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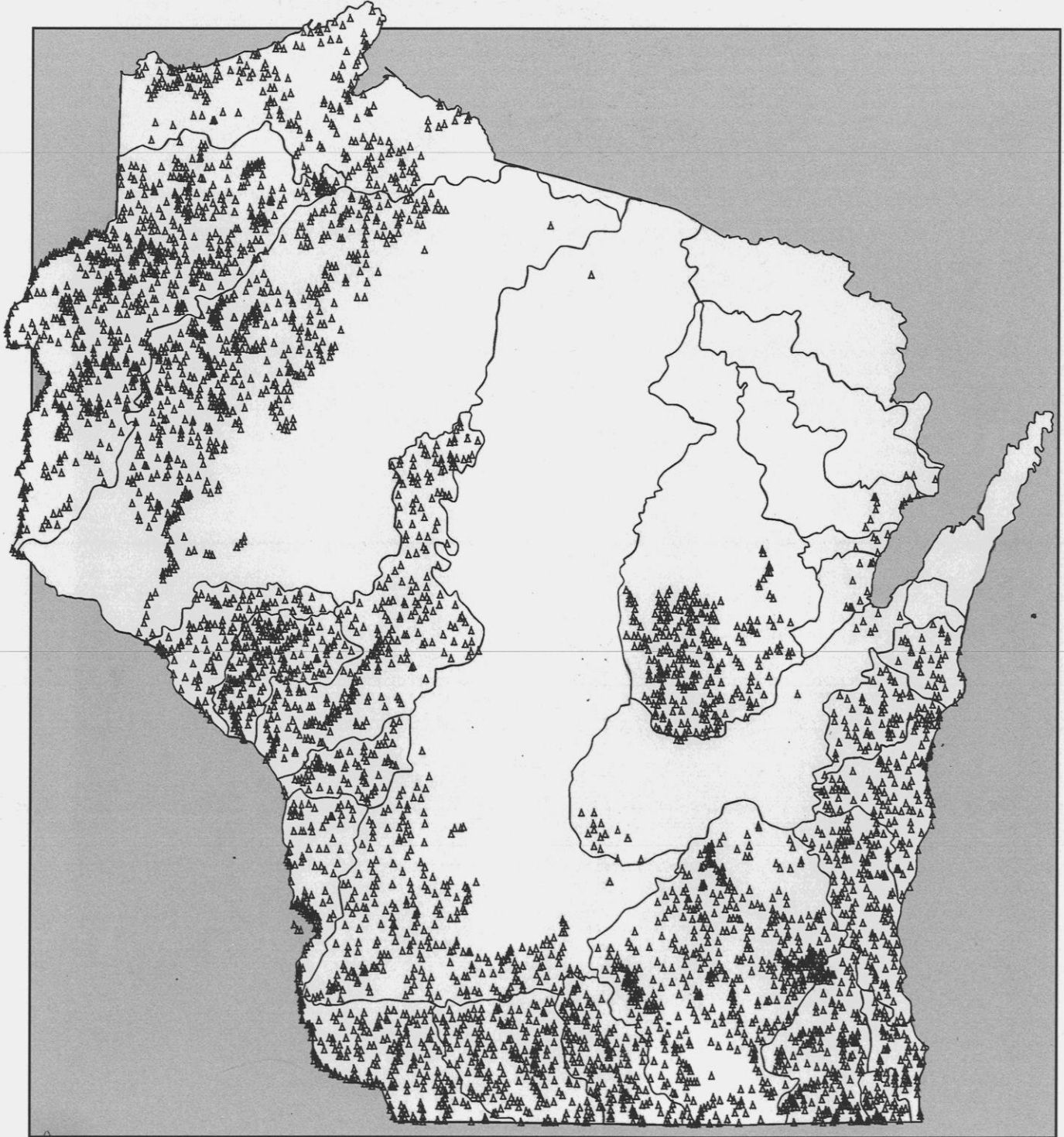
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Distribution and Relative Abundance of Fishes in Wisconsin

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

By Don Fago

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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.

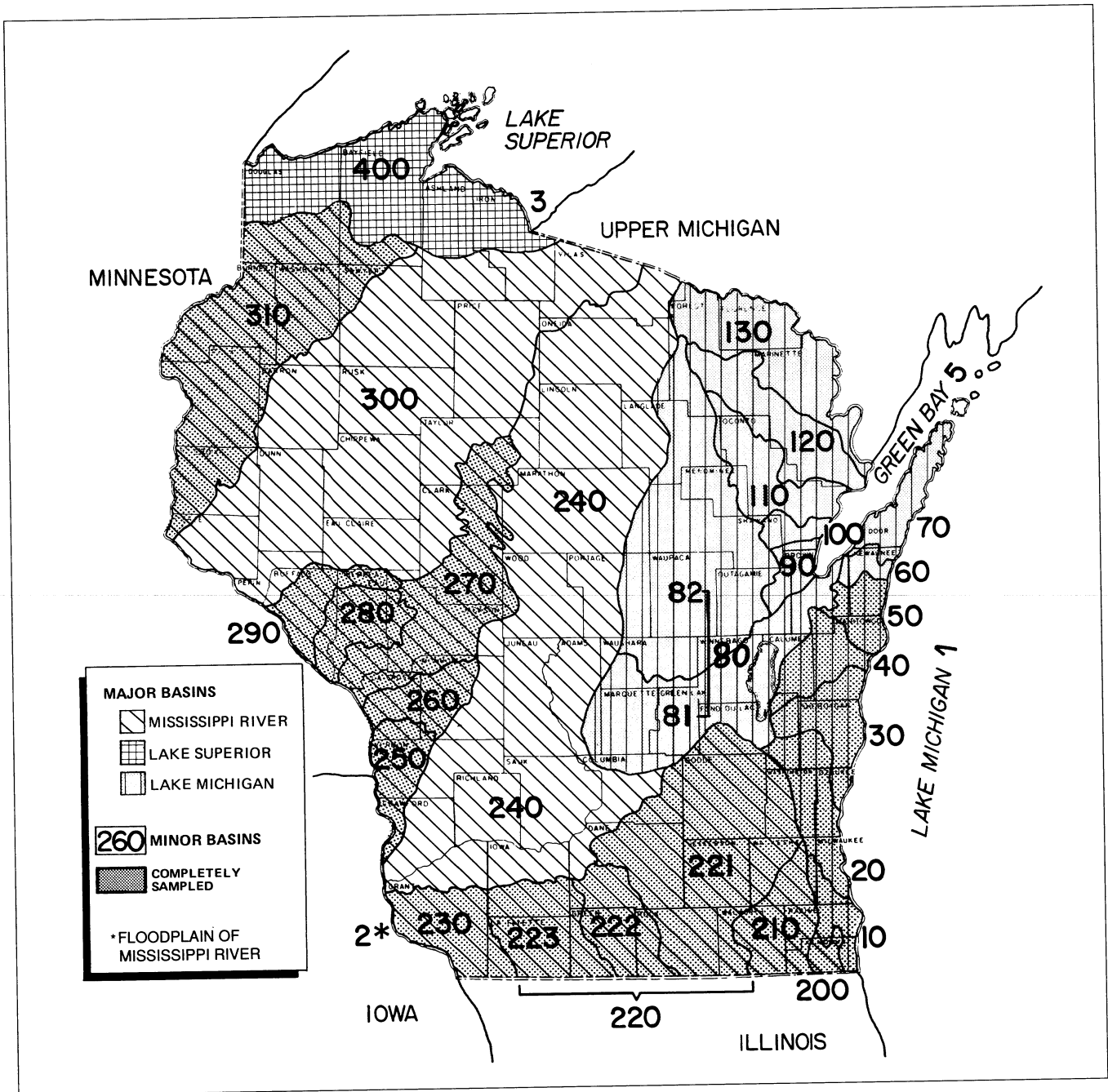


Figure 1. Major and minor river basins in Wisconsin showing those basins in which sampling has been completed. (Sampling has also been completed in one sub-basin of basin 300.)

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* 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.

*Includes 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>-</u> | <u>12</u> | <u>-</u> | <u>-</u> | <u>-</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 | - | - | 1 | - | 141 | (120) | 7 | - | 4 | - | 24 | (3) | 16 | - |
| 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 platyrhynchus</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 gorbuscha</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> |

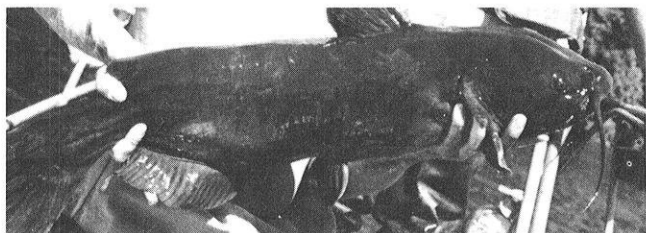
Table 5. Continued.

| 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> |

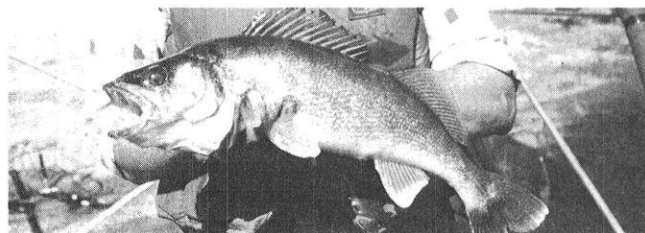
Table 5. Continued.

| 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> |

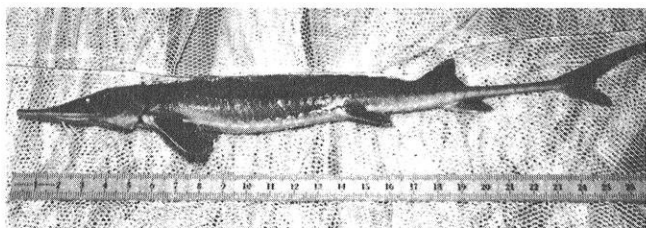
* Previously classified as *Salmo gairdneri*.



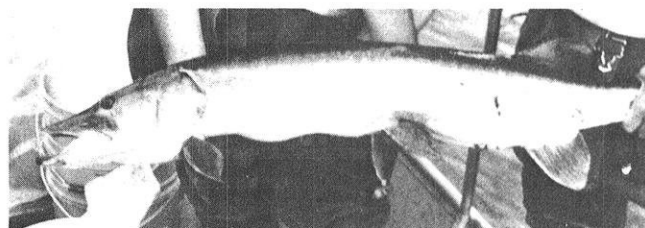
This unusually dark specimen of a channel catfish was taken from the lower Trempealeau River with a boom shocker.



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.

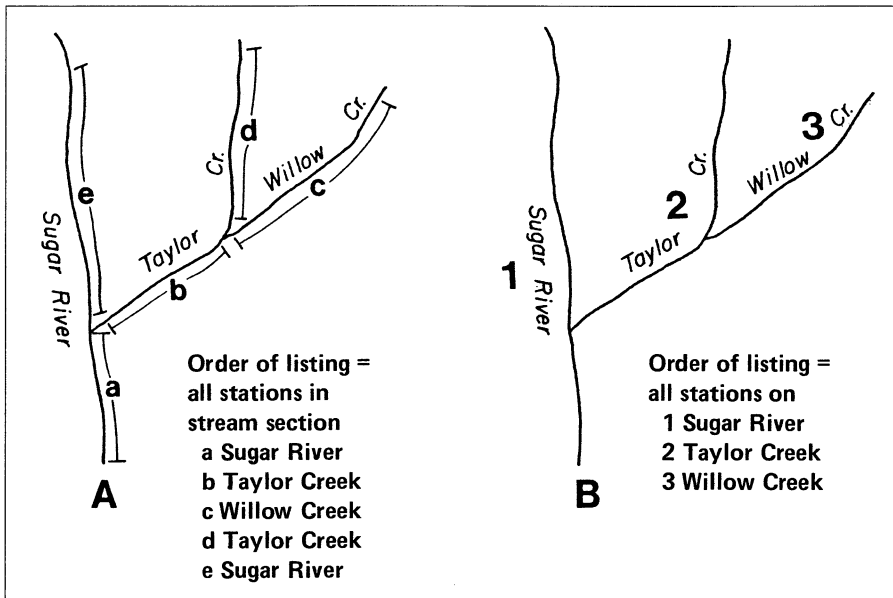
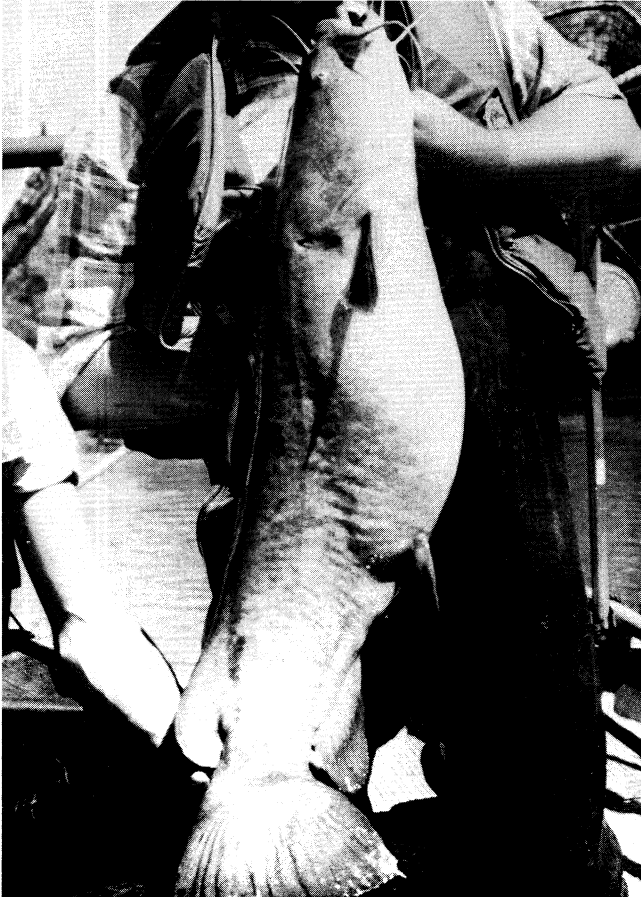


Figure 2. Two methods of organizing stations on computer print-outs.



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 | | | Basins not Found in 1974-86 | 1974-86 | | | Percent Change in Occurrence** | |
|---------|----------------------------|----------|---------------|------------|----------------------------------------------------------------------------|----------|---------------|------------|--------------------------------|-----------------------------|
| | | No. Stn. | Percent Total | No. Basins | | 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 | | | Basins not Found in 1974-86 | 1974-86 | | | Percent Change in Occurrence** | |
|---------|-------------------------|----------|---------------|------------|---------------------------------------------------------------------------------|----------|---------------|------------|--------------------------------|-----|
| | | No. Stn. | Percent Total | No. Basins | | No. Stn. | Percent Total | No. Basins | | |
| 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 redhorse | 6 | 94 |
| Skipjack herring | 0 | 100 | Greater redhorse | 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 redhorse | 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 redhorse | 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 redhorse | 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 | 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 | |
| | | Kickapoo R. | 2 | 3 | |
| | 300 | 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 (<i>continued</i>) | 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. | 2 | 3 | | |
| | | 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. | 2 | 6 | |
| 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 | | |
| | | 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 | |
| | | Tittle L. | 1 | 1 | |
| | 81 | Fox R. | 1 | 1 | |
| | 82 | Willow Cr. | 1 | 2 | |
| | | Mynyard L. | 1 | 2 | |
| | 210 | 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 | | |
| | Danville Millpond | | 1 | 4 | | |
| | 222 | | 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 | | |
| | | Mississippi R. | 4 | 4 | | |
| | 2 | 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 (continued) | 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 | | |
| | | Chippewa R. | 2 | 2 | | |
| | 300 | 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 (<i>continued</i>) | 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) | | | | | | | | | | | | |
|-----------------------------------|-----------------------------|--------|---------|---------|---------|---------|-----------|-------------|-------------|-------------|-------------|--------|-------|
| | 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. | 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) | | | | | | | | | | | | |
|-----------------------------------|-----------------------------|--------|---------|---------|---------|---------|-----------|-------------|-------------|-------------|-------------|--------|-------|
| | 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. | 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 | 101-300 | 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 | 101-300 | 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 | 89 | 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) | | | | | | | | | | | | |
|-----------------------------------------|-----------------------------|--------|---------|---------|---------|---------|-----------|-------------|-------------|-------------|-------------|--------|-------|
| | 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. | 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) | | | | | | | | | | | | |
|-----------------------------------|-----------------------------|--------|---------|---------|---------|---------|-----------|-------------|-------------|-------------|-------------|--------|-------|
| | 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. | 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 | Logperch 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) |

| | | | | | | | | | | | |
|---------------------------------------|--------------------------------------|--------------------------------------------|--------------------------------------------------|-------------------------------------|------------|--------------|-----------|------------|-----------|-----------|-----------|
| M.B. ----- • ----- SECOND | M.B. ----- • ----- THIRD | M.B. MILE ----- • ----- FOURTH | FIRST ORDER MILE ----- • ----- FIFTH | S.D. _____ | GEAR _____ | EFFORT _____ | UP _____ | DOWN _____ | MO. _____ | DAY _____ | YR. _____ |
| SIXTH ----- • ----- | SEVENTH ----- • ----- | EIGHTH ----- • ----- | NINTH ----- • ----- | STATION MILE ----- • ----- | SPECIES | NO. | | | | | |
| LOCATION ----- | | | | | | | | | | | |
| JAR _____ | WTC _____ | TOWN _____ | RANGE _____ | SEC. _____ | 1/16 _____ | 1/4 _____ | CO. _____ | | | | |
| WIDTH | BOTTOM TYPE | STREAM BANK VEGETATION | | | | | | | | | |
| L _____ | CONCRETE | A _____ | CULTIVATED | | A _____ | | | | | | |
| M _____ | BEDROCK | B _____ | FALLOW | | B _____ | | | | | | |
| U _____ | HARDPAN | C _____ | UPLAND PASTURE | | C _____ | | | | | | |
| DEPTH | Boulder | D _____ | UPLAND MEADOW | | D _____ | | | | | | |
| L _____ | RUBBLE | E _____ | UPLAND HARDWOOD | | E _____ | | | | | | |
| M _____ | GRAVEL | F _____ | UPLAND CONIFER | | F _____ | | | | | | |
| U _____ | SAND | G _____ | UPLAND SHRUB | | G _____ | | | | | | |
| VELOCITY | SILT & MUCK | H _____ | LOWLAND PASTURE | | H _____ | | | | | | |
| _____ | CLAY | I _____ | LOWLAND HARDWOOD | | I _____ | | | | | | |
| WATER TEMP. | MARL | J _____ | LOWLAND CONIFER | | J _____ | | | | | | |
| _____ °F | DETRITUS | K _____ | LOWLAND SHRUB | | K _____ | | | | | | |
| CONDUCTIVITY | RUBBISH | L _____ | OPEN MARSH | | L _____ | | | | | | |
| _____ <small>umhos</small> | PEAT | M _____ | CUT GRASSES | | M _____ | | | | | | |
| TURBIDITY | AQUATIC VEG. | | BEACH | | N _____ | | | | | | |
| _____ | EMERGENT | _____ | LOWLAND MEADOW | | O _____ | | | | | | |
| PH | SUBMERGENT | _____ | OPEN WATER | | P _____ | | | | | | |
| _____ | DUCKWEED | _____ | | | | | | | | | |
| _____ | ALGAE (ATT) | _____ | | | | | | | | | |
| _____ | ALGAE (FF) | _____ | | | | | | | | | |

WIS. DEPARTMENT OF
NATURAL RESOURCES
FORM 8100-46
REV. 2-80

Appendix Figure C.1. Example of the data form (8100-46) for recording fish and stream information in the field. (Front and back are shown.)

