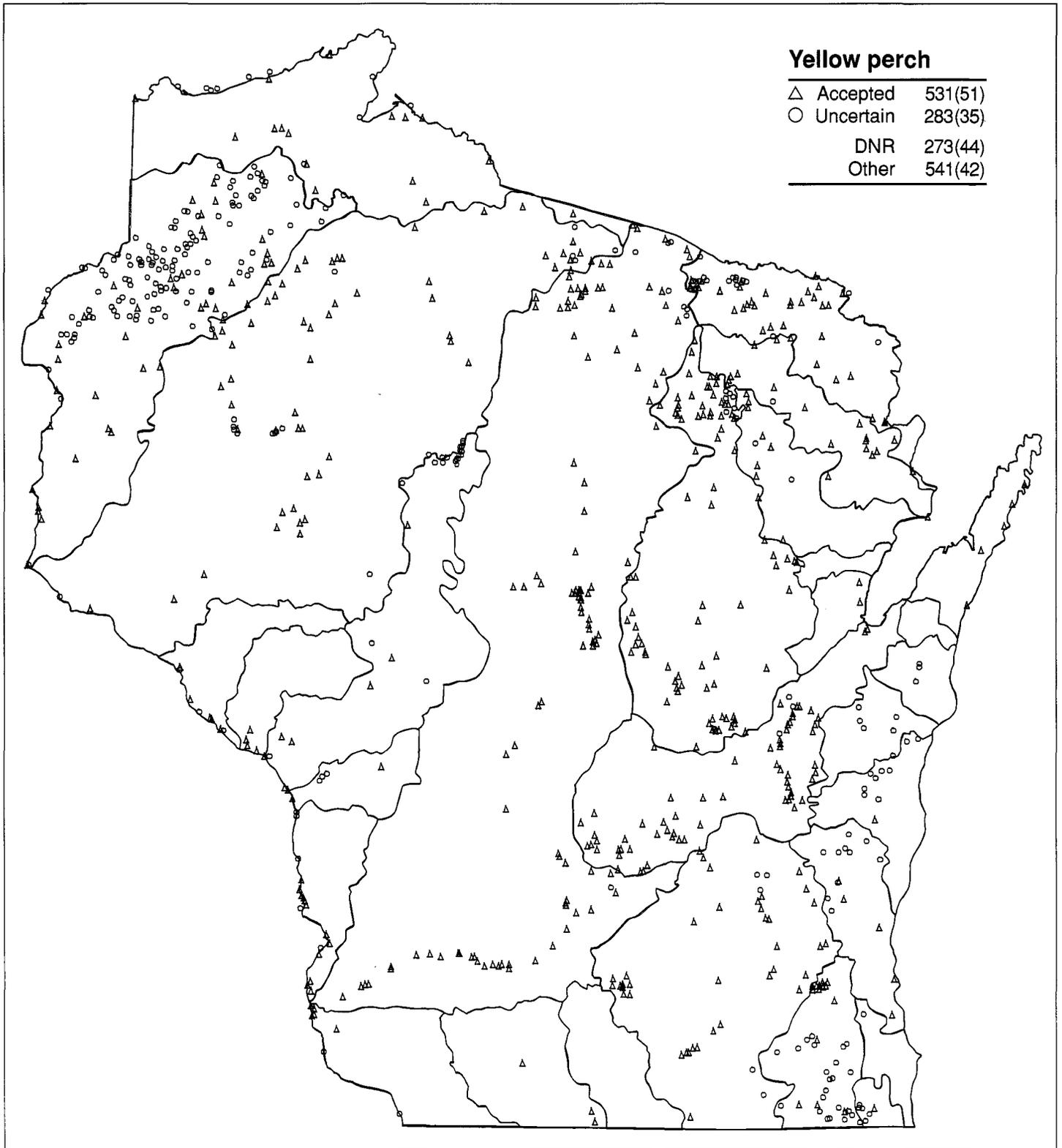


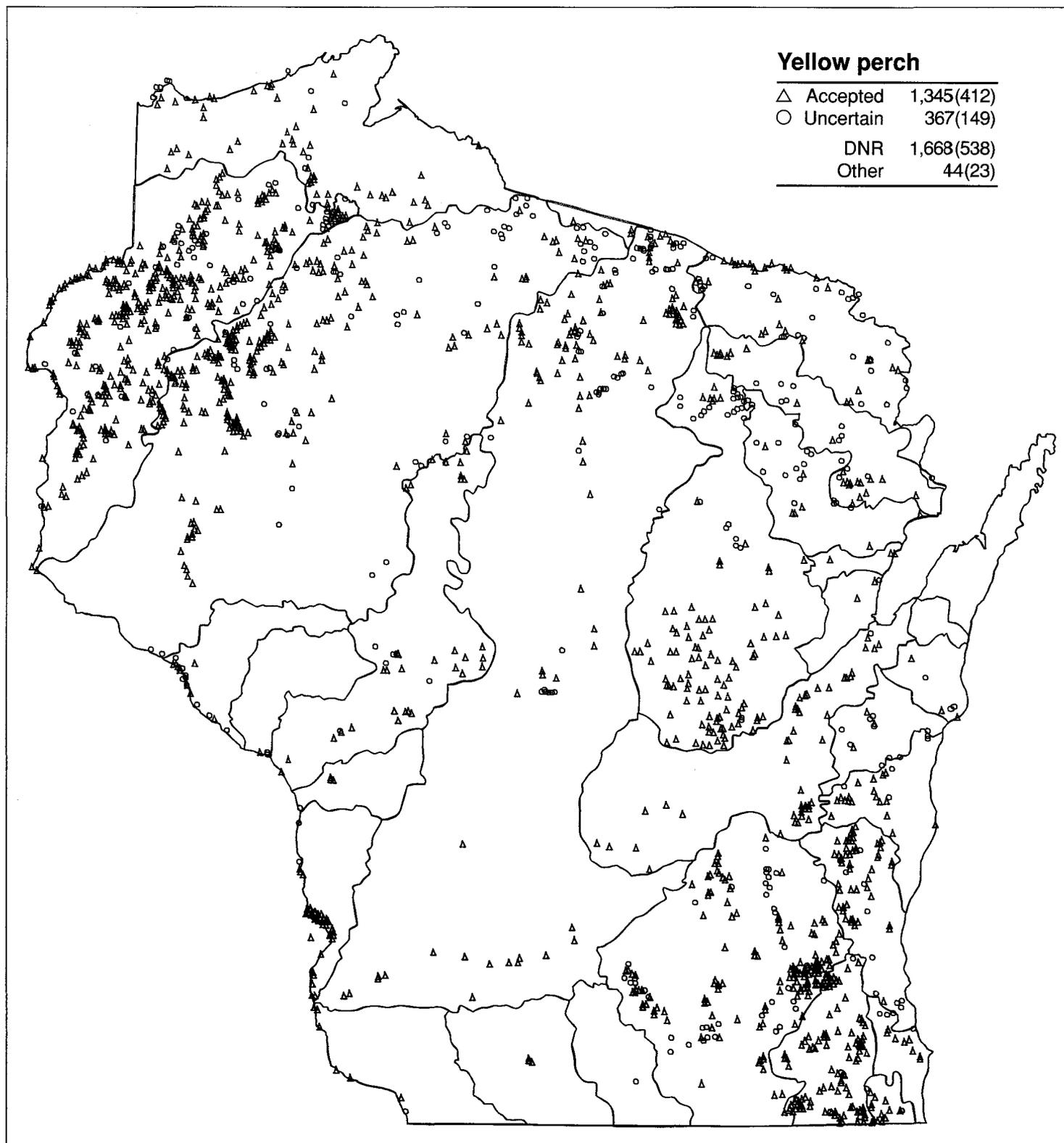
Map 133(E)



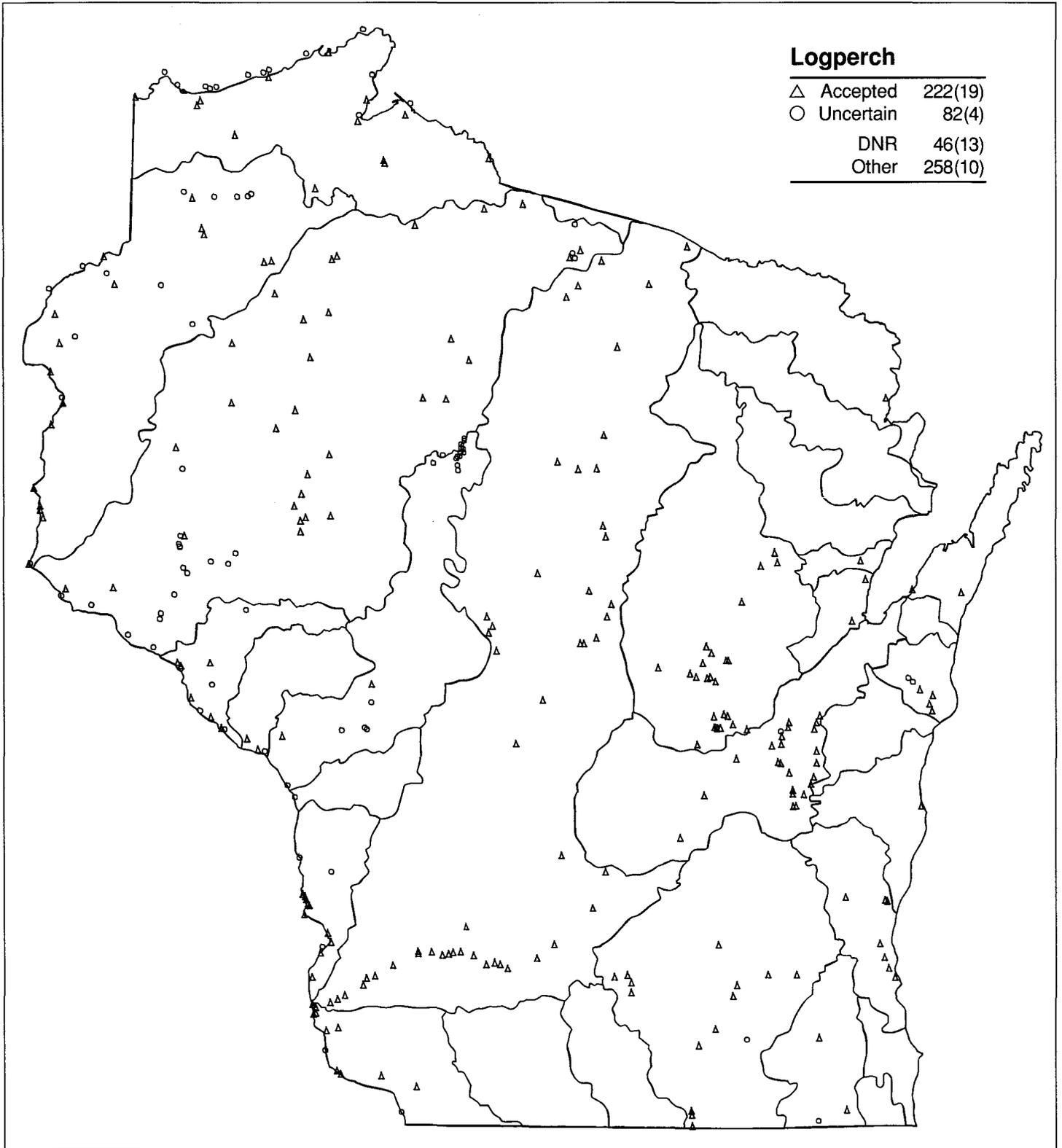


Map 134(E)