- 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) _____

REPORT LOCATION

STATION MILEAGE _____

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 _____ / _____ / _____ HOUR _____
MO DAY YR

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

VELOCITY _____ TEMPERATURE _____ CONDUCTIVITY _____ TURBIDITY _____

F
I
S
H
B
O
T
T
O
M
T
Y
P
E
S

AQUATIC VEG. _____

STRM. BANK VEG. _____

WB-I-C _____

FISH SPECIES

O
N
L
Y
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) _____ F
 21) _____ 22) _____ 23) _____ 24) _____ I
 25) _____ 26) _____ 27) _____ 28) _____ S
 29) _____ 30) _____ 31) _____ 32) _____ H
 33) _____ 34) _____ 35) _____ 36) _____ O
 37) _____ 38) _____ 39) _____ 40) _____ N
 41) _____ 42) _____ 43) _____ 44) _____ L
 _____ _____ _____ _____ Y

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.)

| MAJ | MIN | MB.MI. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | ACRES | STREAM OR LAKE NAME | D | WL | LOCATION |
|--------|-----|--------|---------|--------|------|-------|------|------|---|-------|-----------------------------|---|-----|-----------------|
| 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 NWSE13 |
| 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 SENW13 |
| 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 SENW23 |
| 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 NESE23 |
| 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 |

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 4)

PAGE 1

-----O R D E R M I L E A G E S-----
 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 WB-I-C

STATION LOCATION

| | | | | | | | | | | | | | | | | | | | | | | | | |
|-------|---------|--------|---------|-------|------|----|----------------|----------------------------|---------|---------------|---------------|----|-----|----|-----|----|-----|----|-----|----|-----------------|-----|------|-----|
| 2 222 | 1N | 10E | 27 NW | SW 54 | | + | SUGAR R -OXBOW | 46 5 | 8/ 0/63 | 1N10E27NWSW54 | | | | | | | | | | | | | | |
| | 0 0 | | | | | | 0873000 | | | | | | | | | | | | | | | | | |
| | SP=04 | HY=00 | UNSP=00 | FISH | M20 | + | 005 | + | S02 | + | W08 | + | | | | | | | | | | | | |
| 2 222 | 1434.8R | 156.9L | .7R | 6.9R | | | 2.3 | E FK RACCOON CR | 61 5 | 12/12/65 | 1N12E31NWSW54 | | | | | | | | | | | | | |
| | 2 | | | | | | 0874100 | | | | | | | | | | | | | | | | | |
| | SP=13 | HY=00 | UNSP=02 | FISH | M04 | + | M05 | + | M14 | + | M28 | + | M29 | + | M41 | + | M43 | + | M45 | + | M50 | + | | |
| | | | | | N09 | + | U01 | + | X10 | + | X12 | + | X14 | + | X18 | + | | | | | | | | |
| 2 222 | 1434.8R | 156.9L | .7R | 6.9R | | | 2.4 | E FK RACCOON CR | 11 2 06 | 5/15/74 | 1N12E31SWNE54 | | | | | | | | | | | | | |
| | 3 2 | | | | | | 0874100 | | | | | | | | | | | | | | | | | |
| | SP=15 | HY=01 | UNSP=01 | FISH | A05 | 4 | I21 | 10 | L02 | 6 | L07 | 1 | M05 | 6 | M12 | 1 | M28 | 1 | M29 | 1 | M45 | 13 | | |
| | | | | | M50 | 4 | N09 | 28 | W05 | 3 | W09 | 1 | X10 | 13 | X12 | 31 | X14 | 2 | Z01 | 6 | | | | |
| 2 222 | 1434.8R | 156.9L | .7R | 6.9R | 2.7R | | 1.5 | UN CR (CHAMBERLIN SPRINGS) | 71 5 | 10/ 5/77 | 1N12E29SWNW54 | | | | | | | | | | | | | |
| | 2 | | | | | | 0874300 | | | | | | | | | | | | | | | | | |
| | SP=08 | HY=00 | UNSP=00 | FISH | M06 | 1 | M29 | 27 | M43 | 10 | M48 | 29 | M50 | 99 | N09 | 3 | U01 | 5 | X12 | 11 | | | | |
| 2 222 | 1434.8R | 156.9L | .7R | 6.9R | 2.7R | | 3.8 | UN CR | 11 3 06 | 5/15/74 | 1N12E21NWNW54 | | | | | | | | | | | | | |
| | 3 2 | | | | | | 0874300 | | | | | | | | | | | | | | | | | |
| | SP=07 | HY=00 | UNSP=01 | FISH | M05 | 99 | M43 | 19 | M46 | 4 | M48 | 75 | M50 | 53 | N09 | 30 | U01 | 8 | X12 | 2 | | | | |
| 2 222 | 1434.8R | 156.9L | .7R | 6.9R | | | 3.2 | E FK RACCOON CR | 11 2 05 | 11/ 5/75 | 1N12E31NENW54 | | | | | | | | | | | | | |
| | 1 2 | | | | | | 0874100 | | | | | | | | | | | | | | | | | |
| | SP=17 | HY=00 | UNSP=01 | FISH | A05 | 2 | K01 | 6 | L01 | 2 | M05 | 33 | M28 | 2 | M45 | 11 | M46 | 3 | M48 | 20 | M50 | 16 | | |
| | | | | | N09 | 47 | W05 | 10 | W09 | 6 | X07 | 1 | X10 | 30 | X12 | 25 | X14 | 2 | X18 | 10 | Z01 | 27 | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | (006 | 030 | 0 | 40) |
| | | | | | | | | | | | | | | | | | | | | | (1 49 | 3 | 0001 |) |
| | | | | | | | | | | | | | | | | | | | | | (ET F1 G2 H5 I2 | | |) |
| | | | | | | | | | | | | | | | | | | | | | (D3 FT K4 M2 01 | | |) |
| 2 222 | 1434.8R | 156.9L | .7R | 6.9R | | | 3.3 | E FK RACCOON CR | 61 5 | 6/10/65 | 1N12E31NENW54 | | | | | | | | | | | | | |
| | 2 | | | | | | 0874100 | | | | | | | | | | | | | | | | | |
| | SP=07 | HY=00 | UNSP=01 | FISH | M05 | + | M28 | + | M39 | + | M43 | + | M45 | + | M50 | + | N09 | + | X10 | + | | | | |
| 2 222 | 1434.8R | 156.9L | .7R | 6.9R | | | 7.8 | E FK RACCOON CR | 11 2 06 | 5/15/74 | 1N11E12SESW54 | | | | | | | | | | | | | |
| | 3 2 | | | | | | 0874100 | | | | | | | | | | | | | | | | | |
| | SP=16 | HY=00 | UNSP=01 | FISH | I21 | 2 | K01 | 2 | M05 | 99 | M09 | 1 | M43 | 99 | M45 | 99 | M46 | 5 | M48 | 79 | M50 | 99 | | |
| | | | | | N09 | 99 | U01 | 99 | W05 | 5 | W08 | 1 | X10 | 99 | X11 | 46 | X12 | 61 | Z01 | 2 | | | | |
| 2 222 | 1434.8R | 156.9L | .7R | | | | 10.7 | RACCOON CR | 11 2 06 | 7/ 0/74 | 1N11E35SENW54 | | | | | | | | | | | | | |
| | 3 2 | | | | | | 0874000 | | | | | | | | | | | | | | | | | |
| | SP=19 | HY=00 | UNSP=01 | FISH | L02 | 8 | M05 | 15 | M12 | 7 | M19 | 6 | M28 | 32 | M36 | 27 | M45 | 54 | M46 | 6 | M50 | 3 | | |
| | | | | | N09 | 11 | O05 | 1 | O06 | 13 | O10 | 2 | U01 | 2 | W04 | 2 | W05 | 2 | W06 | 1 | X12 | 3 | | |
| | | | | | X14 | 4 | X18 | 4 | | | | | | | | | | | | | | | | |
| 2 222 | 1434.8R | 156.9L | .7R | | | | 10.7 | RACCOON CR | 61 5 | 6/10/65 | 1N11E35SENW54 | | | | | | | | | | | | | |
| | 2 | | | | | | 0874000 | | | | | | | | | | | | | | | | | |
| | SP=12 | HY=00 | UNSP=00 | FISH | K01 | + | L02 | 1 | M39 | + | M45 | + | N09 | + | O05 | + | O06 | + | S02 | + | U01 | + | | |
| | | | | | W05 | + | X12 | + | X18 | + | | | | | | | | | | | | | | |

Appendix Figure C.4. Example of a page from the Master Fish File showing the 3-digit alphanumeric code for the fish species collected at each station. (Listing method A—Figure 2—is used here.)

MAY 13, 1988

FISH MASTER FILE (MARK IV) WITH COMMON NAMES

PAGE 1

-----O R D E R M I L E A G E S-----
 BASIN MBM 1 2/7 3/8 4/9 5/10 6/11 MILE ----STREAM OR LAKE NAME----- SD G EF --DATE-- TWRNGSECQTQTCO
 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 + BLACKSTRIPED TOPMINNOW + ORANGESPOTTED SUNFISH + | | | | | | | | | | | |
| 2 222 | 1434.8R | 156.9L | .7R | 6.9R | | 2.3 | E FK RACCOON CR 0874100 | 61 5 | 12/12/65 | 1N12E31NWSE54 | |
| SP=13 HV=00 UNSP=02 FISH SHINERS + STONEROLLERS + BRASSY MINNOW + COMMON SHINER + BIGMOUTH SHINER + SUCKERMOUTH MINNOW + COMMON SHINER + 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 01) 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.)

BASINS=223, SOURCE=NOT40 81 94 95 99 MILE LIMIT ON SPECIES LIMIT P. 02
 RESTRICTED TO = S.M. = FROM TO
 MONTH = TO YEAR = 1950 TO 1973 COUNTY=-N-N- WBC# =

X12 JOHNNY DARTER ETHEOSTOMA NIGRUM DATE RUN 10/10/88

| -----O R D E R M I L E A G E S----- | | | | | | | | | | N86007A | | | | | | |
|-------------------------------------|-----|---------|--------|--------|-------|-------|------|-------|-----------------------|---------|----|----|-----|----------|--------|------------|
| BASIN | MBM | 1 | 2/7 | 3/8 | 4/9 | 5/10 | 6/11 | MILE | LAKE OR STREAM NAME | WT | NO | SD | GEF | DATE | TWNRNG | SECQTQTCO |
| 2 | 223 | 1434.8R | 156.9L | | | | | 139.1 | PECATONICA R | 2 | 2 | 46 | 5 | 6/27/60 | 2N | 3E12SESE33 |
| 2 | 223 | 1434.8R | 156.9L | | | | | 182.4 | PECATONICA R -MIFFLIN | 2 | 11 | 46 | 5 | 8/15/62 | 5N | 1E27SESE25 |
| 2 | 223 | 1434.8R | 156.9L | 72.8R | | | | 30.5 | RICHLAND CR | 2 | 61 | 5 | | 11/28/65 | 1N | 8E 7SENE23 |
| 2 | 223 | 1434.8R | 156.9L | 72.8R | 27.0R | | | 1.8E | TWIN GROVE BR | 2 | 61 | 5 | | 10/20/64 | 1N | 8E29NWNE23 |
| 2 | 223 | 1434.8R | 156.9L | 102.8R | 13.8Y | | | 1.3 | BUCKSKIN SCHOOL CR | 2 | 61 | 5 | | 7/ 5/65 | 2N | 7E 5SWSW23 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | | | | 30.2 | E BR PECATONICA R | 2 | 44 | 46 | 5 | 6/30/60 | 4N | 5E26SESE33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | | | | 40.3 | E BR PECATONICA R | 2 | 27 | 46 | | 6/30/60 | 4N | 5E 4SENE25 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | | | | 53.4 | E BR PECATONICA R | 2 | 61 | 5 | | 10/15/64 | 5N | 5E 4NWNW25 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | | | | 58.3 | E BR PECATONICA R | 2 | 3 | 61 | 5 | 8/ 1/69 | 6N | 5E22SWSE25 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 10.9L | | | 0.5 | WHITESIDE CR | 2 | 3 | 46 | | 6/30/60 | 2N | 5E 3SESW33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 10.9L | 1.6R | | 1.9 | APPLE BR | 2 | 61 | 5 | | 10/ 7/65 | 3N | 5E32 NE33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 10.9L | 1.6R | | 3.3E | APPLE BR | 2 | 19 | 46 | | 6/29/60 | 3N | 5E30SESE33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 15.0R | | | 5.3 | DOUGHERTY CR | 2 | 61 | 5 | | 10/ 6/64 | 3N | 6E19NWSE23 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 19.2L | | | 0.3 | MUD BR | 2 | 24 | 46 | | 6/29/60 | 3N | 5E22 SW33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 19.2L | | | 3.7 | MUD BR | 2 | 61 | 5 | | 10/ 1/64 | 3N | 5E20NWNW33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 19.2L | | | 9.6 | MUD BR | 2 | 24 | 46 | | 6/29/60 | 3N | 4E15NENW33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 19.7L | | | 6.1E | YELLOWSTONE R | 2 | 5 | 46 | | 6/29/60 | 3N | 5E 8SENE33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 19.7L | | | 17.0 | YELLOWSTONE R | 2 | 9 | 46 | | 6/28/60 | 4N | 4E23SESE33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 25.4R | | | 1.3 | SAWMILL CR | 2 | 61 | 5 | | 10/ 7/64 | 3N | 5E 2NESE33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 25.4R | | | 6.5E | SAWMILL CR | 2 | 61 | 5 | | 10/ 6/64 | 4N | 6E20SESW23 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 27.5L | | | 1.0 | UN CR | 2 | 27 | 46 | | 6/28/60 | 4N | 5E27NWSE33 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 33.5R | | | 0.9 | GORDON CR | 2 | 61 | 5 | | 10/ 1/64 | 4N | 5E13NWSW25 |
| 2 | 223 | 1434.8R | 156.9L | 105.8R | 44.2L | 6.1R | | 6.3 | CONLEY LEWIS CR | 2 | 1 | 61 | 5 | 8/ 1/69 | 6N | 4E34SWNE25 |
| 2 | 223 | 1434.8R | 156.9L | 139.3L | | | | 1.2 | AMES BR | 2 | 3 | 46 | | 6/27/60 | 2N | 3E11SESE33 |
| 2 | 223 | 1434.8R | 156.9L | 140.8R | | | | 0.4 | OTTER CR | 2 | 2 | 46 | | 6/27/60 | 2N | 4E 6SEW33 |
| 2 | 223 | 1434.8R | 156.9L | 153.4L | | | | 5.1 | BONNER BR | 2 | 7 | 46 | | 8/15/62 | 3N | 2E11SENW33 |
| 2 | 223 | 1434.8R | 156.9L | 159.0R | | | | 9.9 | MINERAL POINT BR | 2 | 3 | 46 | 5 | 8/15/62 | 4N | 2E10 NE25 |
| 2 | 223 | 1434.8R | 156.9L | 159.0R | | | | 13.7 | MINERAL POINT BR | 2 | 1 | 46 | | 8/ 9/62 | 5N | 2E36SWNE25 |
| 2 | 223 | 1434.8R | 156.9L | 159.0R | 8.8L | | | 8.3 | SUDAN BR | 2 | 4 | 46 | | 8/14/62 | 5N | 2E29SWSE25 |
| 2 | 223 | 1434.8R | 156.9L | 159.0R | 8.8L | 10.6R | | 0.4 | PEDLER CR | 2 | 2 | 46 | | 8/14/62 | 5N | 2E21SWNE25 |
| 2 | 223 | 1434.8R | 156.9L | 172.9L | | | | 1.5 | JONES BR | 2 | 45 | | | 7/11/62 | 4N | 1E23SWSE33 |