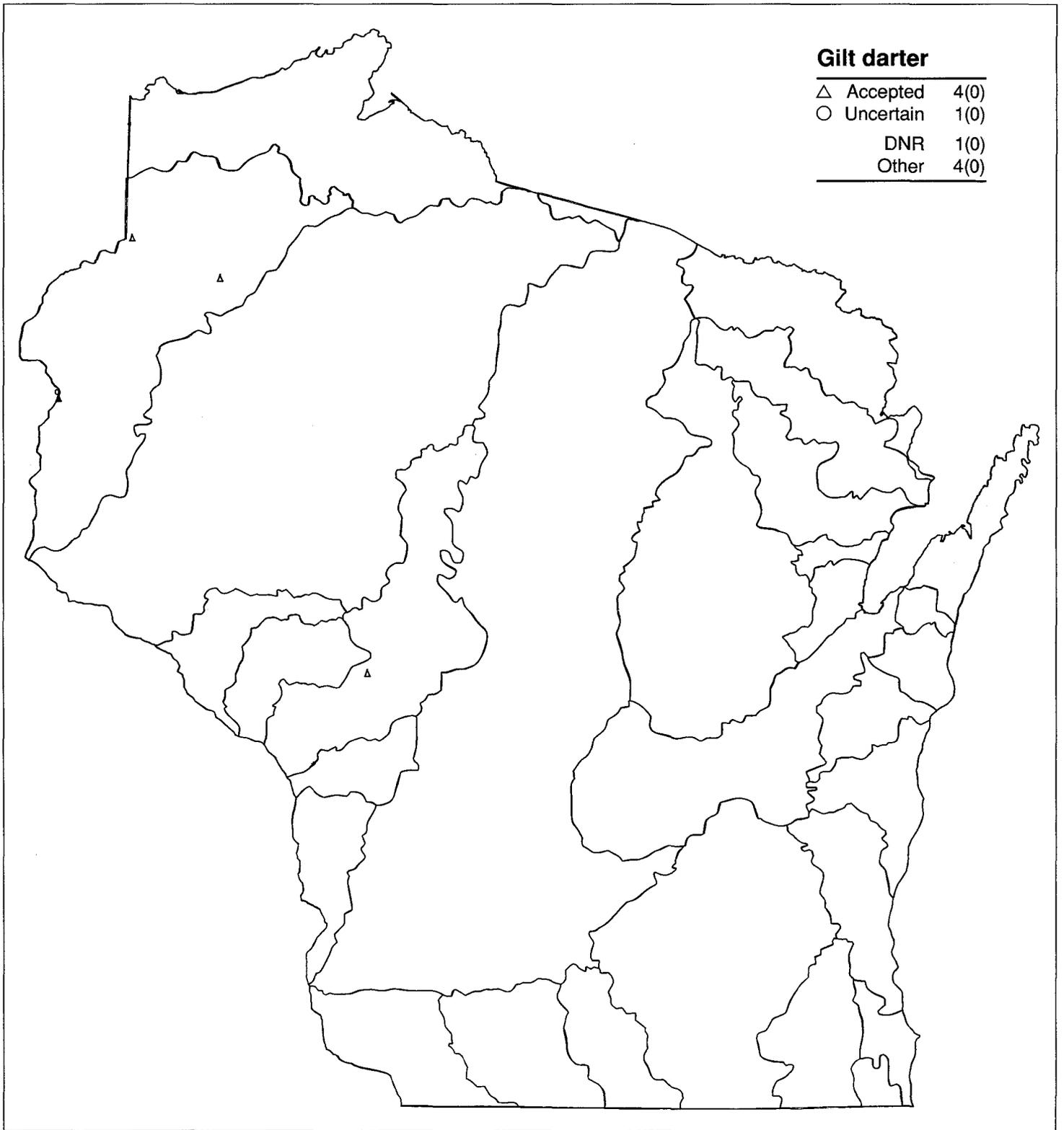


Map 135(E)

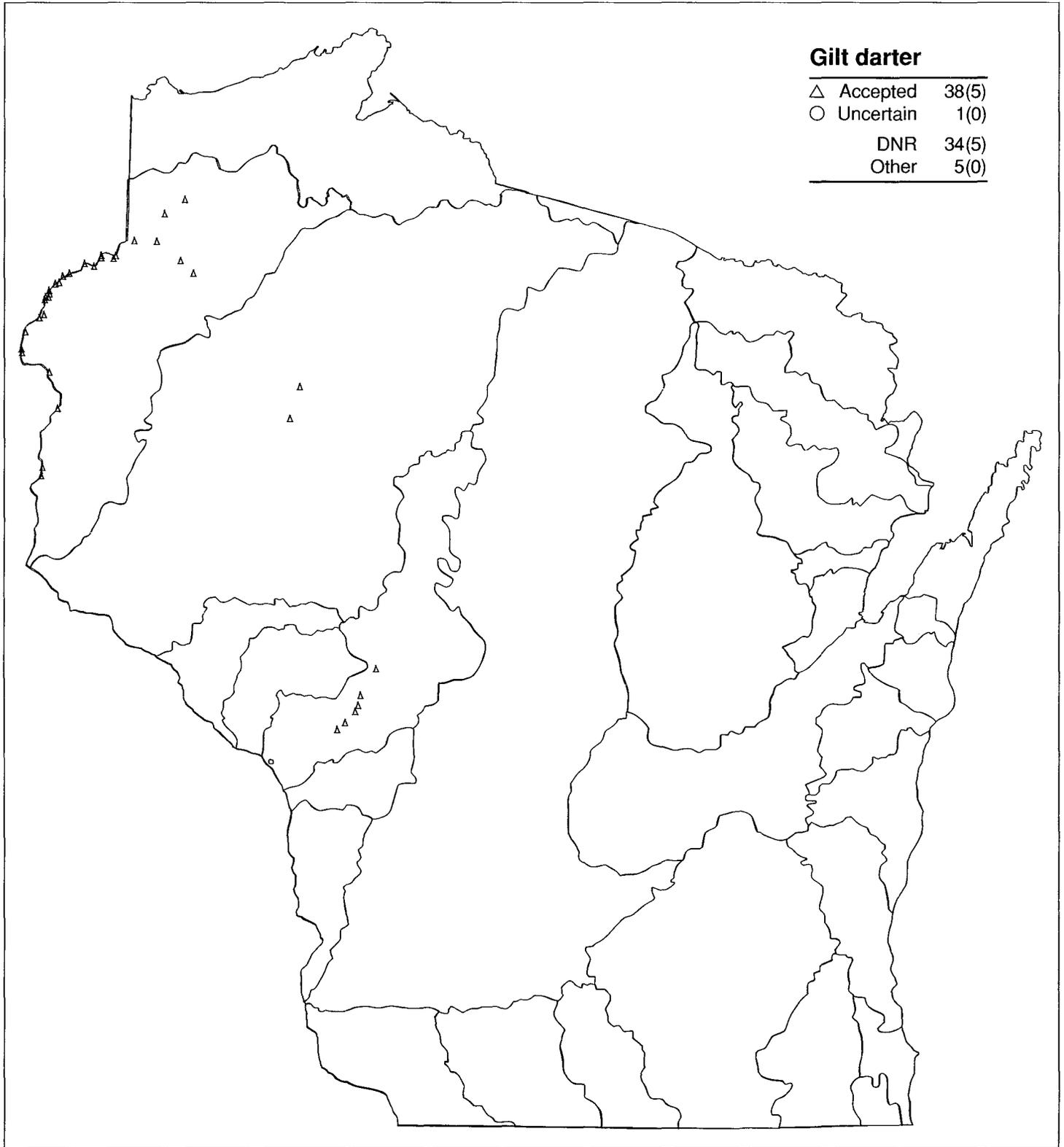




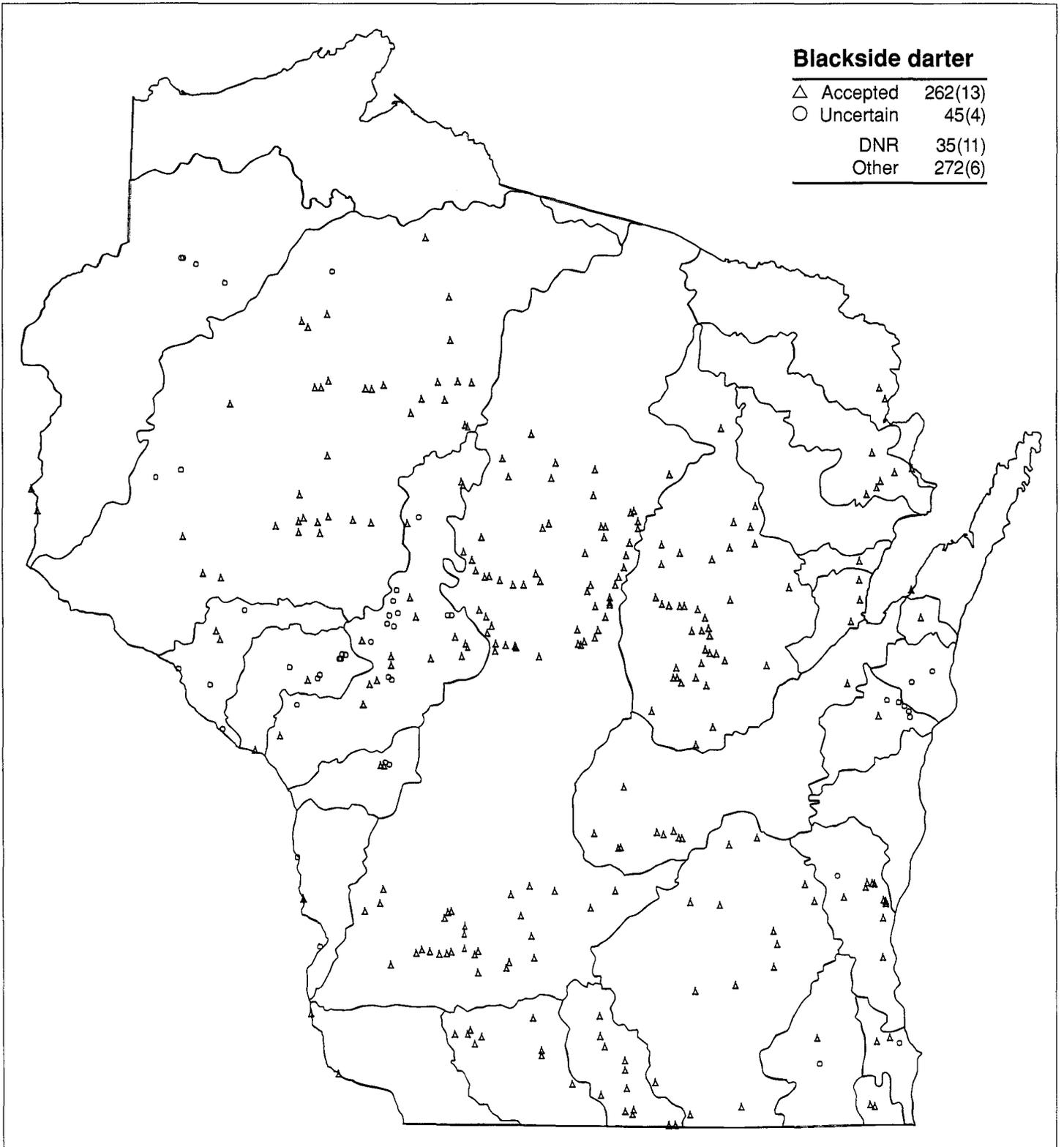
Map 136(E)

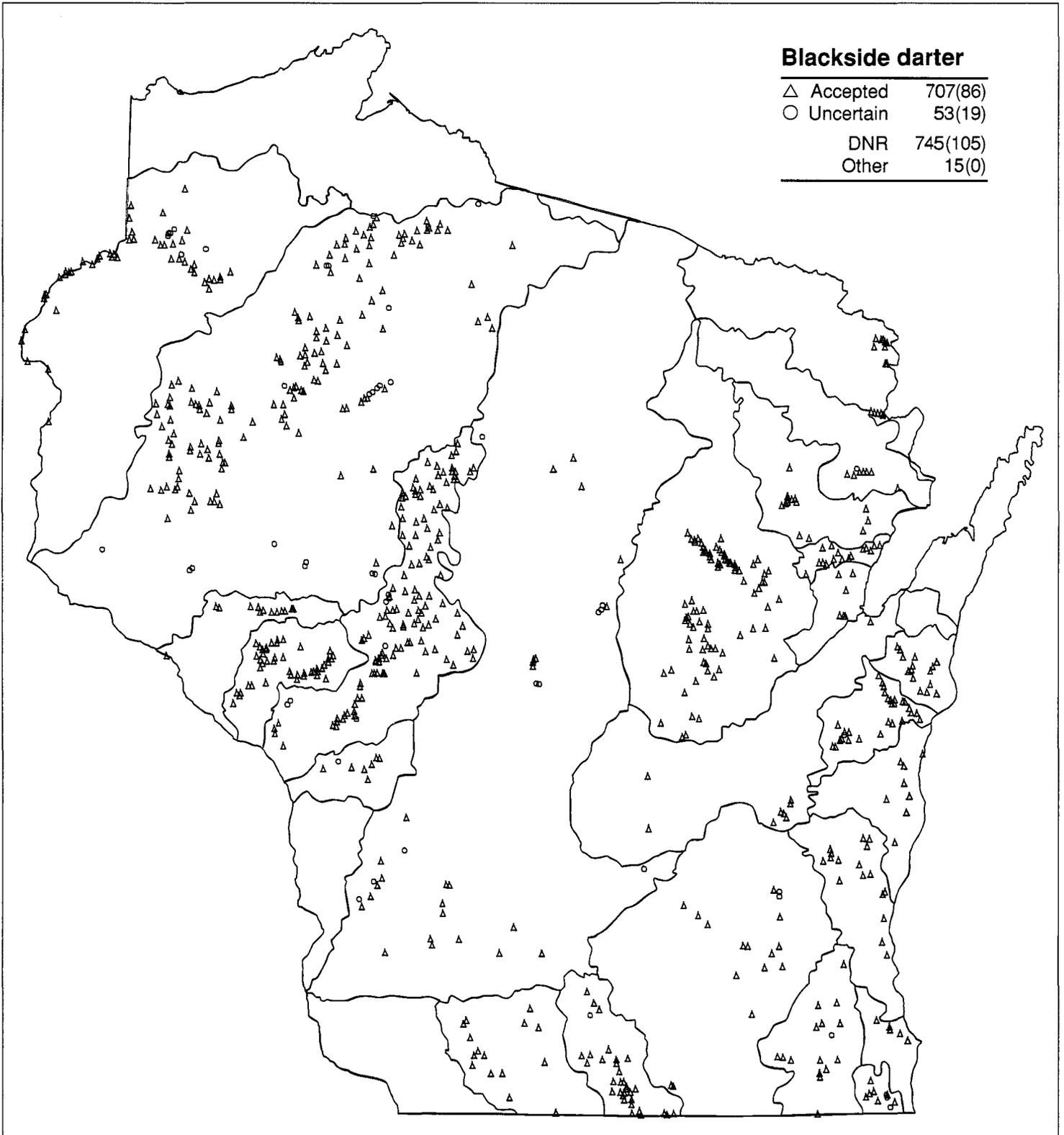


Map 136(L)



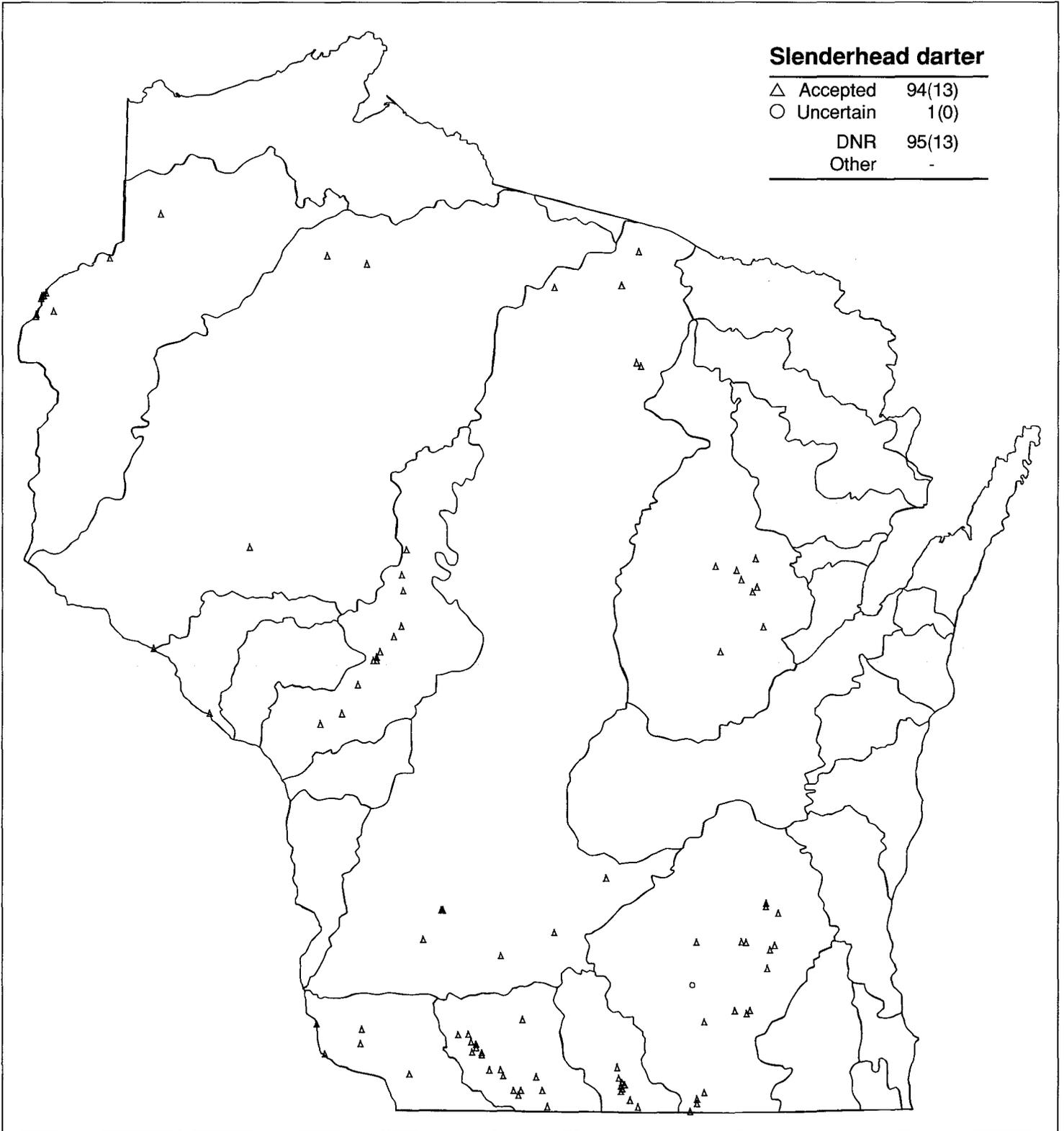
Map 137(E)