NUMBER OF STATIONS WITH FISH = 31 NUMBER OF STATIONS WITH 1-98 FISH = 20 NUMBER OF STATIONS WITH 99 OR MORE FISH = 0
 TOTAL NUMBER OF FISH = 221 AVERAGE NUMBER OF FISH = 11.1 (ESTIMATE)
 PERCENT OF TOTAL NUMBER OF STATIONS = 79.49 NUMBER OF STATIONS WITH A " " = 11
 # STATIONS/SD: SD-11= 0 SD-14,16= 0 SD-15,17,19= 0 SD-23-33= 0 SD-40= 0 SD-45,46= 19 SD-50= 0 SD-55,56= 0
 SD-61= 12 SD-66= 0 SD-72= 0 SD-75= 0 SD-76= 0 SD-77= 0 SD-78= 0 SD-80= 0
 SD-83= 0 SD-86= 0 SD-88= 0 SD-89= 0 SD-94= 0 SD-98= 0 SD-99= 0 SD-36= 0

TOTAL NUMBER OF SPECIES OCCURRENCES 31

Appendix Figure C.6. Example of the species listing portion of a computer print-out showing detailed records (i.e., station location, stream name, number of fish taken, collector, gear, effort, and data) for one species. (Listing method B—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 HORNHEAD 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 SHORRHEAD REDHORSE | 13 | 33.33 | |
| O08 CHANNEL CATFISH | 1 | 2.56 | |
| O10 STONECAT | 5 | 12.82 | |
| S02 BLACKSTRIPE 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

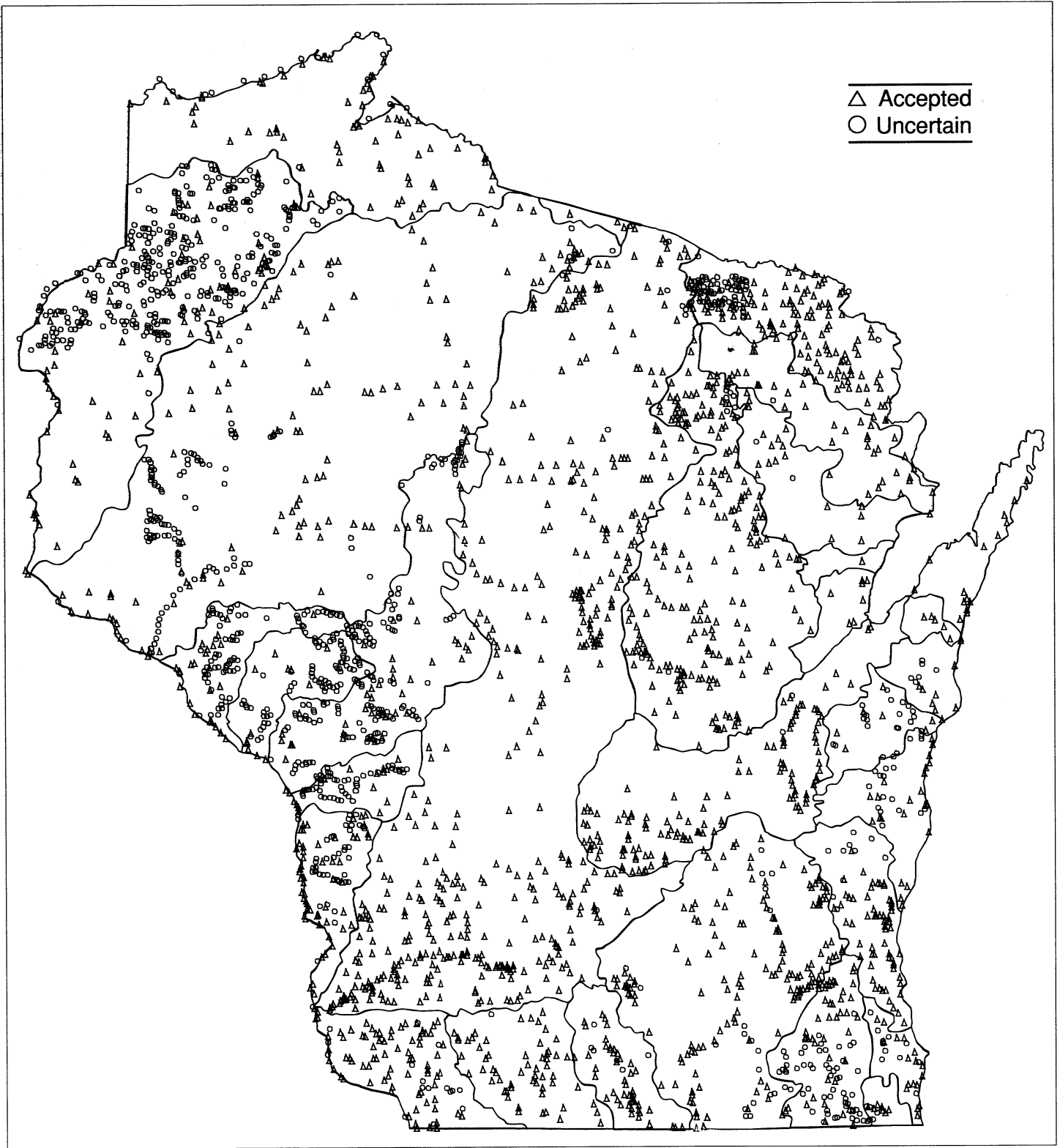
| | | | | | | | | |
|----------------|--------------|-----------|---------------|----------|-------------|---------------|----------|----------|
| # STATIONS/SD: | SD-11-36 = 0 | SD-40 = 0 | SD-45-47= 283 | SD-50= 0 | SD-55,56= 0 | SD-60,61= 158 | SD-66= 0 | SD-72= 0 |
| | SD-75= 0 | SD-76= 0 | SD-77= 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-01= 0 |
| | SD-65= 0 | SD-70= 0 | SD-71= 0 | SD-87= 0 | SD-94= 0 | SD-99= 0 | | |

TOTAL NUMBER OF SPECIES OCCURRENCES 441

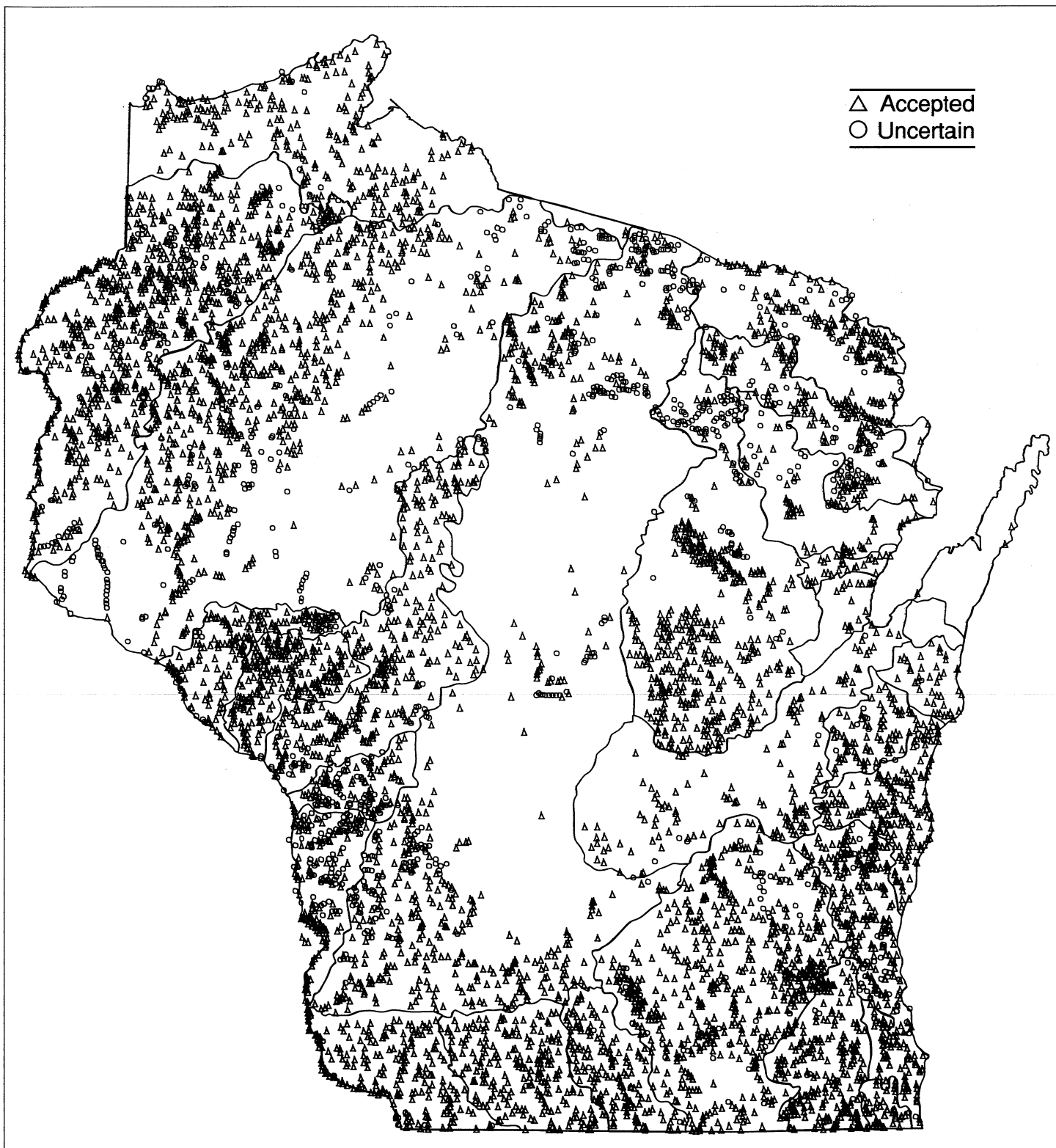
| | |
|-----------------------------|----|
| TOTAL NUMBER OF STATIONS | |
| (WITH MILE RULE) | 39 |
| (WITHOUT MILE RULE) | 42 |
| TOTAL NUMBER OF SPECIES | 45 |
| TOTAL NUMBER OF HYBRIDS | 1 |
| TOTAL NUMBER OF UNSPECIFIED | 3 |

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.

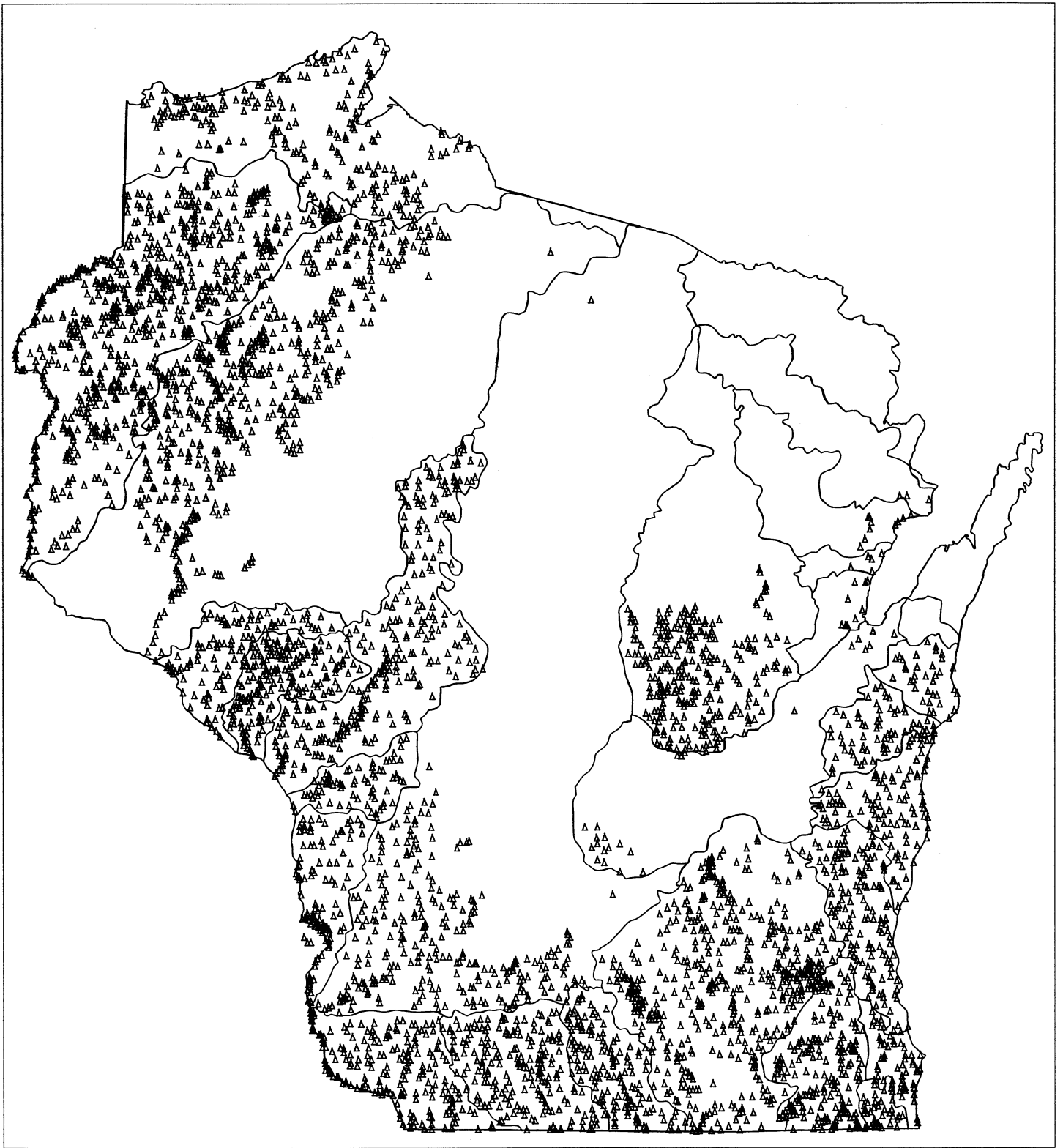
Appendix D. Locations of Sampling Stations



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.

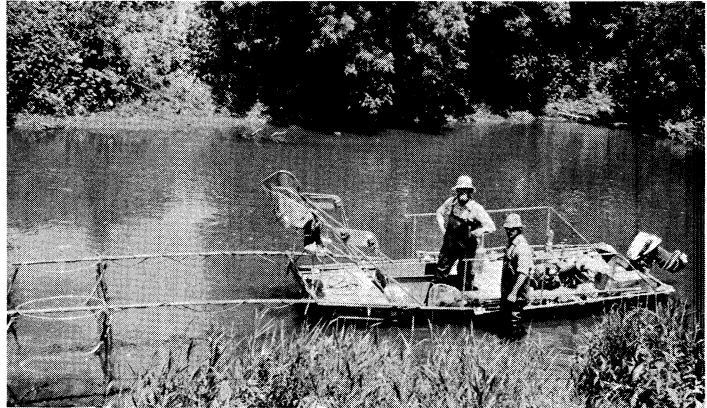


Appendix Figure D.3. Location of 5,396 stations in Wisconsin sampled during 1974-86 by Fish Distribution Study personnel. Due to lack of space, 1,109 stations are not shown.

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.

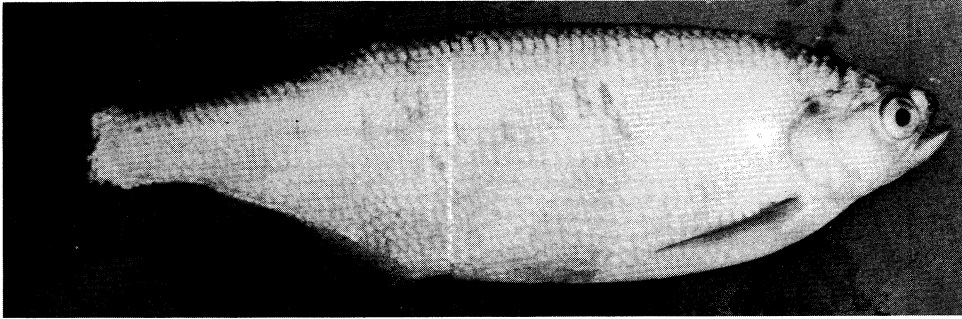


C. DC backpack shocker powered by a 12-volt, deep-cycle battery. Pictured are Rick Tollefson and David Siegler.

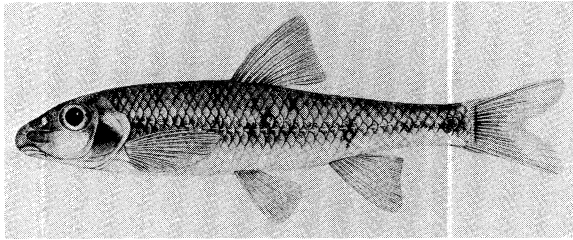


F. Small mesh seine, with a 4- by 4-ft bag at the right, in use in the Mississippi River by Tom Meyer, Keith Otis, and Paul Johnson.

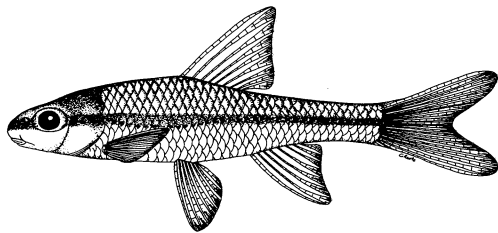
Appendix Figure E.1. Example of gear used during the recent (1974-86) survey of fish distribution. Other gear used but not shown were DC longline shockers and AC stream shockers. Members of the sampling crew are identified from left to right.