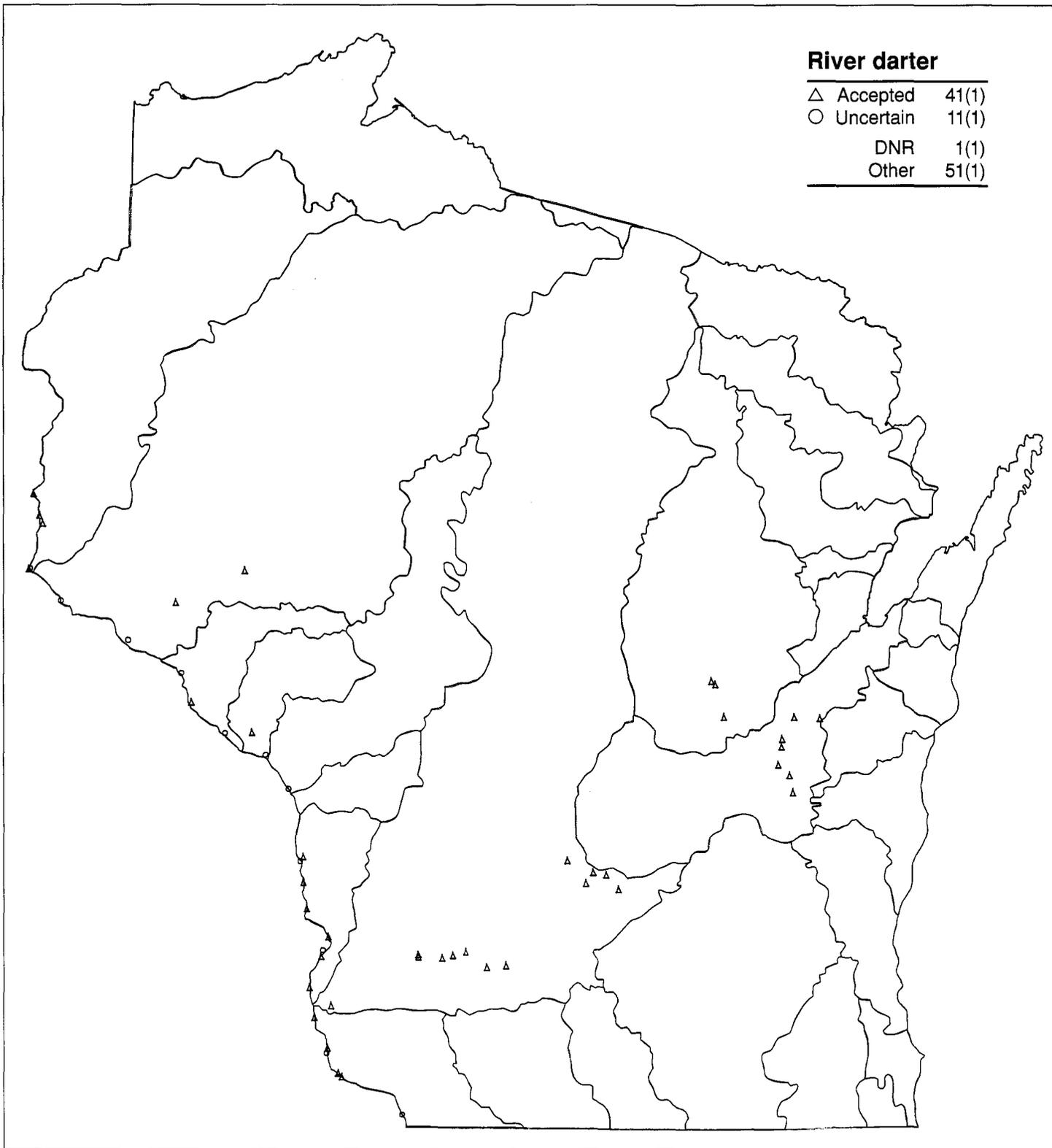


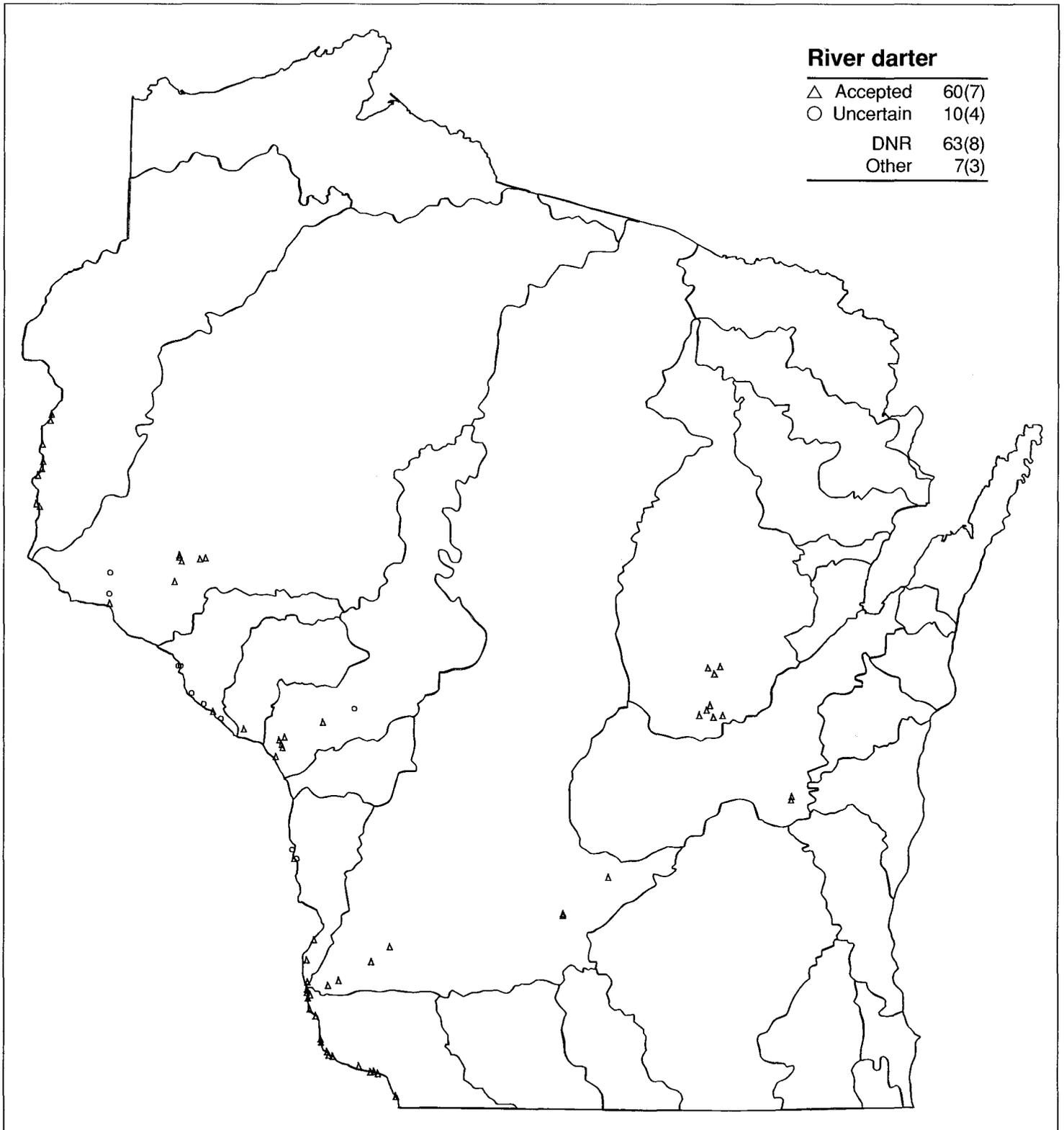
Map 138(E)



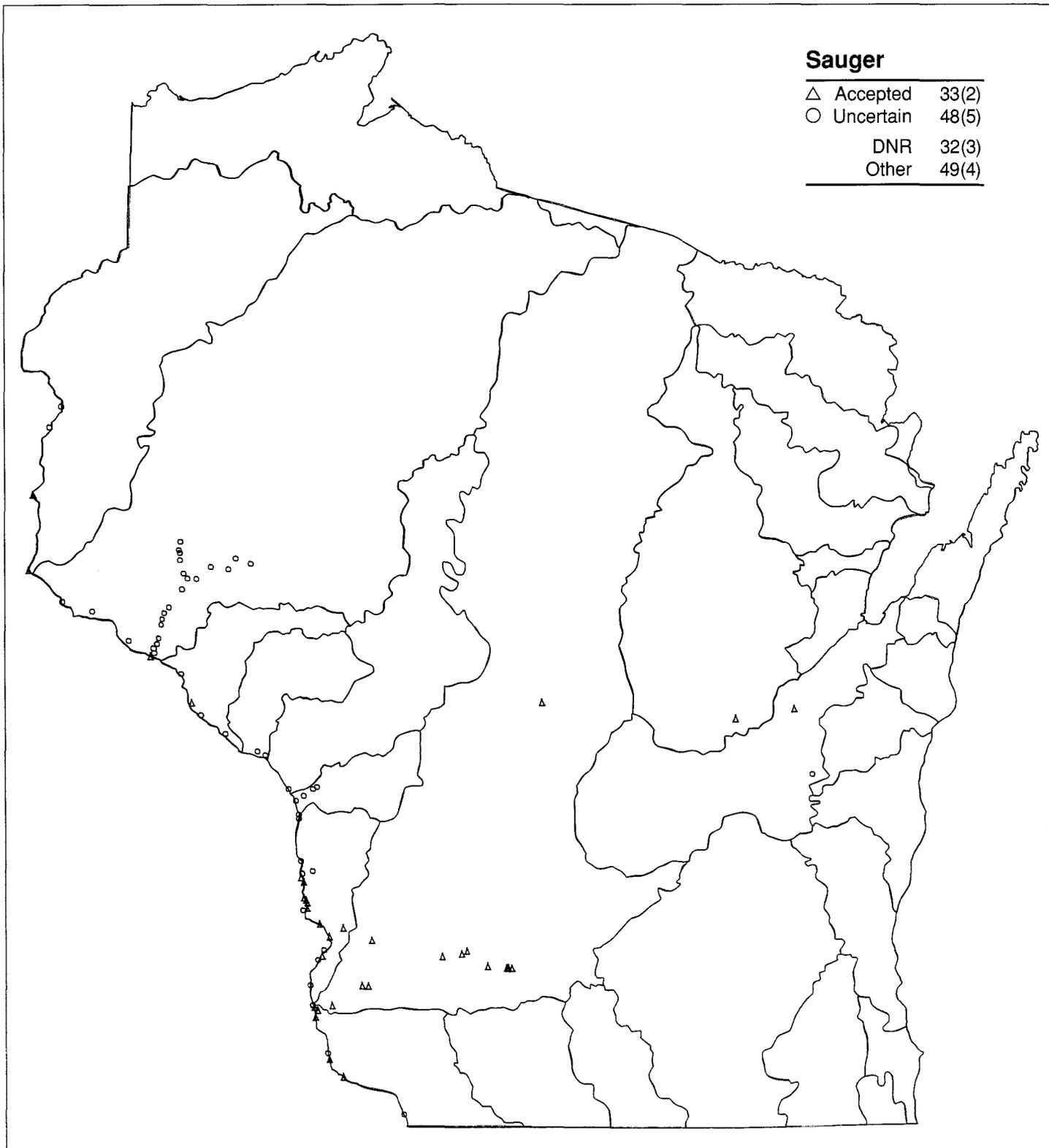


Map 139(E)

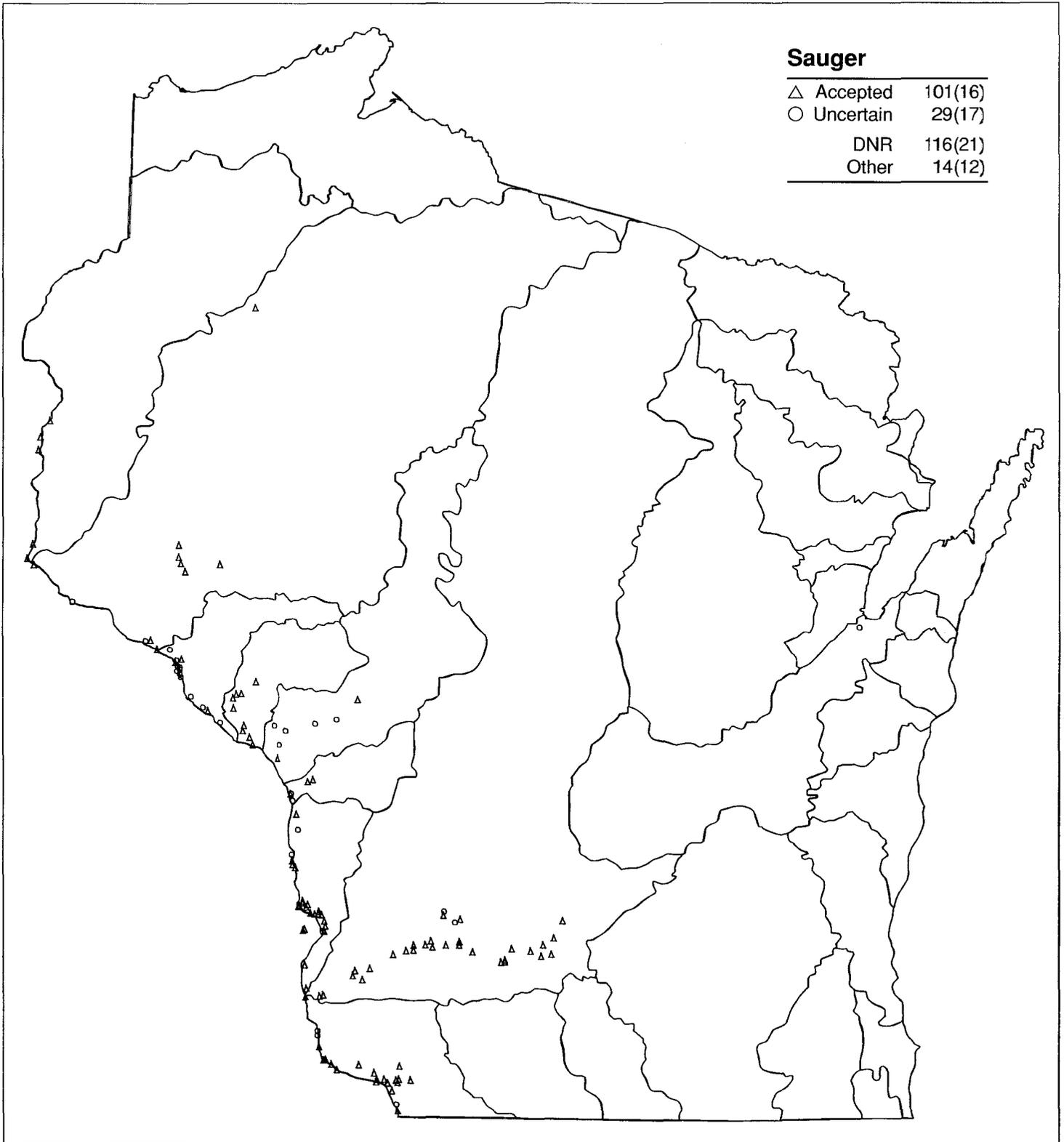




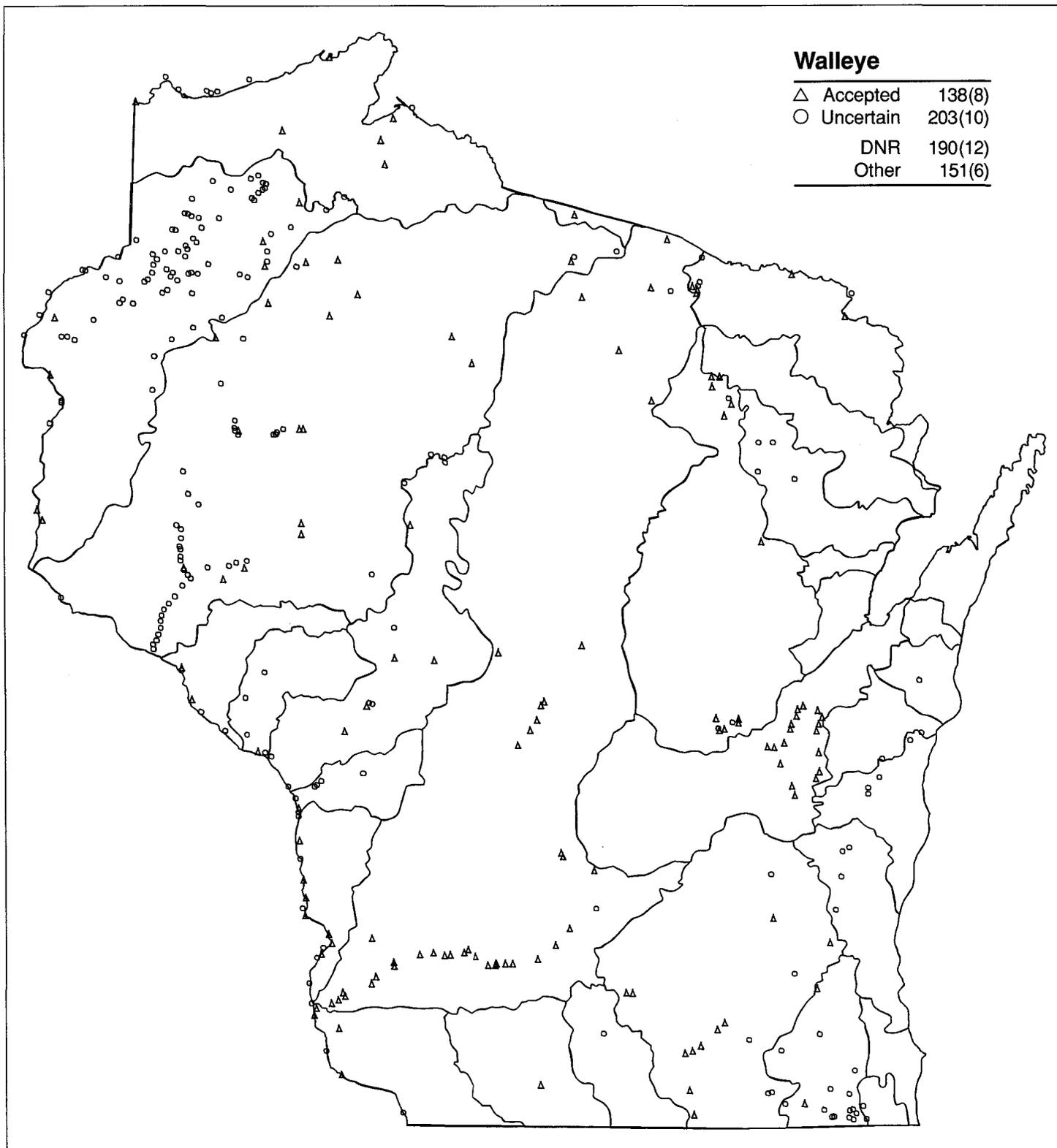
Map 140(E)