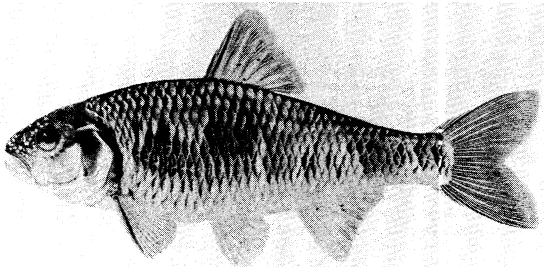
A. *Goldeye taken from the Chippewa River. They prefer large rivers.*



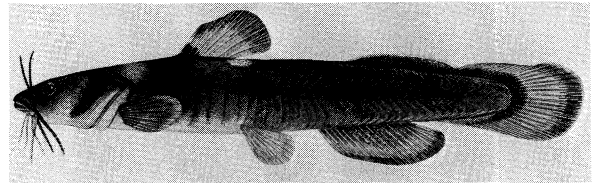
B. *Gravel chubs inhabit riffles of medium-to-large rivers.*



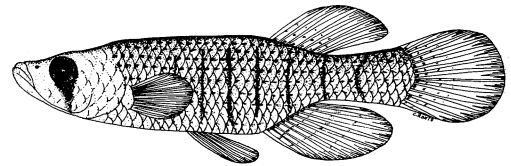
C. *Pallid shiners inhabit sluggish sections of large rivers.*



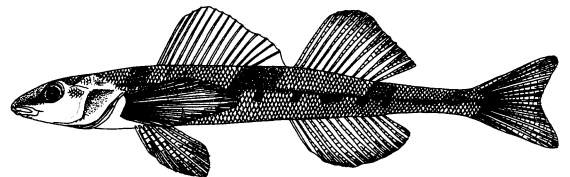
D. *Striped shiners appear to be restricted to 5 small-to medium-sized rivers in the Milwaukee River basin.*



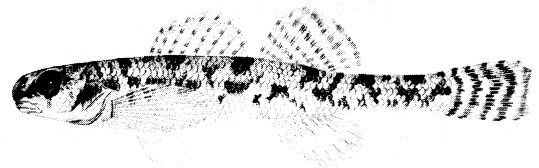
E. *Slender madtom prefer riffle sections of streams.*



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

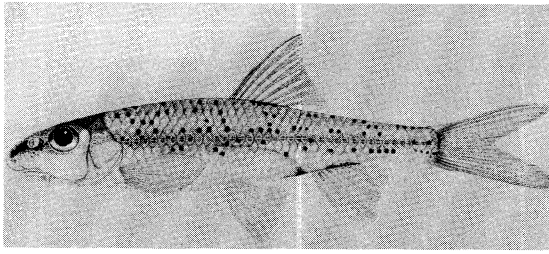


G. *Crystal darters prefer the riffle sections of large rivers.*

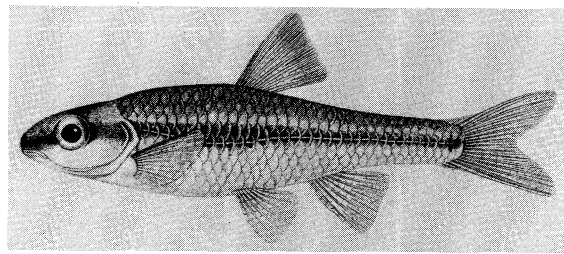


H. *Bluntnose darters inhabit sluggish stretches of large rivers.*

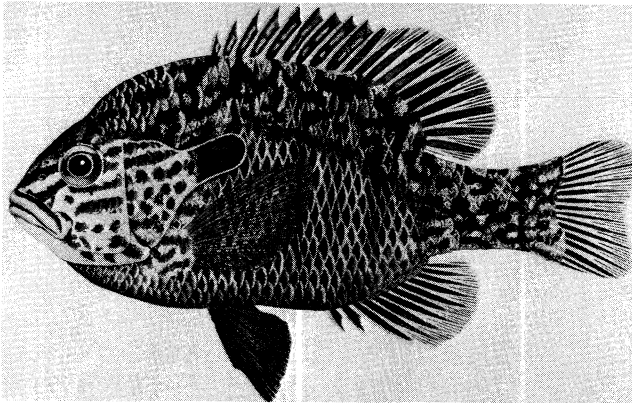
Appendix Figure E.2. *Illustrations and habitat preferences of endangered fish species that were collected in the recent period (1974-86).*



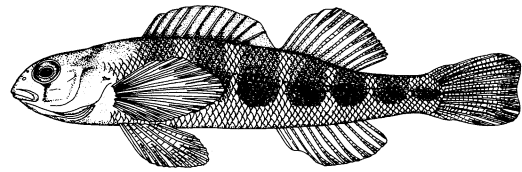
A. *Speckled chubs prefer sandy substrate in large rivers.*



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



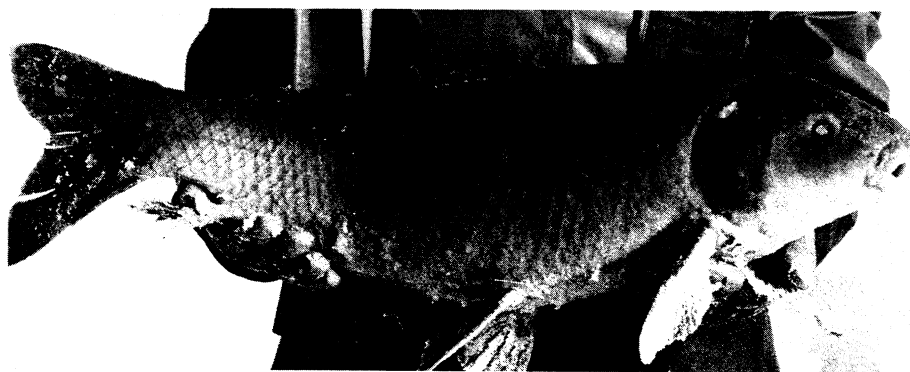
C. *Longear sunfish prefer medium-to-large rivers and lakes.*



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

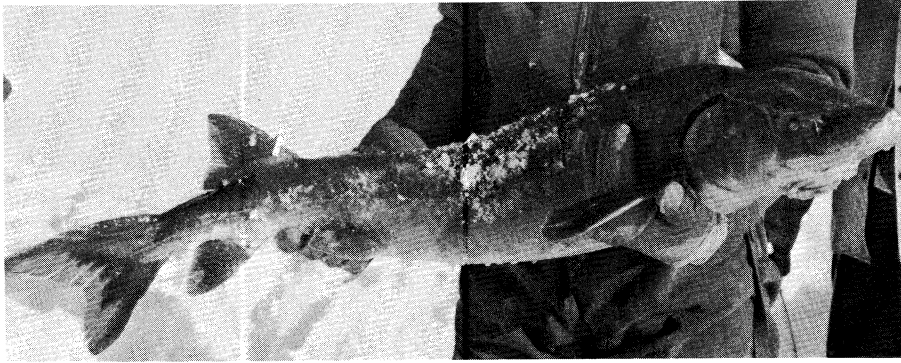


E. *Blue sucker (held by the author) taken from the St. Croix River. They prefer fast-moving sections of large rivers.*



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

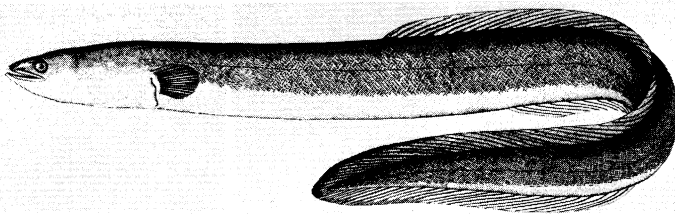
Appendix Figure E.3. *Illustrations and habitat preferences of threatened fish species that were collected in the recent period (1974-86).*



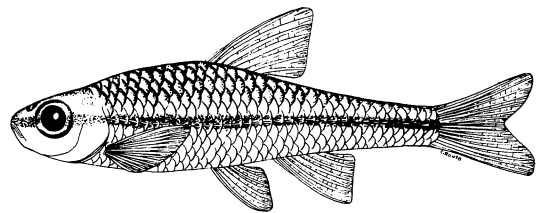
A. Lake sturgeon taken from Lake Wisconsin. They prefer large rivers and lakes.



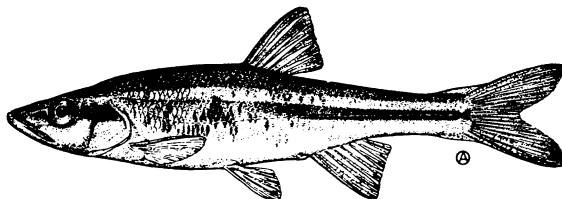
B. Paddlefish (held by Fred Hagstrom) taken from a small tributary to the Wisconsin River where it was presumably trying to spawn. They prefer large rivers.



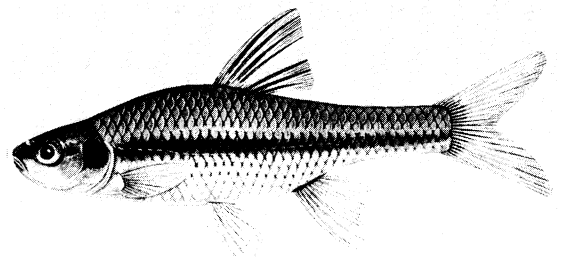
C. American eel prefer medium-to-large rivers. Only females are found in freshwater; they spawn in the Sargasso Sea.



E. Pugnose shiners prefer clear, weedy lakes.

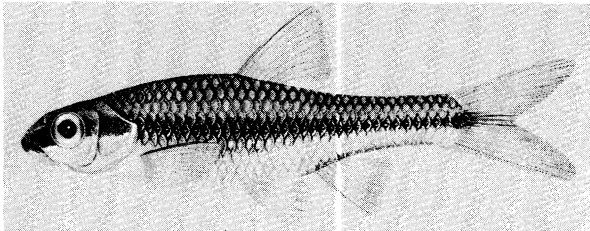


D. Redside dace prefer clear pools in small- to medium-sized streams.

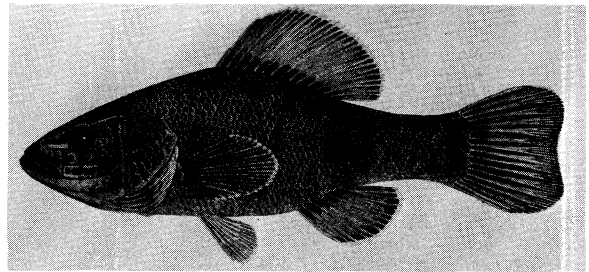


F. Pugnose minnows inhabit large low-gradient rivers.

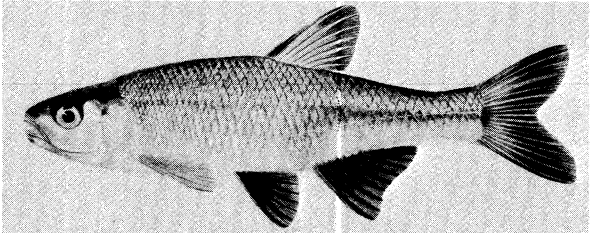
Appendix Figure E.4. Illustrations and habitat preferences of selected watch fish species that were collected in the recent period (1974-86).



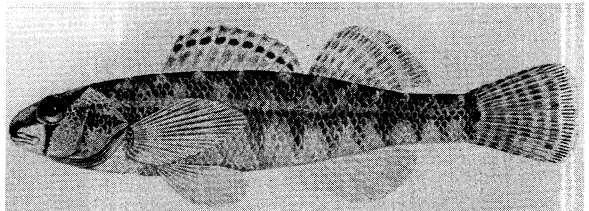
G. Weed shiners inhabit sluggish areas of medium-to-large rivers and lakes.



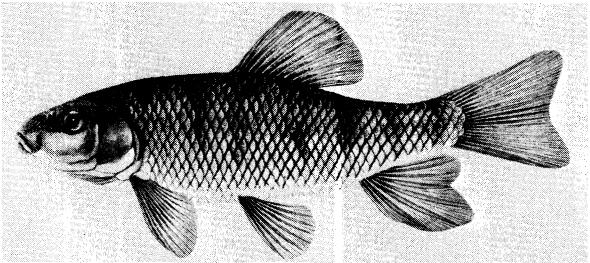
L. Pirate perch prefer small streams of the backwaters or sloughs of medium-to-large rivers.



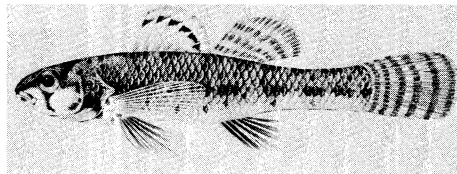
H. Redfin shiners inhabit slow pool areas of medium-to-large rivers and lakes.



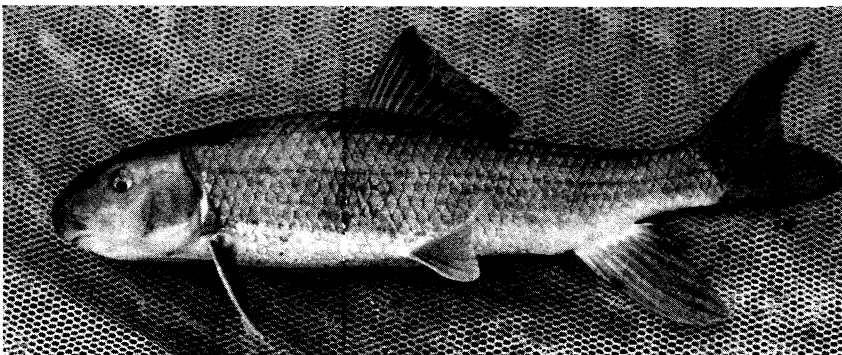
M. Mud darters prefer slow-moving, weedy areas adjacent to medium-to-large rivers.



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

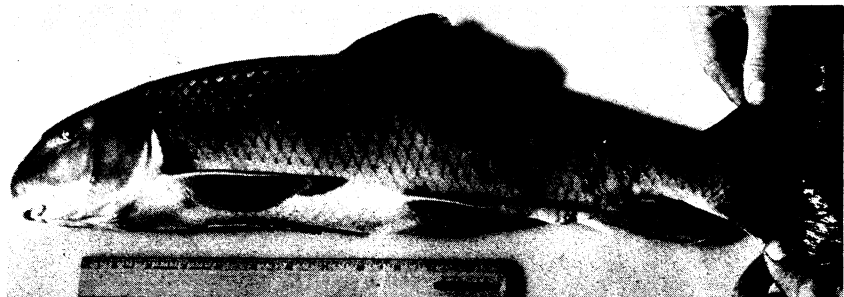


N. Least darters inhabit quiet, weedy areas of small streams.



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.

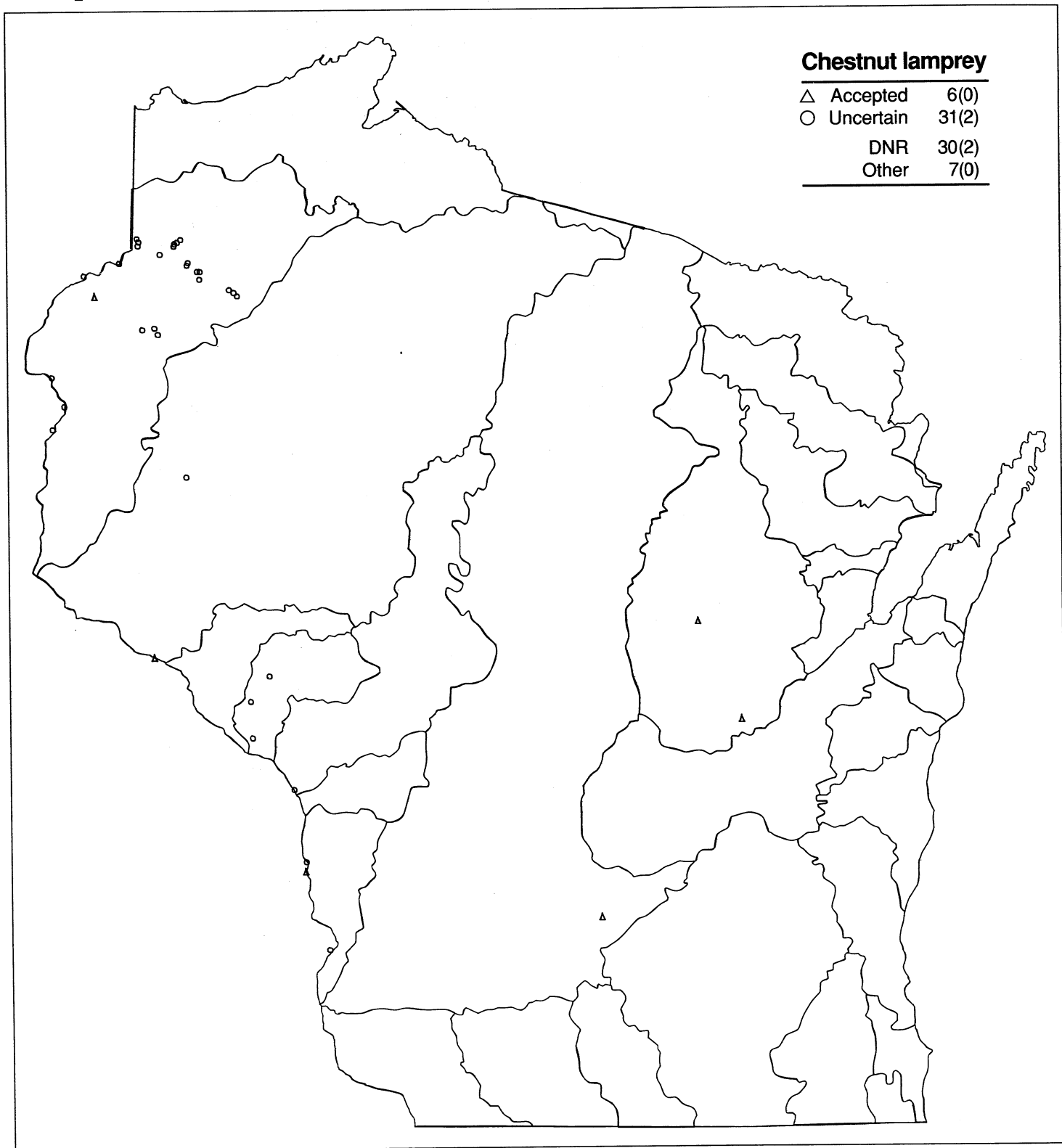
Map captions also divide the total number of collections for each species into the number of collections made by DNR personnel and the number made by others. As for the map symbols, these numbers give first the number shown on the map and in parentheses the number not mapped.