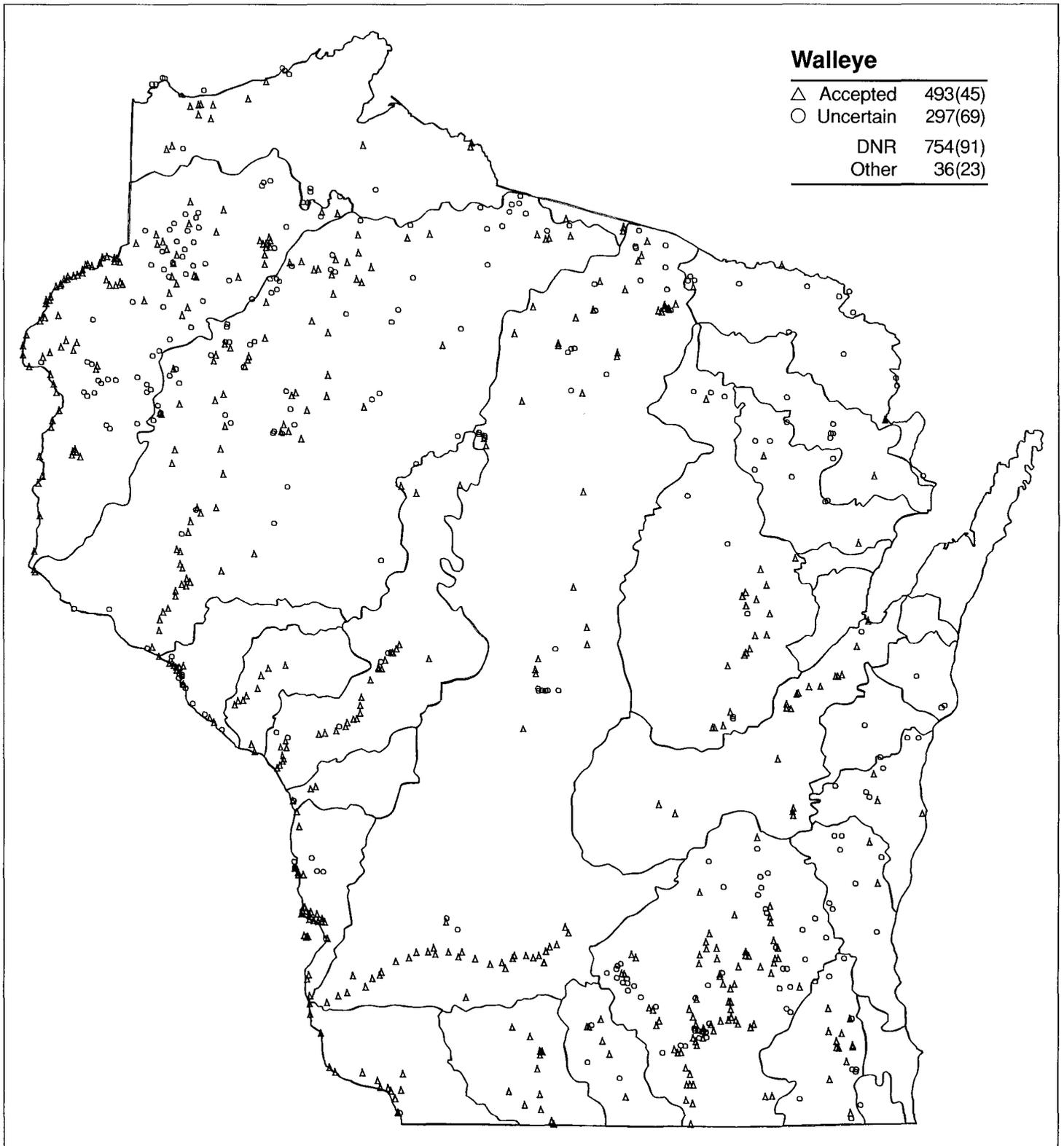


Map 140(L)

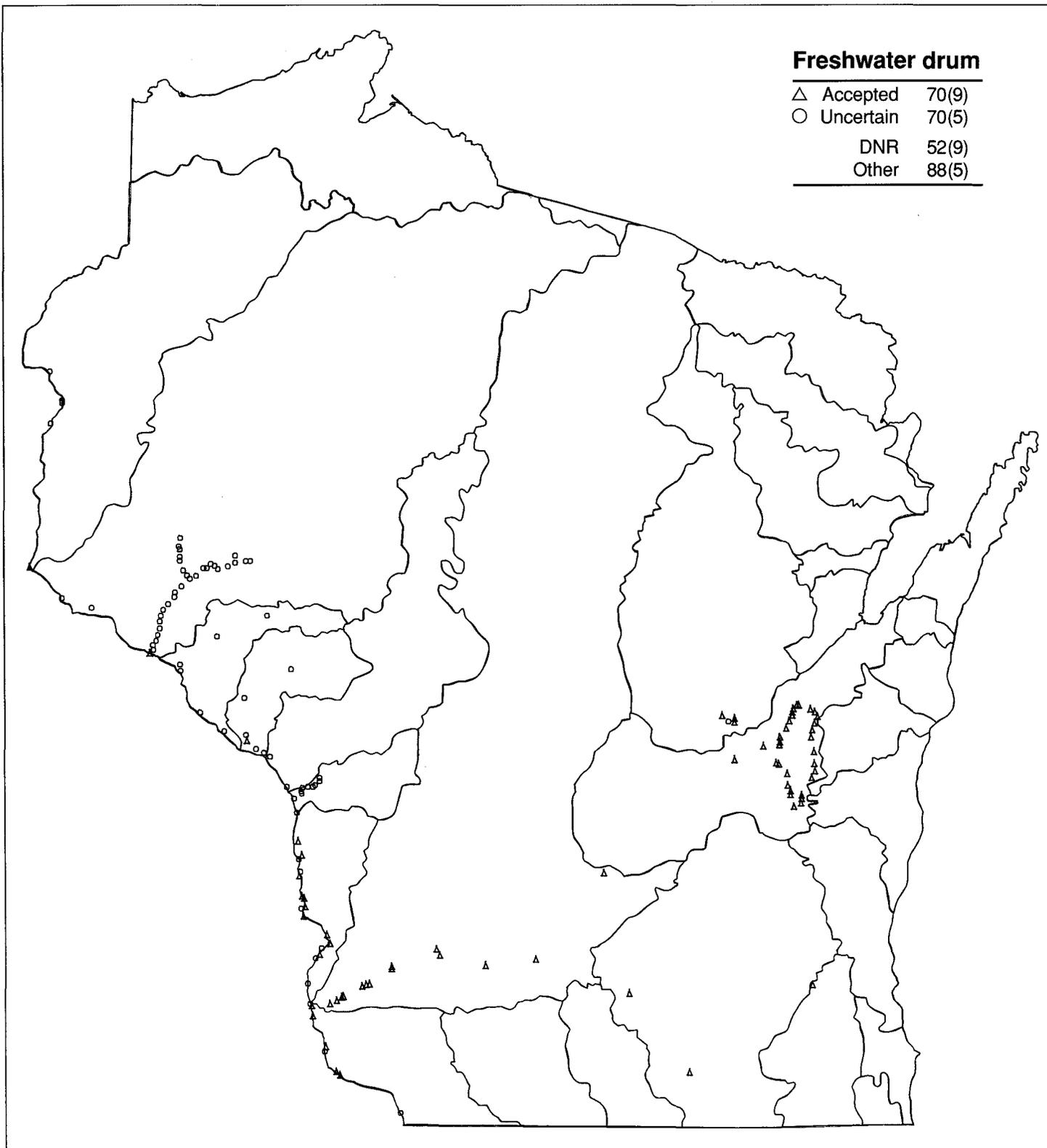


Map 141(E)



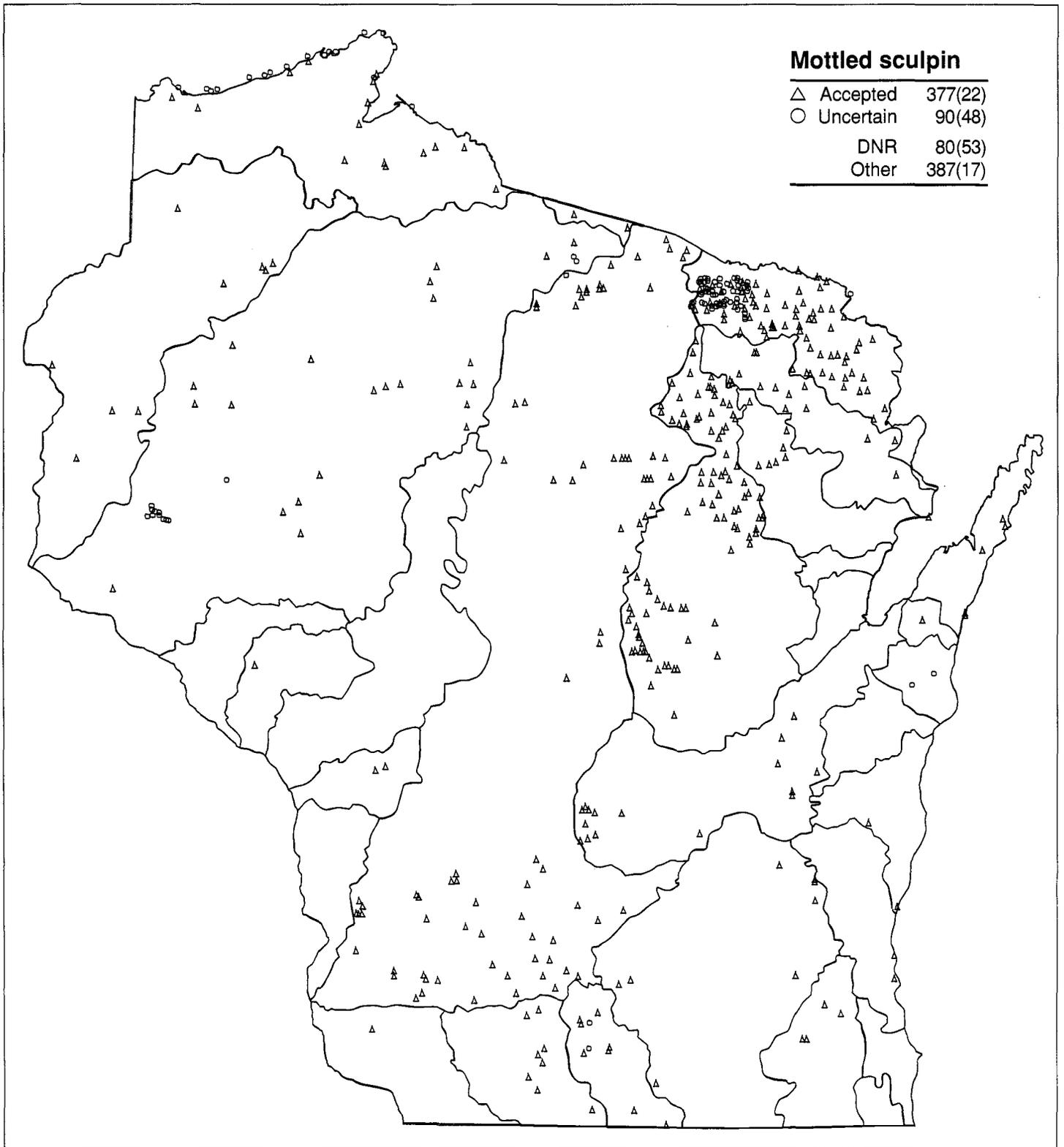


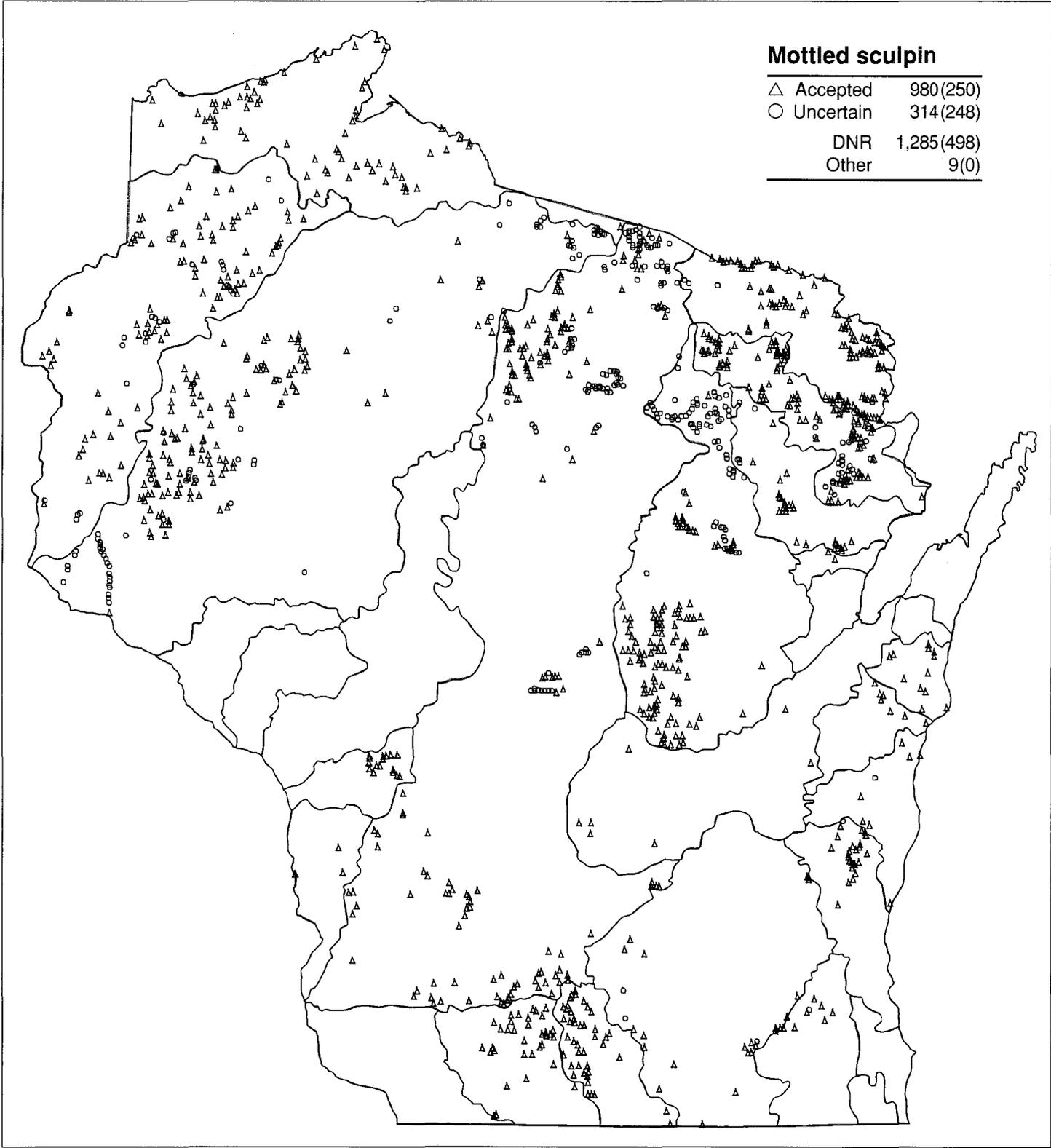
Map 142(E)



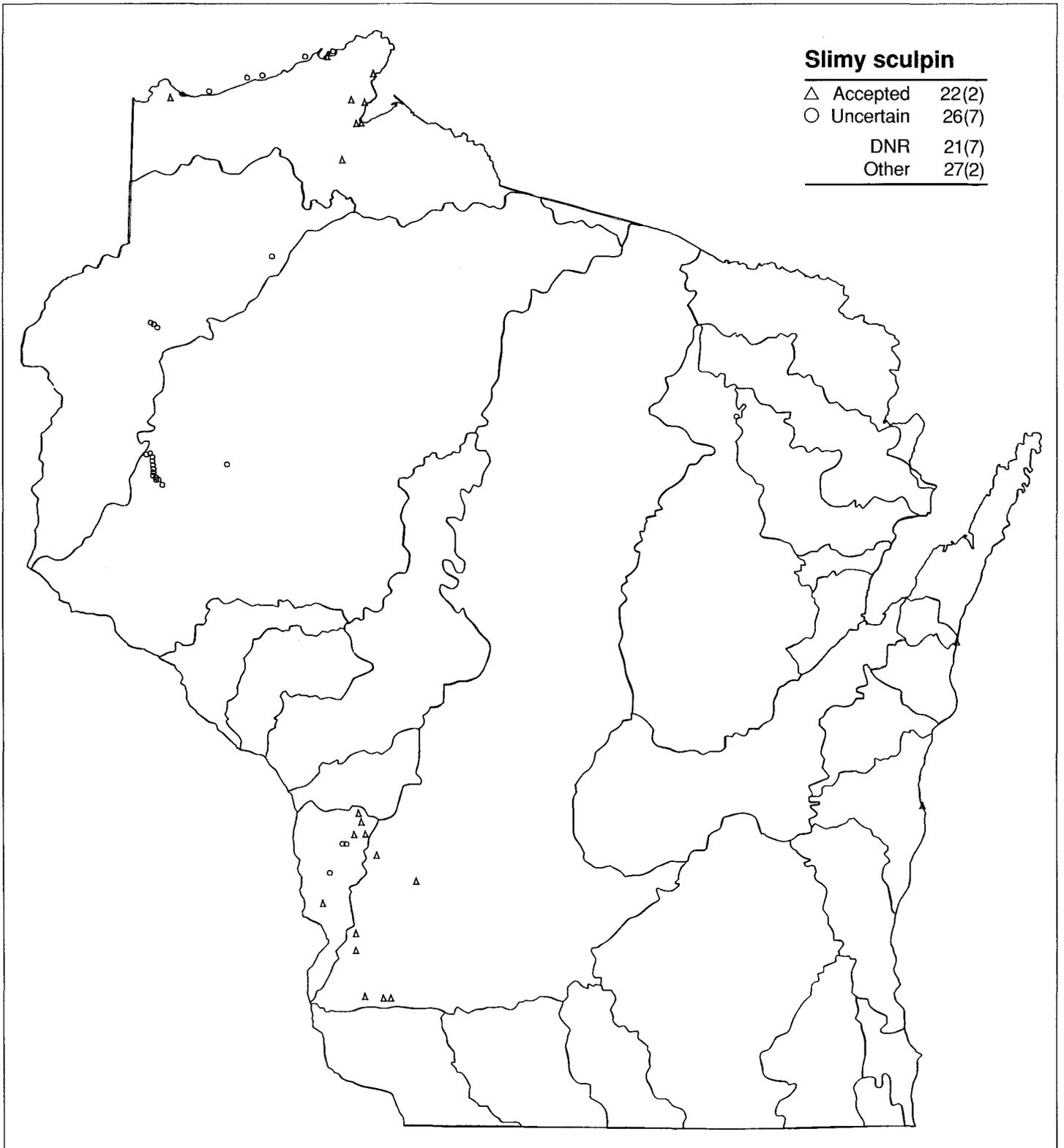


Map 143(E)