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.

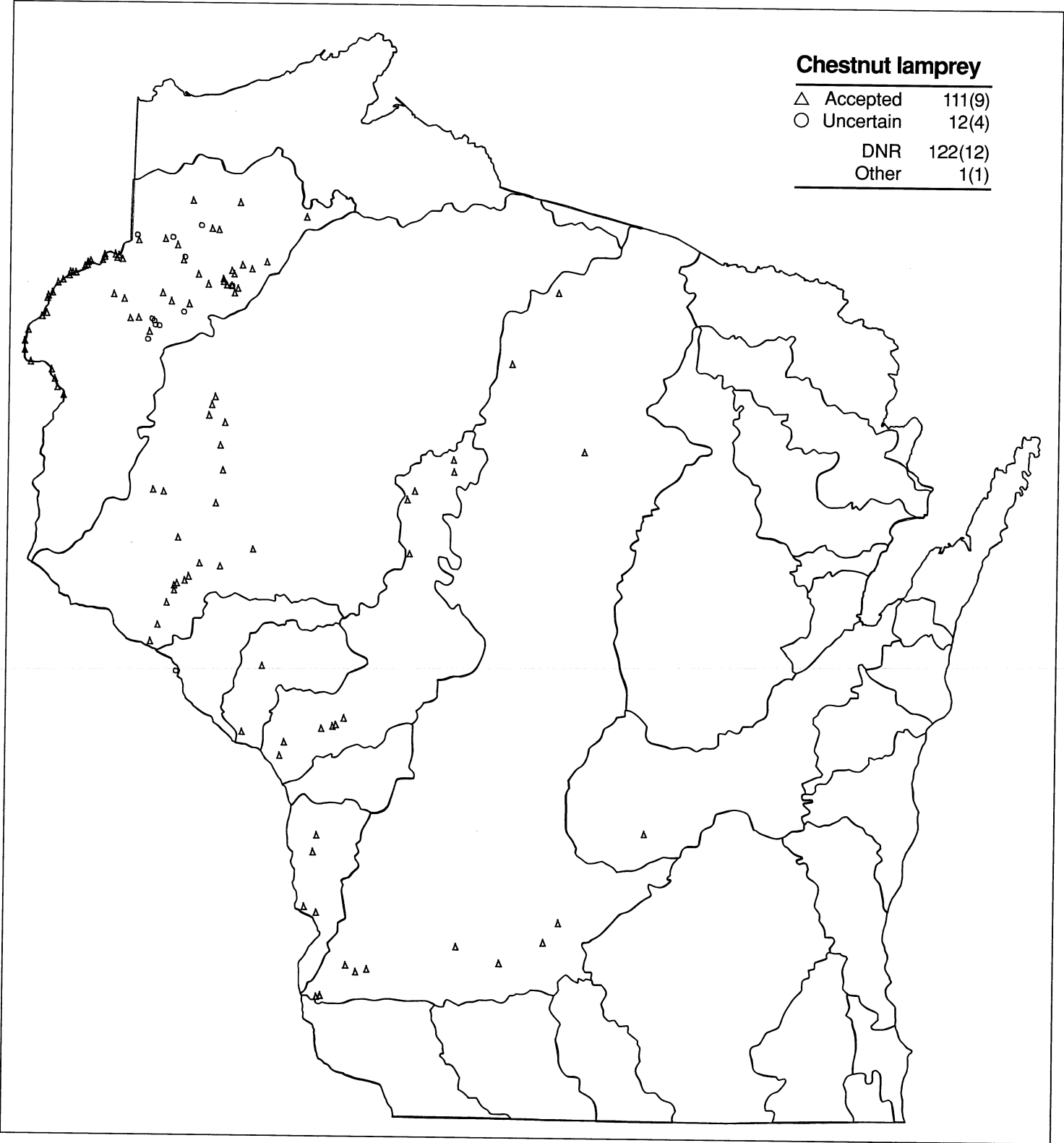
Map Interpretation. Readers are reminded that the maps show distribution only in that part of the state that has been sampled. Since sampling has been completed in only about half of the state, empty portions of the distribution maps may mean that area has not yet been surveyed. Figure 1 of this report 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.

| <i>Map caption examples:</i> | | | |
|------------------------------|------------|-------------------------|-------------|
| Map 1(E) | | Map 1(L) | |
| Chestnut lamprey | | Chestnut lamprey | |
| △ Accepted | 6(0) | △ Accepted | 111(9) |
| ○ Uncertain | 31(2) | ○ Uncertain | 12(4) |
| | DNR 30(2) | | DNR 122(12) |
| | Other 7(0) | | Other 1(1) |

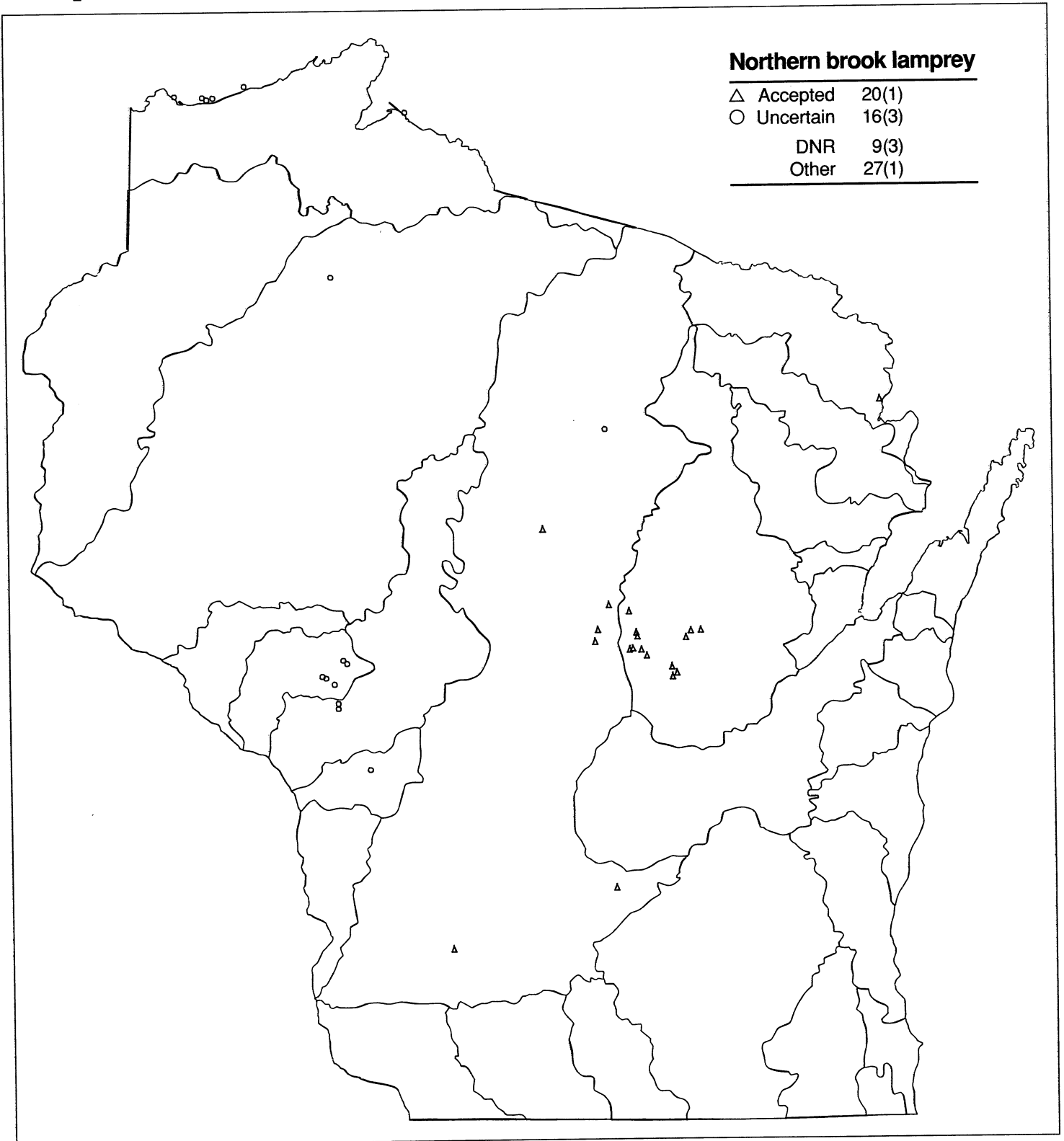
Map 1(E)



Map 1(L)



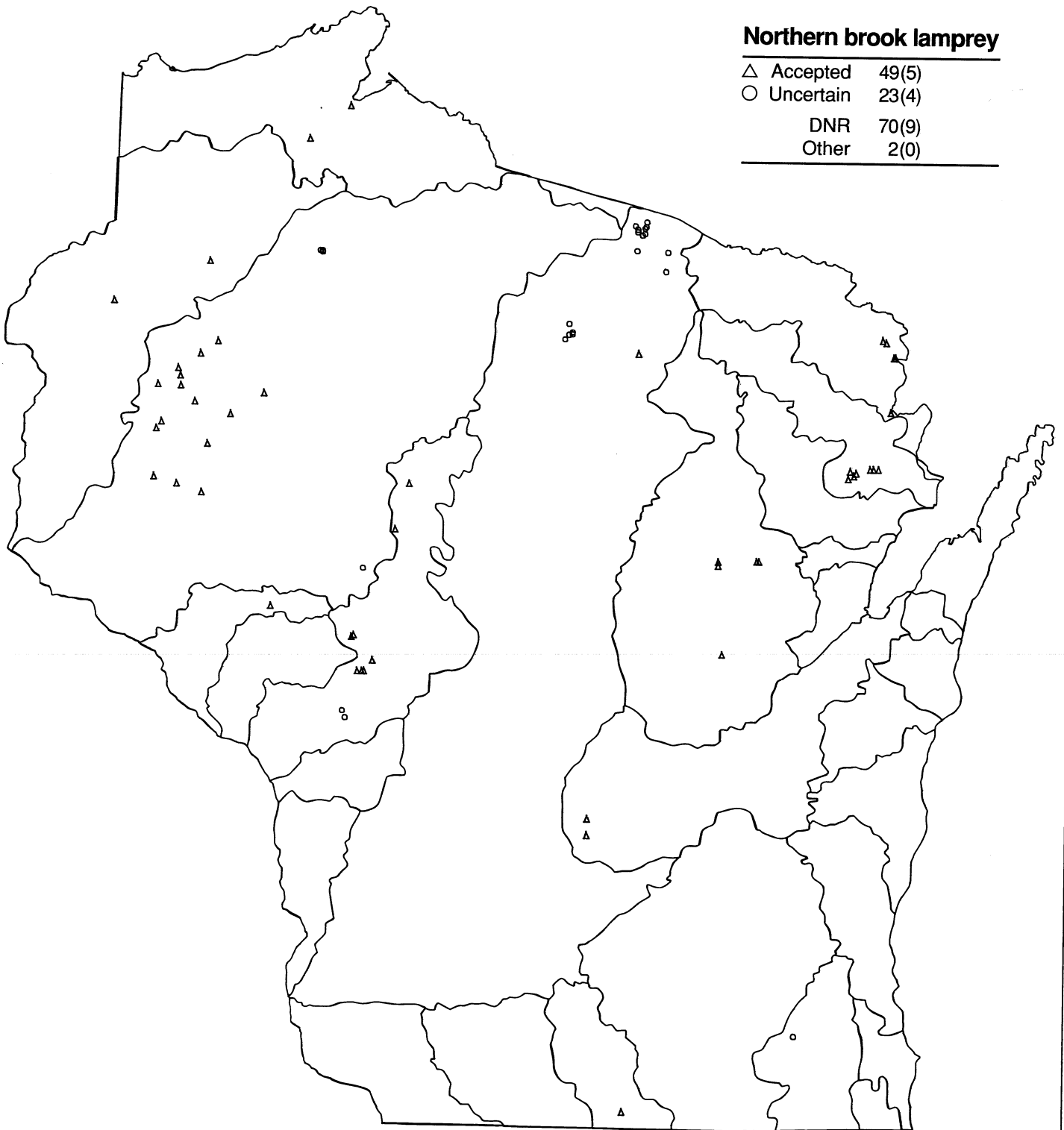
Map 2(E)



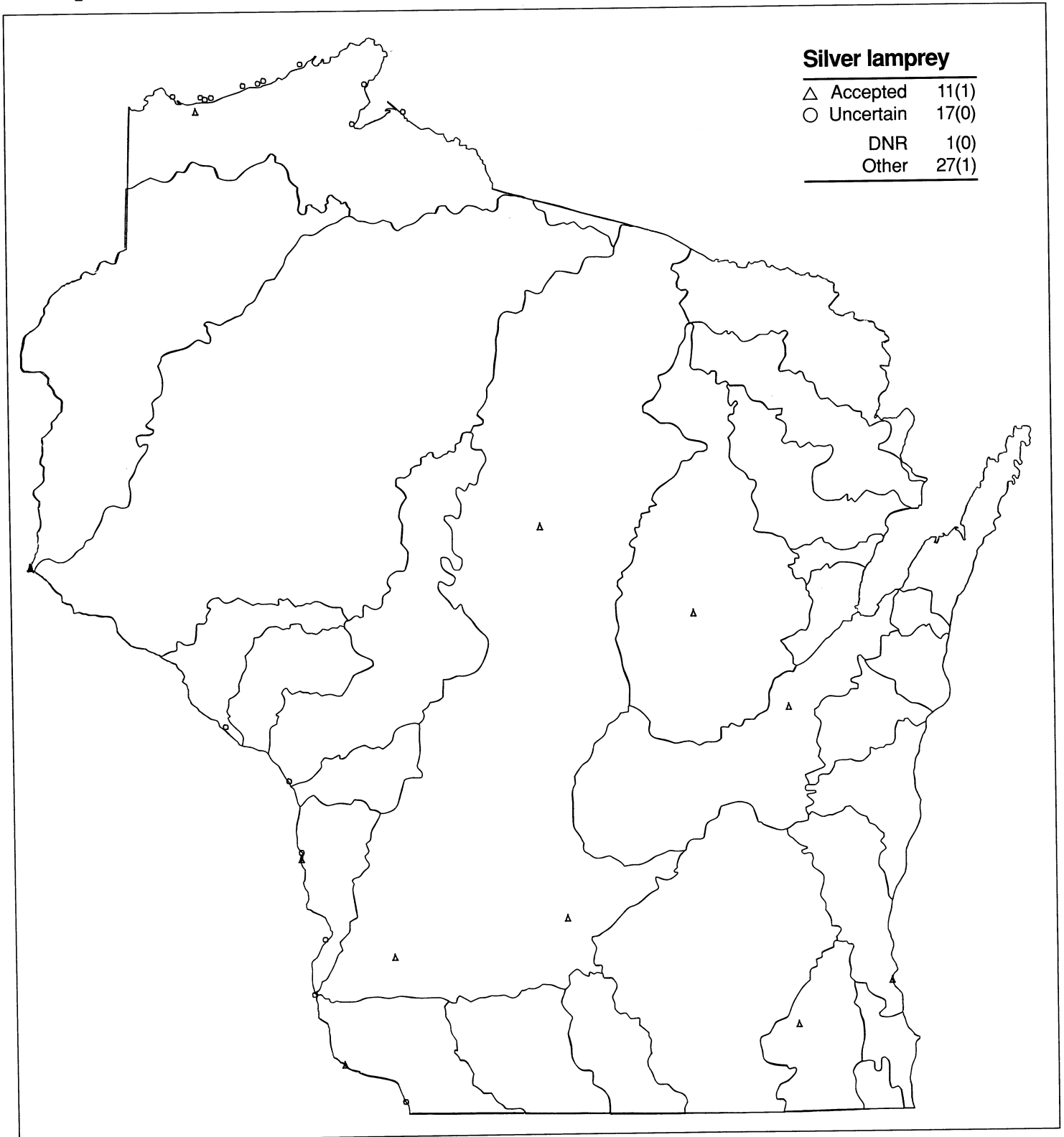
Map 2(L)