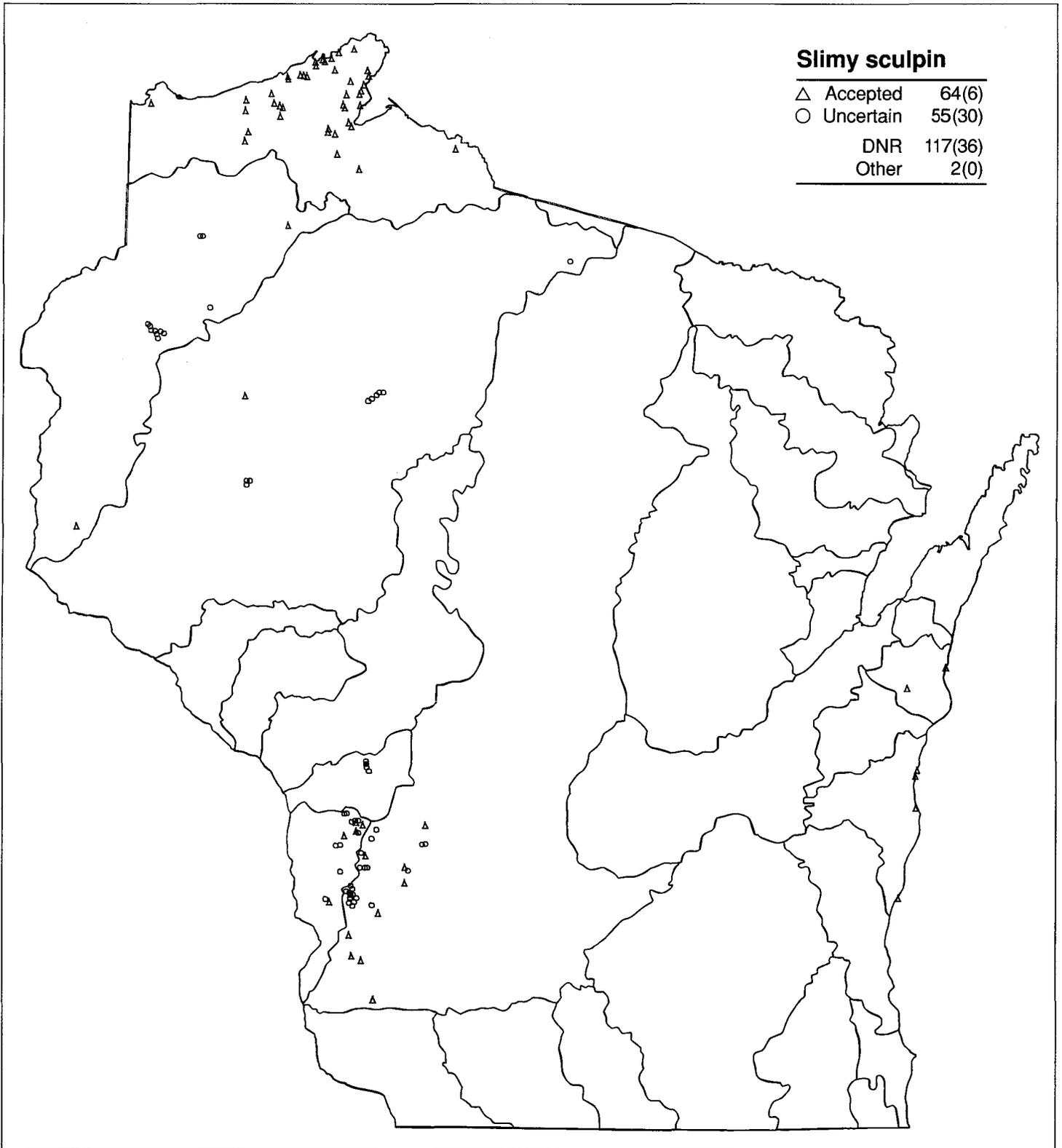




Map 144(E)



Map 144(L)



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INDEXES

Index A. *Index to sampling effort (Appendix A).*

Basin	Table No.	
	Streams	Lakes
All basins completed	A.1	A.2
All basins to be sampled	A.3	A.4
Individual basins to be sampled		
2 Mississippi River	A.5	A.18
60 Kewaunee River	A.6	A.19
70 Door Peninsula drainage	A.7	A.20
81 Fox River	A.8	A.21
82 Wolf River	A.9	A.22
90 Suamico River	A.10	A.23
100 Pensaukee River	A.11	A.24
110 Oconto River	A.12	A.25
120 Peshtigo River	A.13	A.26
130 Menominee River	A.14	A.27
240 Wisconsin River	A.15	A.28
300 Chippewa River	A.16	A.29
400 Lake Superior drainage	A.17	A.30

Index B. Index to distribution maps (Appendix G).

Species	Map No.		Species	Map No.		Species	Map No.	
	1900-72	1974-86		1900-72	1974-86		1900-72	1974-86
Alewife	13(E)	13(L)	Darter (<i>continued</i>)			Sculpin		
Bass			Mud	126(E)	126(L)	Mottled	143(E)	143(L)
Largemouth	121(E)	121(L)	Rainbow	127(E)	127(L)	Slimy	144(E)	144(L)
Rock	113(E)	113(L)	River	139(E)	139(L)	Shad, gizzard	14(E)	14(L)
Smallmouth	120(E)	120(L)	Slenderhead	138(E)	138(L)	Shiner		
White	111(E)	111(L)	Western sand	125(E)	125(L)	Bigmouth	52(E)	52(L)
Yellow	112(E)	112(L)	Drum, freshwater	142(E)	142(L)	Blackchin	54(E)	54(L)
Bluegill	118(E)	118(L)	Eel, American	12(E)	12(L)	Blacknose	55(E)	55(L)
Bowfin	11(E)	11(L)	Gar			Common	51(E)	51(L)
Buffalo			Longnose	9(E)	9(L)	Emerald	47(E)	47(L)
Bigmouth	86(E)	86(L)	Shortnose	10(E)	10(L)	Ghost	49(E)	-
Black	87(E)	87(L)	Goldeye	16(E)	16(L)	Golden	44(E)	44(L)
Smallmouth	85(E)	85(L)	Goldfish	34(E)	34(L)	Mimic	63(E)	63(L)
Bullhead			Herring, skipjack	15(E)	15(L)	Pallid	45(E)	45(L)
Black	94(E)	94(L)	Killifish, banded	105(E)	105(L)	Pugnose	46(E)	46(L)
Brown	96(E)	96(L)	Lamprey			Red	75(E)	-
Yellow	95(E)	95(L)	American brook	4(E)	4(L)	Redfin	62(E)	62(L)
Burbot	104(E)	104(L)	Chestnut	1(E)	1(L)	River	48(E)	48(L)
Carp, common	37(E)	37(L)	Northern brook	2(E)	2(L)	Rosyface	58(E)	58(L)
Carp sucker			Sea	5(E)	5(L)	Sand	60(E)	60(L)
Highfin	78(E)	78(L)	Silver	3(E)	3(L)	Spotfin	59(E)	59(L)
River	76(E)	76(L)	Logperch	135(E)	135(L)	Spottail	56(E)	56(L)
Catfish			Madtom			Striped	50(E)	50(L)
Channel	97(E)	97(L)	Slender	98(E)	98(L)	Weed	61(E)	61(L)
Flathead	101(E)	101(L)	Tadpole	100(E)	100(L)	Silverside, brook	108(E)	108(L)
Chub			Minnow			Smelt, rainbow	27(E)	27(L)
Creek	73(E)	73(L)	Bluntnose	68(E)	68(L)	Stickleback		
Gravel	42(E)	42(L)	Bullhead	70(E)	70(L)	Brook	109(E)	109(L)
Hornyhead	43(E)	43(L)	Brassy	38(E)	38(L)	Ninespine	110(E)	110(L)
Lake	36(E)	36(L)	Fathead	69(E)	69(L)	Stonecat	99(E)	99(L)
Silver	41(E)	41(L)	Mississippi silvery	39(E)	39(L)	Stoneroller		
Speckled	40(E)	40(L)	Ozark	57(E)	57(L)	Central	32(E)	32(L)
Chubsucker			Pugnose	53(E)	53(L)	Largescale	33(E)	33(L)
Creek	82(E)	- *	Suckermouth	64(E)	64(L)	Sturgeon		
Lake	83(E)	83(L)	Mooneye	17(E)	17(L)	Lake	6(E)	6(L)
Cisco (lake herring)	18(E)	18(L)	Mudminnow, central	28(E)	28(L)	Shovelnose	7(E)	7(L)
Crappie			Muskellunge	31(E)	31(L)	Sucker		
Black	123(E)	123(L)	Paddlefish	8(E)	8(L)	Blue	81(E)	81(L)
White	122(E)	122(L)	Perch, yellow	134(E)	134(L)	Longnose	79(E)	79(L)
Dace			Pickrel, grass	29(E)	29(L)	Northern hog	84(E)	84(L)
Blacknose	71(E)	71(L)	Pike, northern	30(E)	30(L)	Spotted	88(E)	88(L)
Finescale	67(E)	67(L)	Pirate perch	102(E)	102(L)	White	80(E)	80(L)
Longnose	72(E)	72(L)	Pumpkinseed	115(E)	115(L)	Sunfish		
Northern redbelly	65(E)	65(L)	Quillback	77(E)	77(L)	Green	114(E)	114(L)
Pearl	74(E)	74(L)	Redhorse			Longear	119(E)	119(L)
Redside	35(E)	35(L)	Golden	91(E)	91(L)	Orangespotted	117(E)	117(L)
Southern redbelly	66(E)	66(L)	Greater	93(E)	93(L)	Topminnow		
Darter			River	90(E)	90(L)	Blackstripe	106(E)	106(L)
Banded	133(E)	133(L)	Shorthead	92(E)	92(L)	Starhead	107(E)	107(L)
Blackside	137(E)	137(L)	Silver	89(E)	89(L)	Trout		
Bluntnose	128(E)	128(L)	Salmon			Brook	25(E)	25(L)
Crystal	124(E)	124(L)	Chinook	-	22(L)	Brown	24(E)	24(L)
Fantail	130(E)	130(L)	Coho	21(E)	21(L)	Lake	26(E)	26(L)
Gilt	136(E)	136(L)	Pink	-	20(L)	Rainbow	23(E)	23(L)
Iowa	129(E)	129(L)	Sauger	140(E)	140(L)	Trout-perch	103(E)	103(L)
Johnny	132(E)	132(L)				Walleye	141(E)	141(L)
Least	131(E)	131(L)				Warmouth	116(E)	116(L)
						Whitefish, lake	19(E)	19(L)

* - = No map prepared since species not collected during this period.

**Approximate
Metric-English Equivalents**

1 ha = 2.47 acres
1 m = 3.28 ft
1 cm = 0.39 inches
1 km = 0.62 miles
1 m² = 1.20 yd²

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Permission to reproduce copies of the fish paintings and line drawings that appear in Appendix E was kindly granted by the 2 sources of these illustrations: (1) for the redbreasted dace: the Fisheries Research Board of Canada, publisher of *Freshwater Fishes of Canada* by W. B. Scott and E. V. Crossman and (2) for all other fish artwork: University of Illinois Press, publisher of *Fishes of Illinois* by Philip Smith.

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