Northern brook lamprey

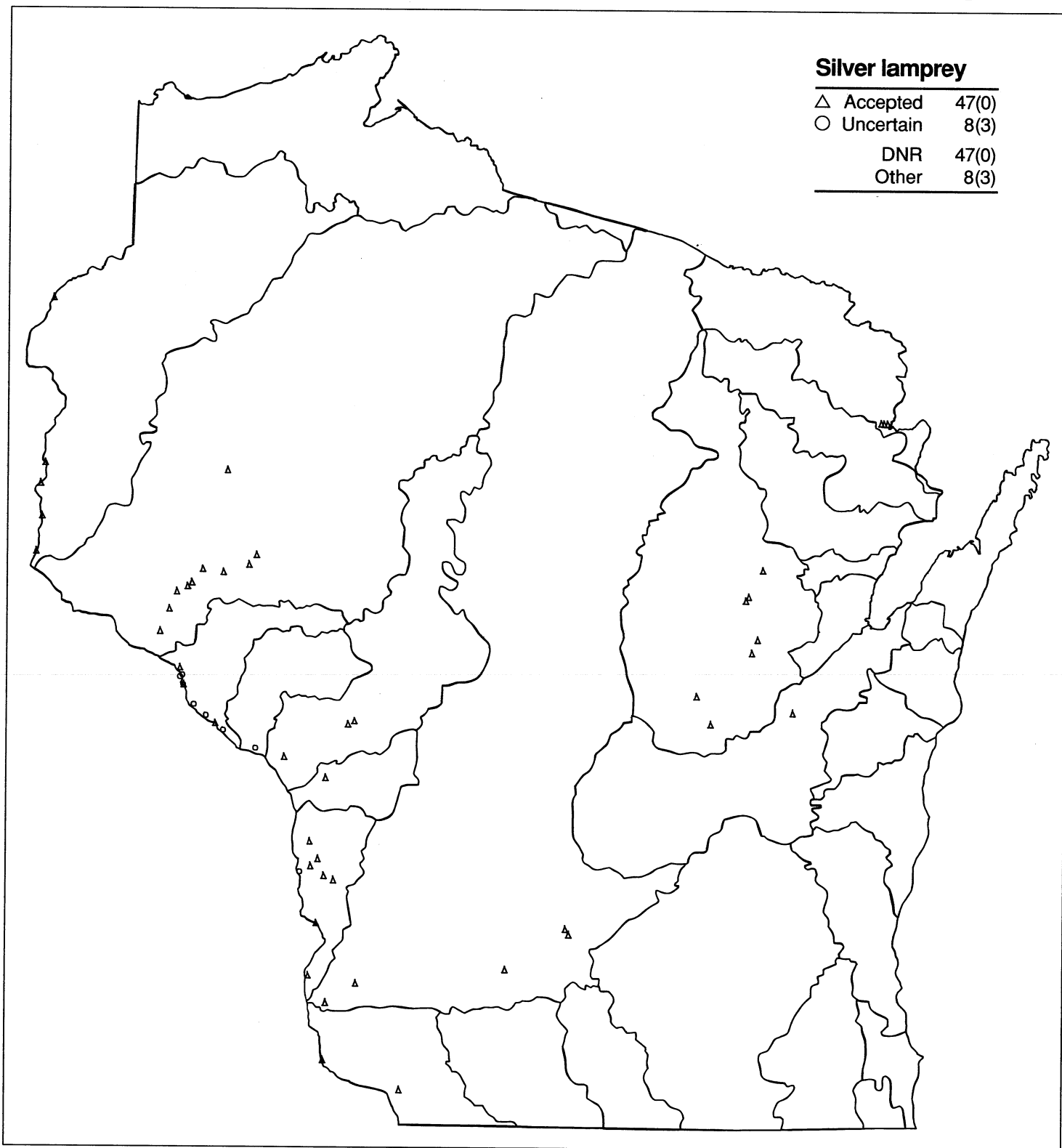
| | | |
|---|-----------|-------|
| △ | Accepted | 49(5) |
| ○ | Uncertain | 23(4) |
| | DNR | 70(9) |
| | Other | 2(0) |



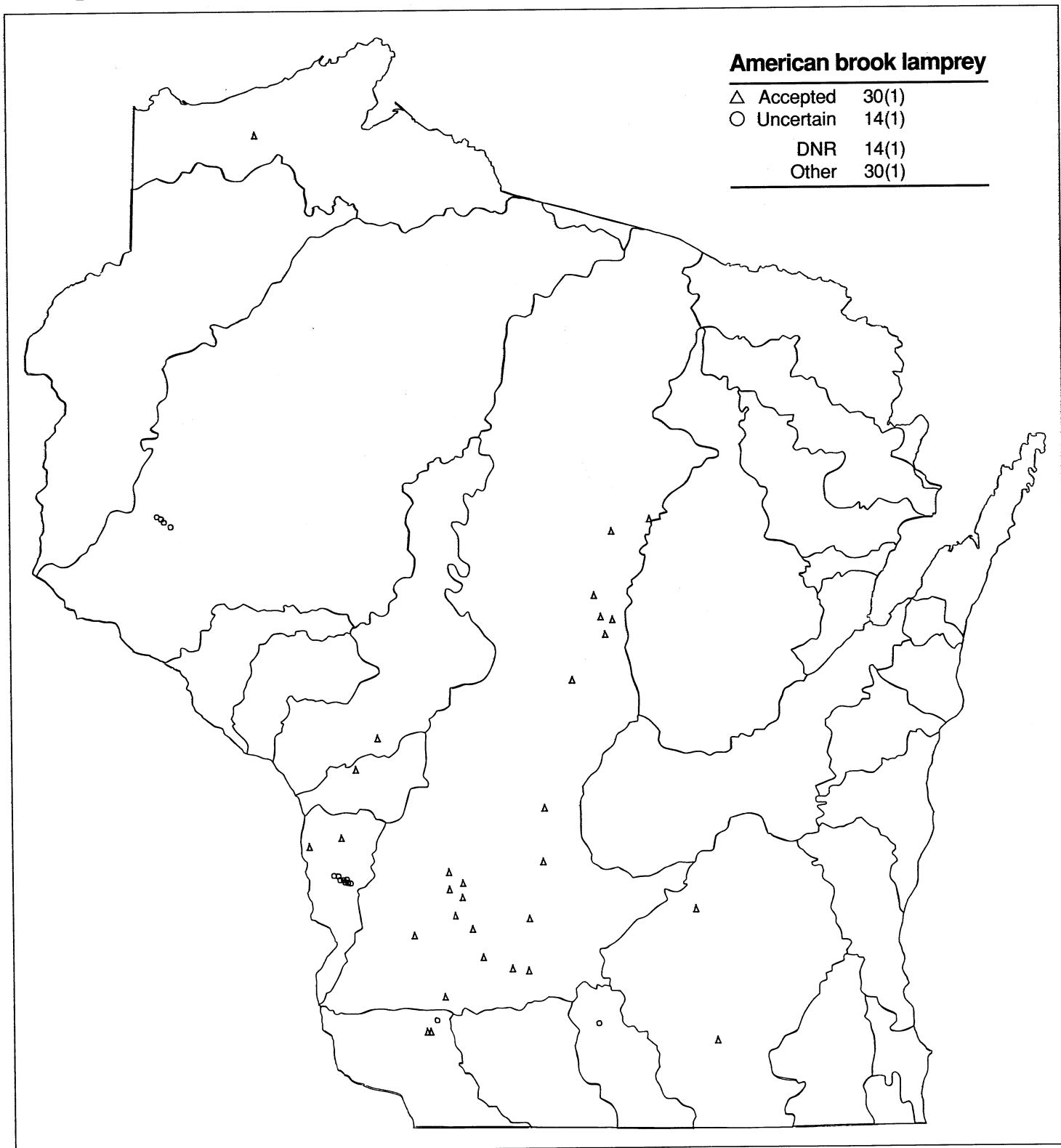
Map 3(E)



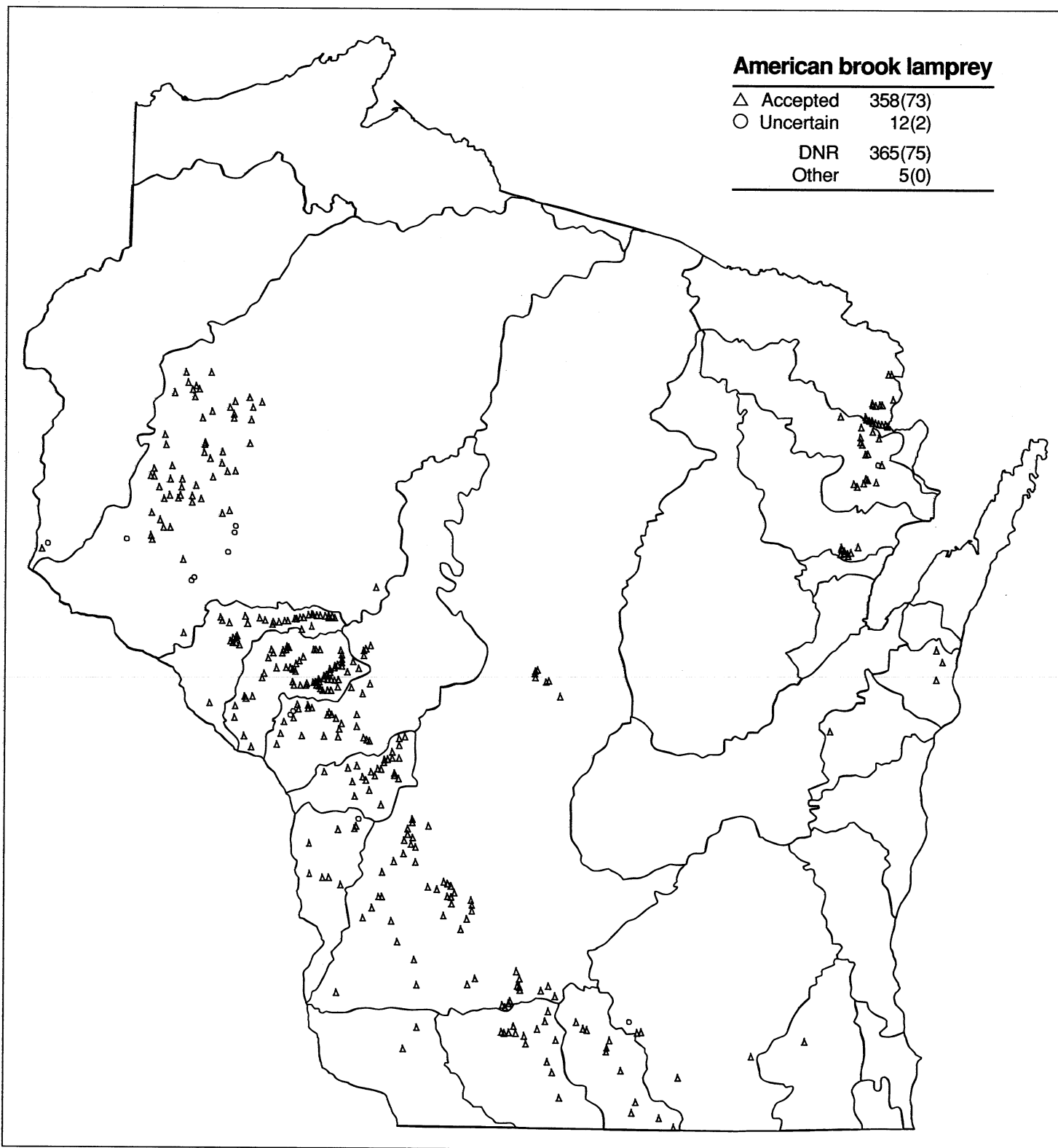
Map 3(L)



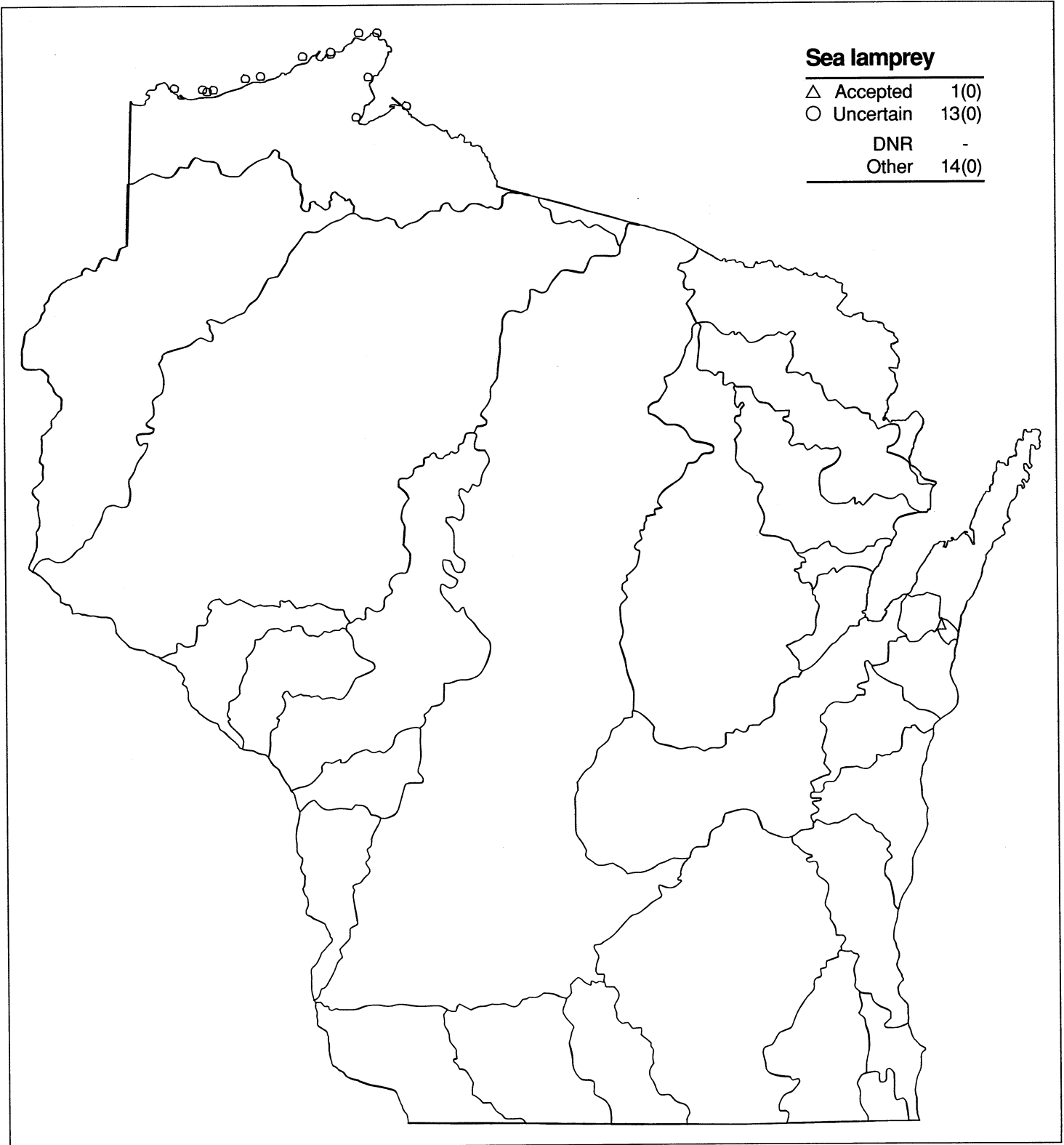
Map 4(E)



Map 4(L)



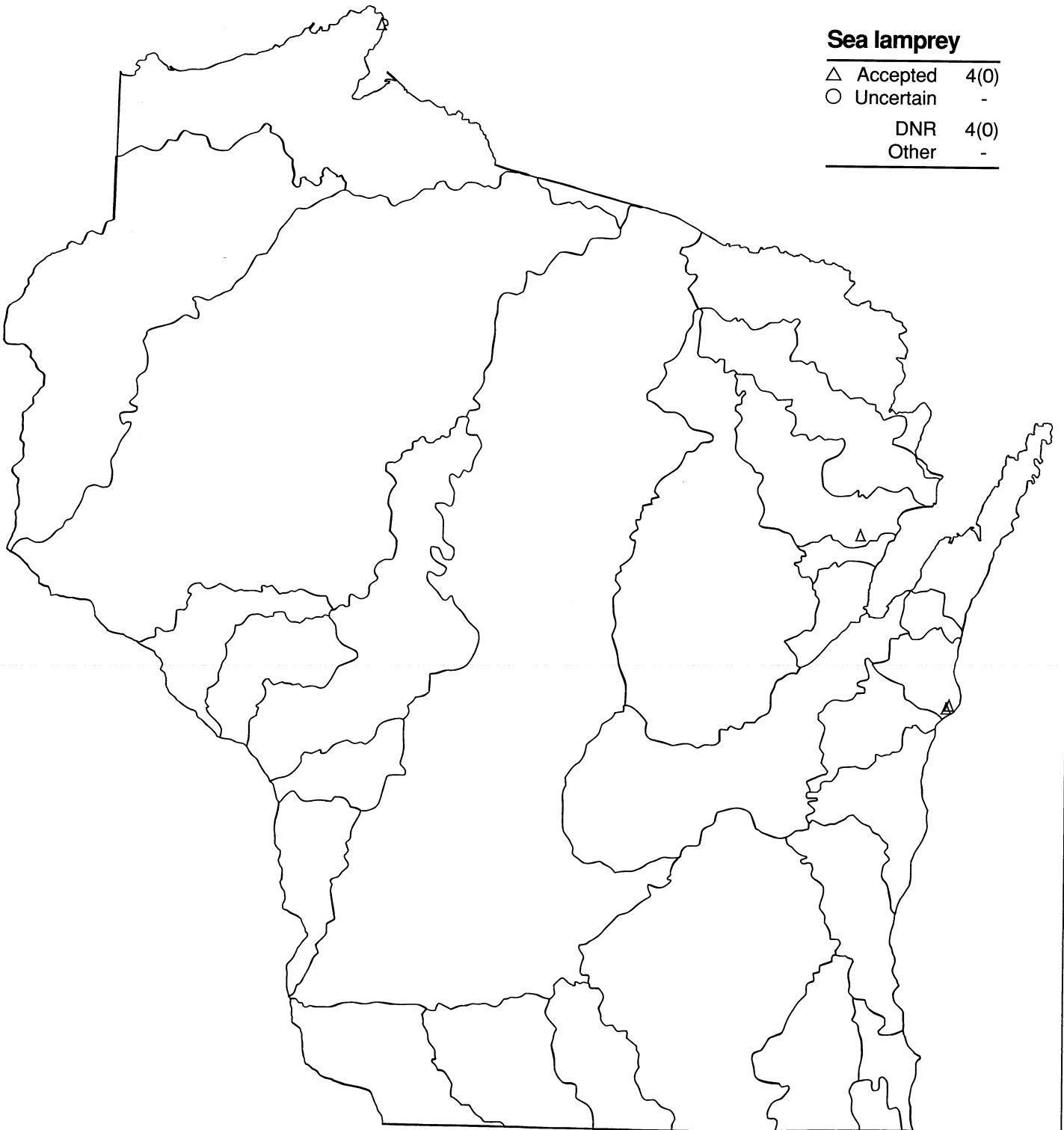
Map 5(E)



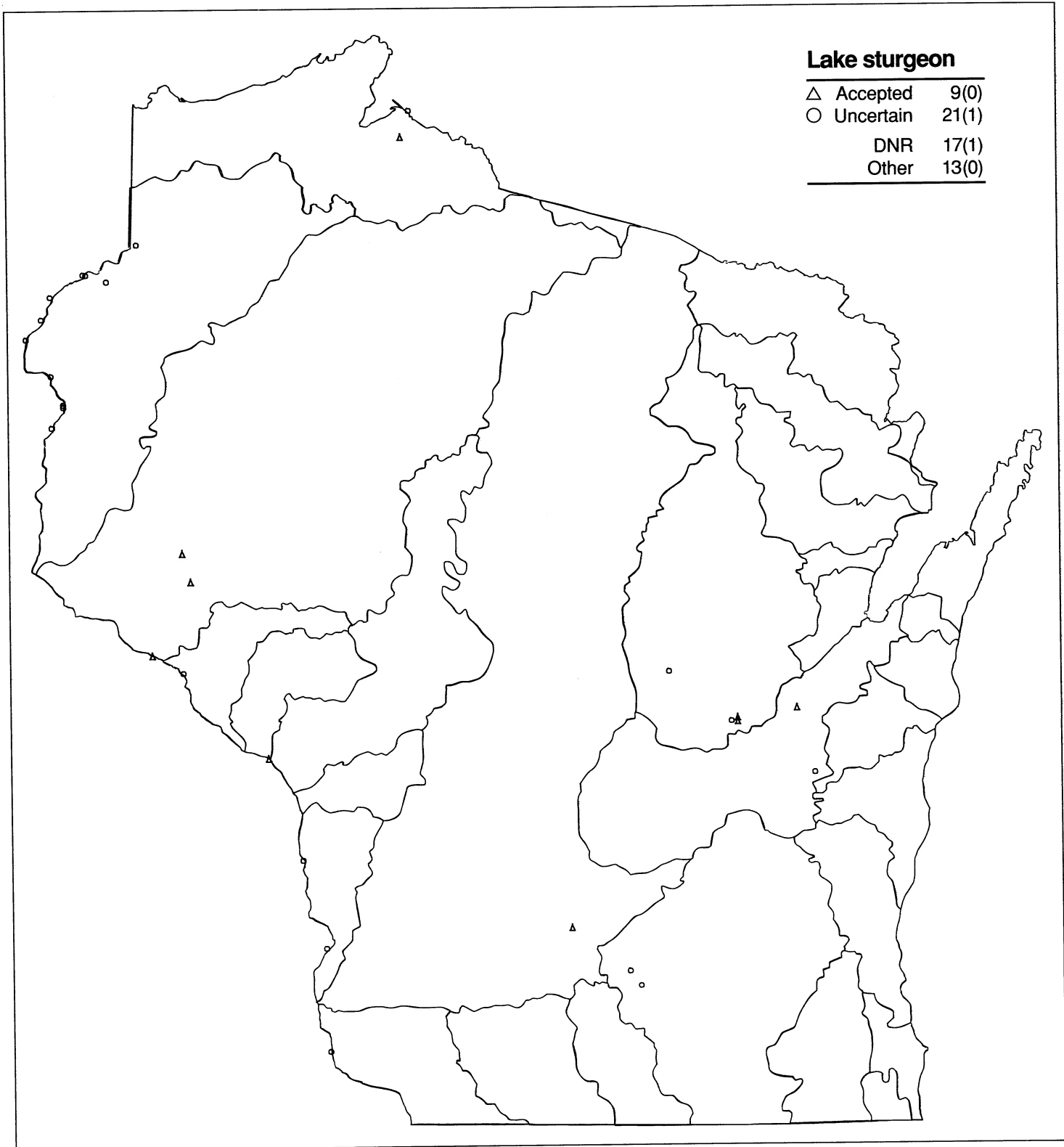
Map 5(L)

Sea lamprey

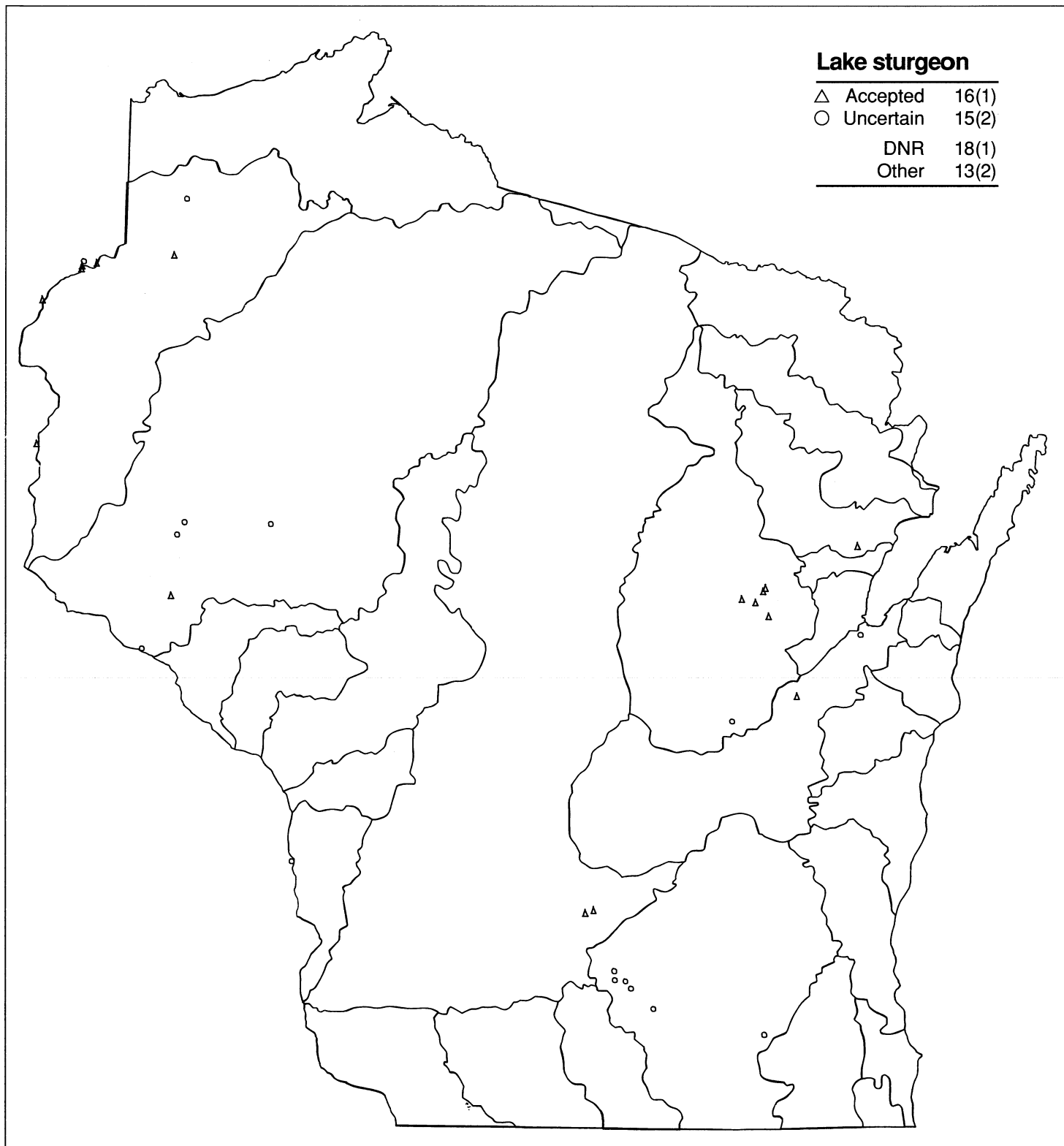
| | |
|-------------|------|
| △ Accepted | 4(0) |
| ○ Uncertain | - |
| DNR | 4(0) |
| Other | - |



Map 6(E)

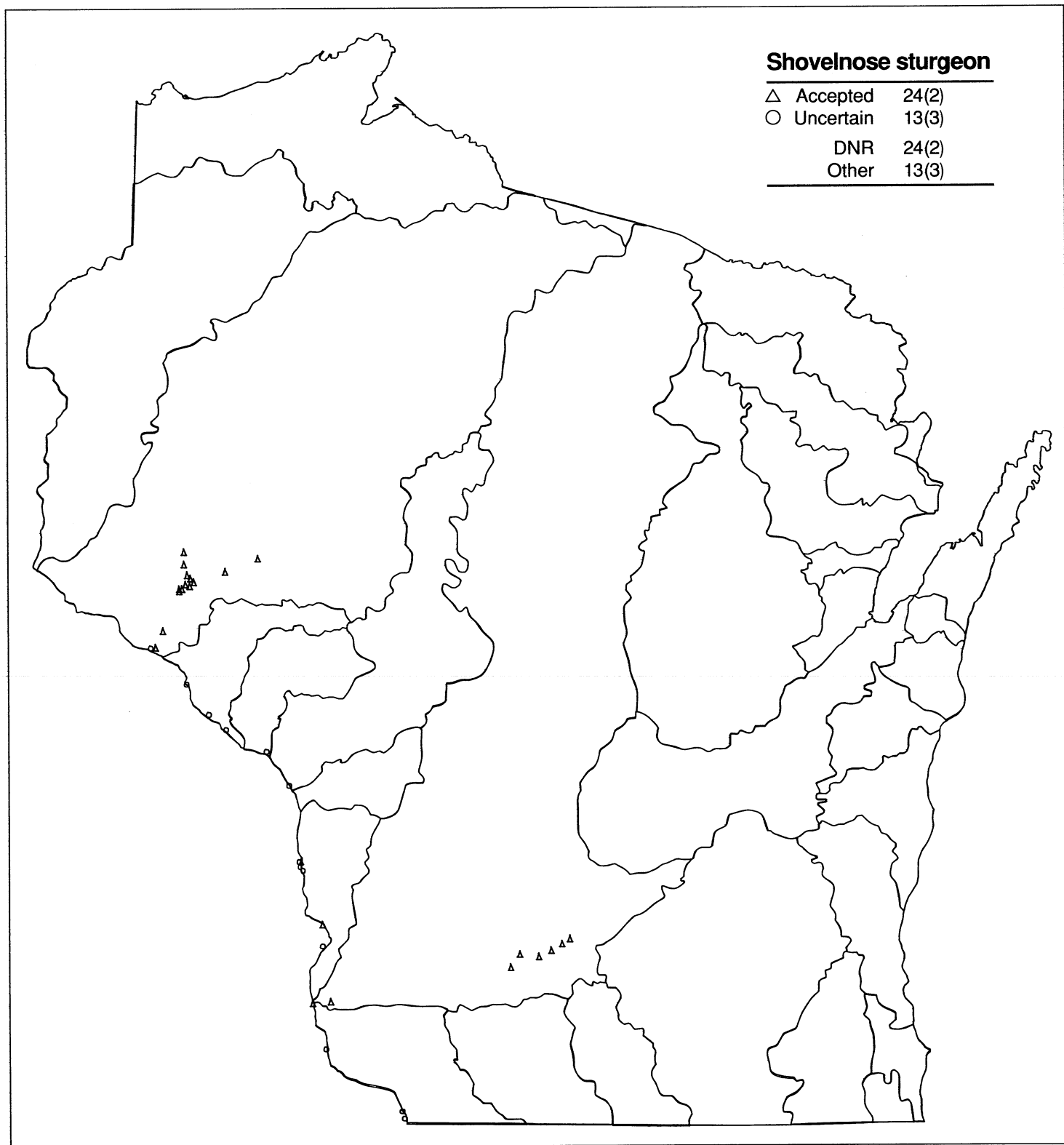


Map 6(L)

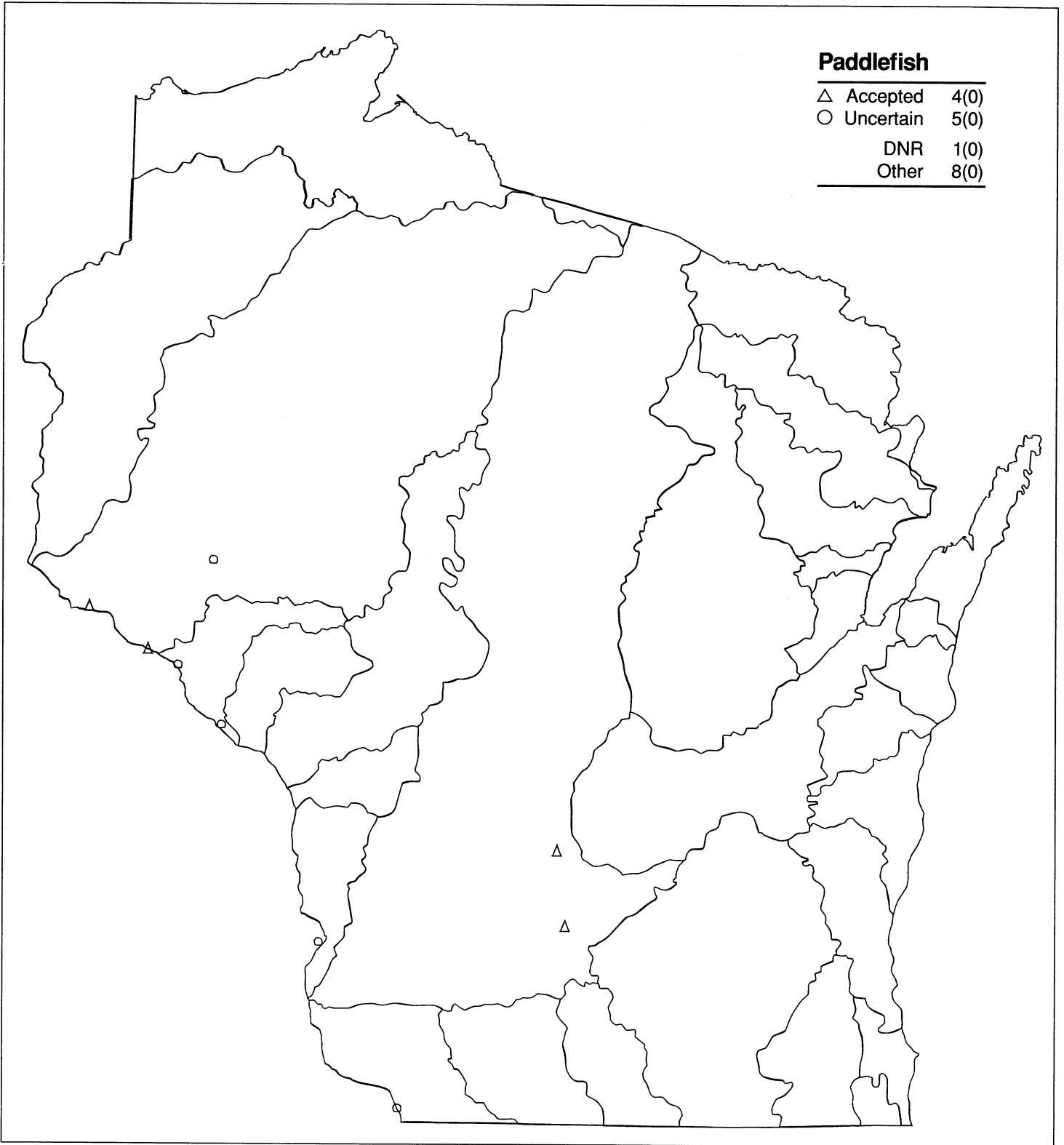


Map 7(E)

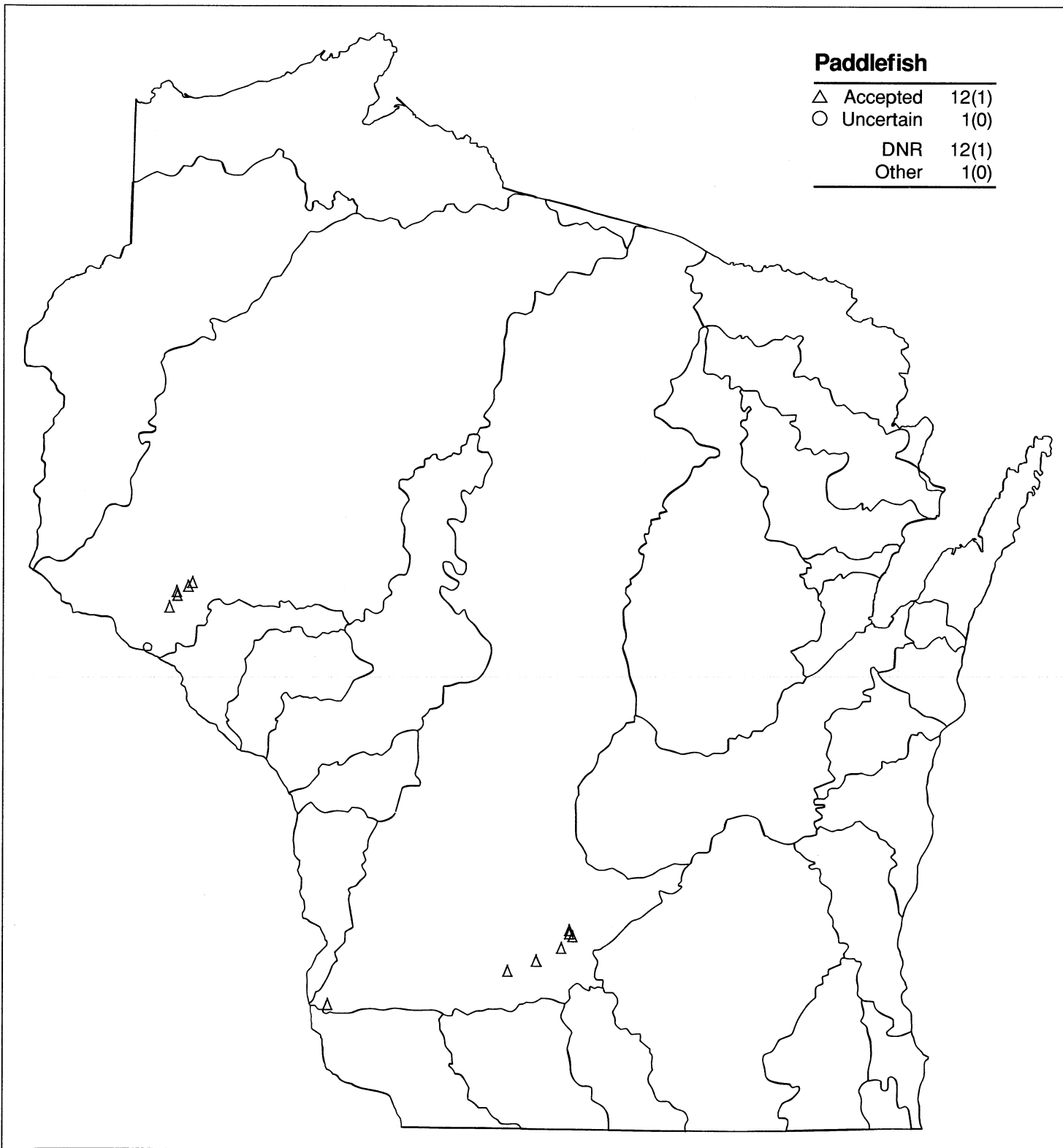




Map 8(E)



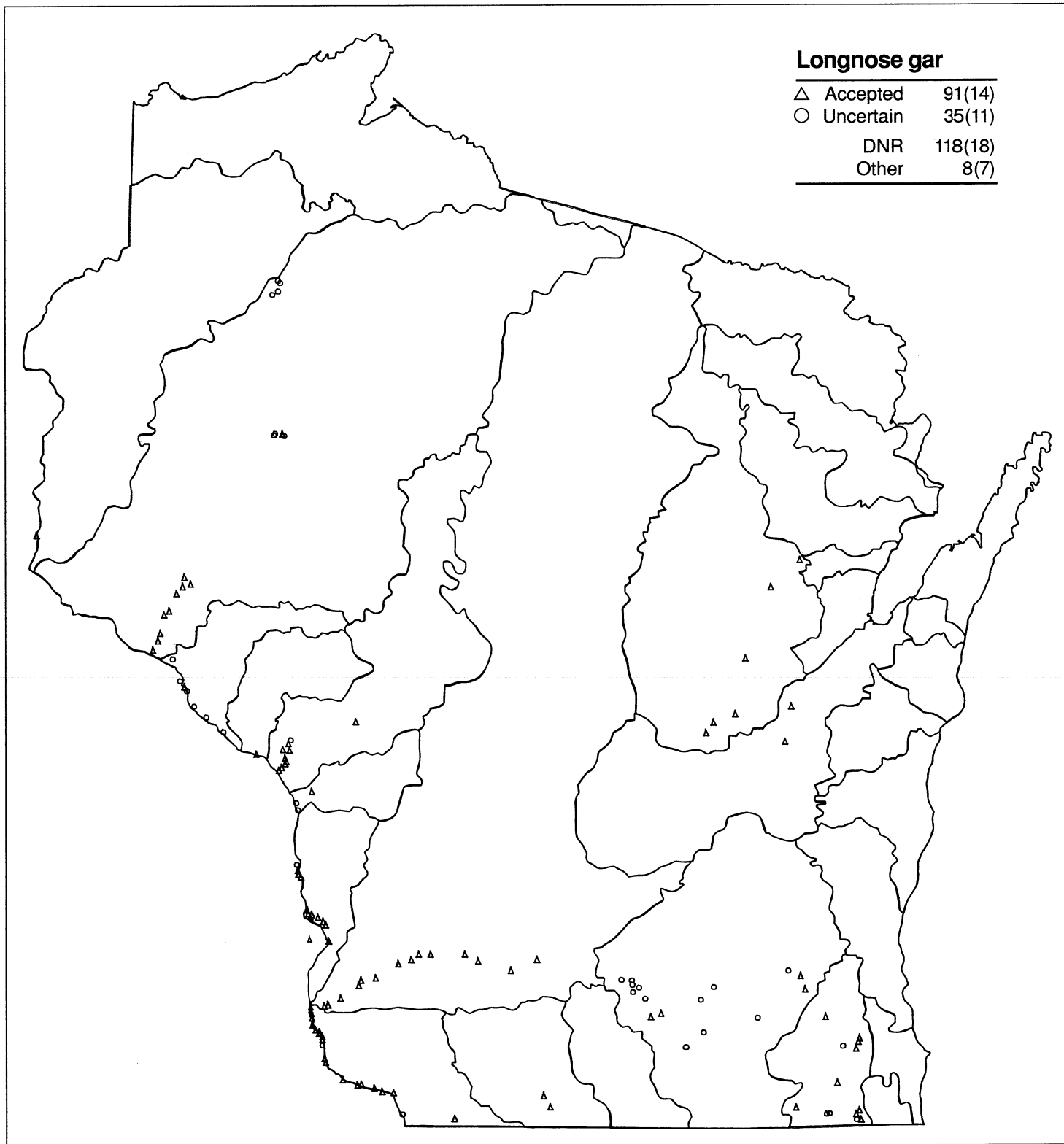
Map 8(L)



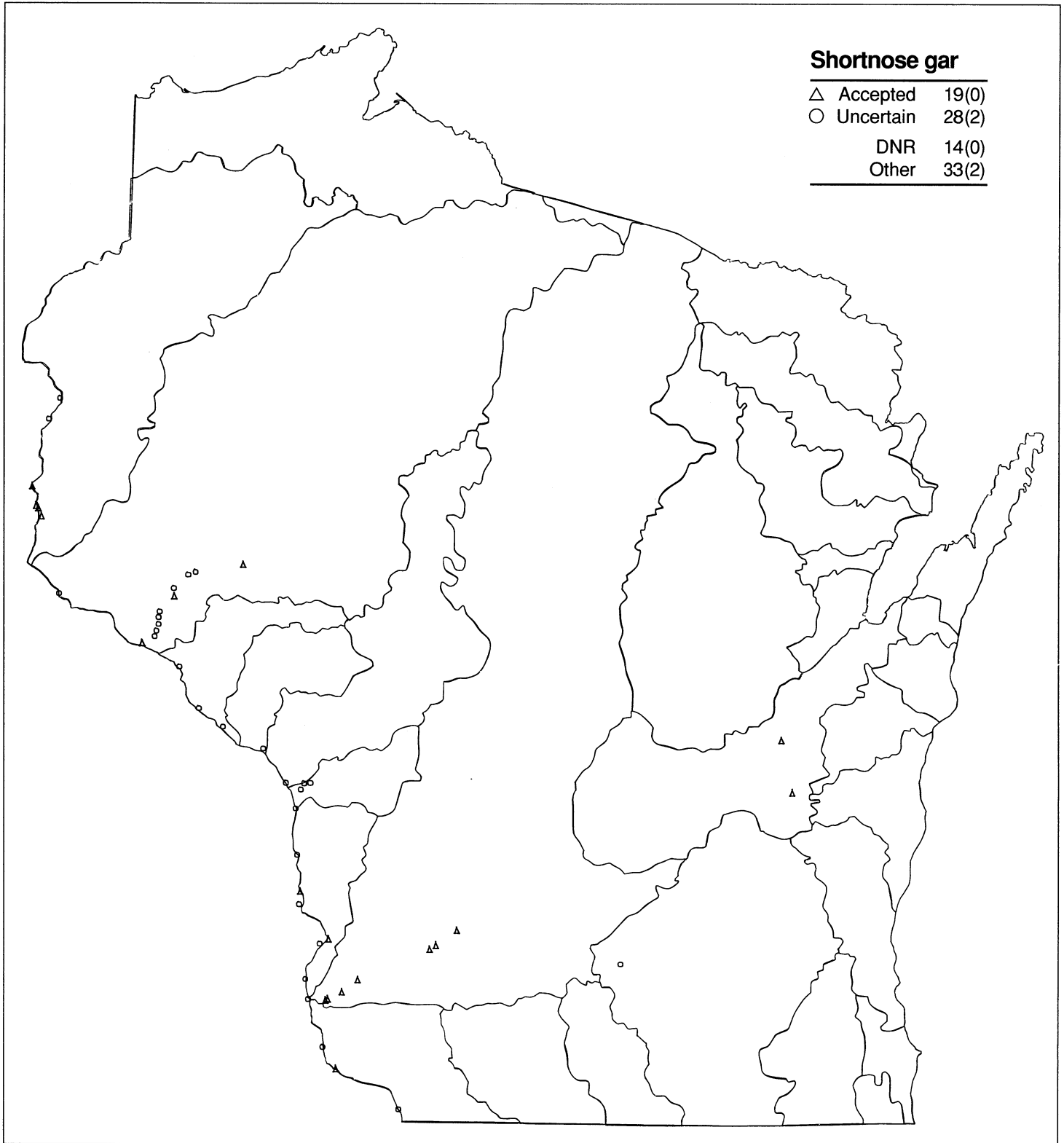
Map 9(E)



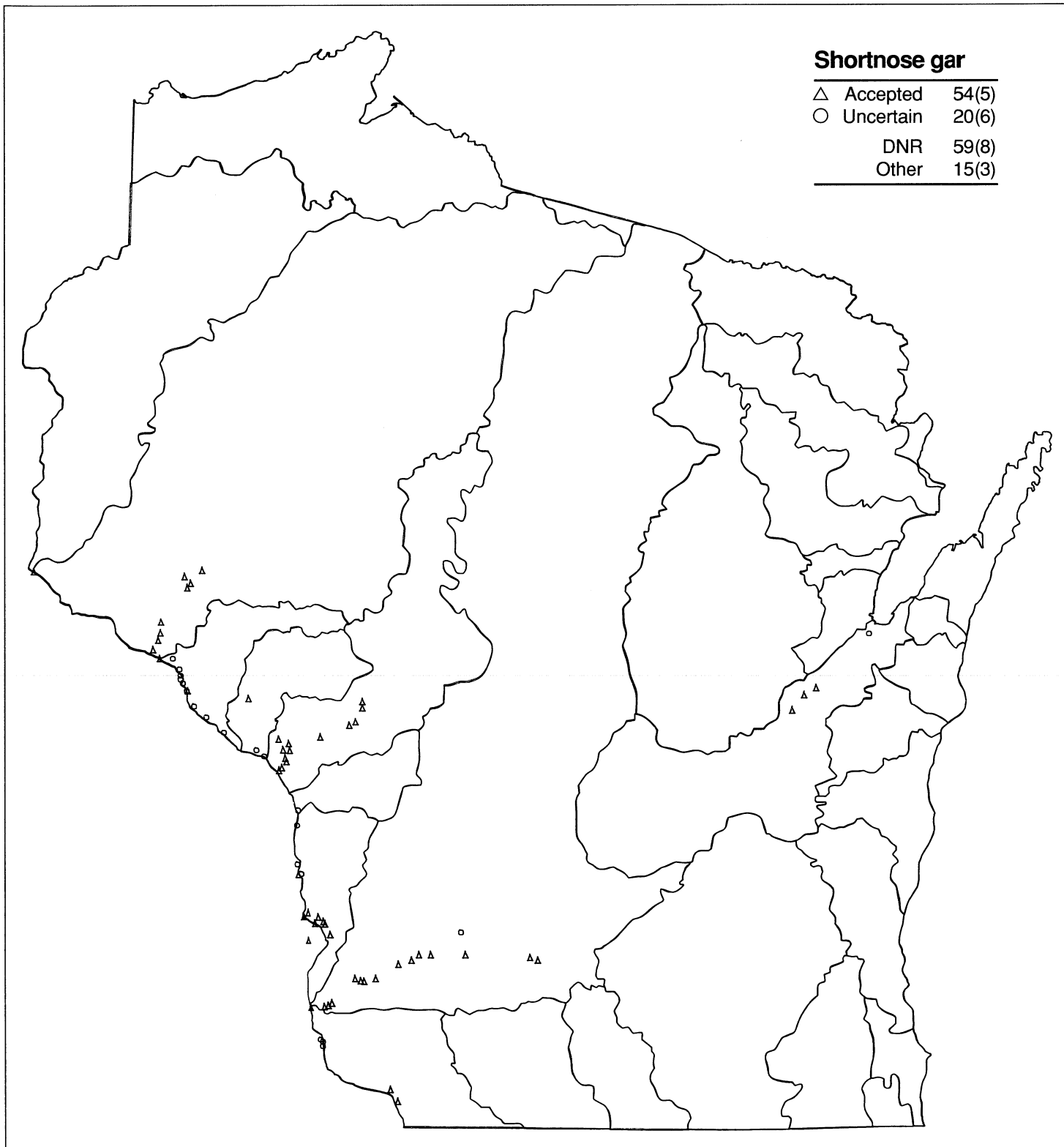
Map 9(L)



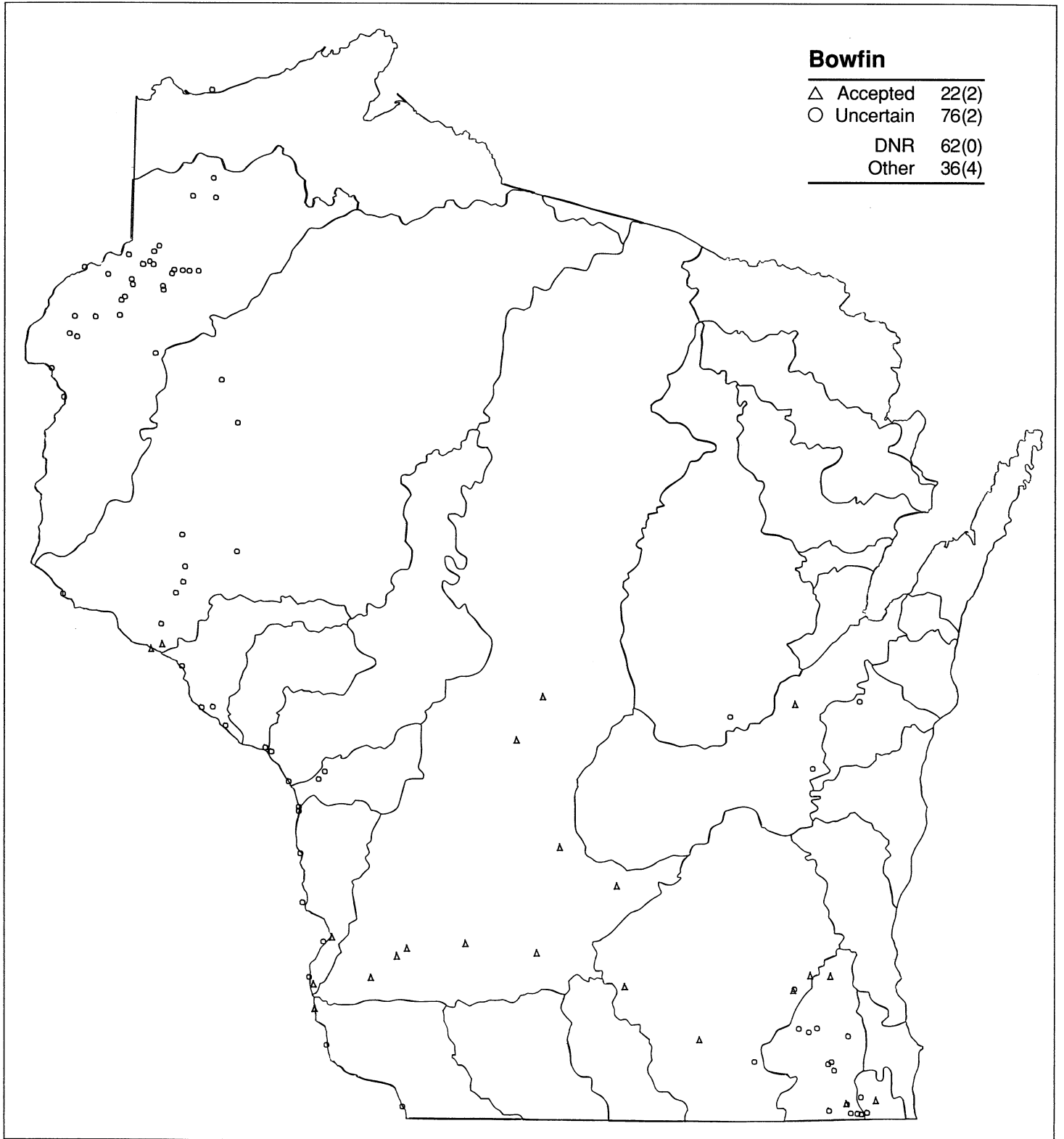
Map 10(E)



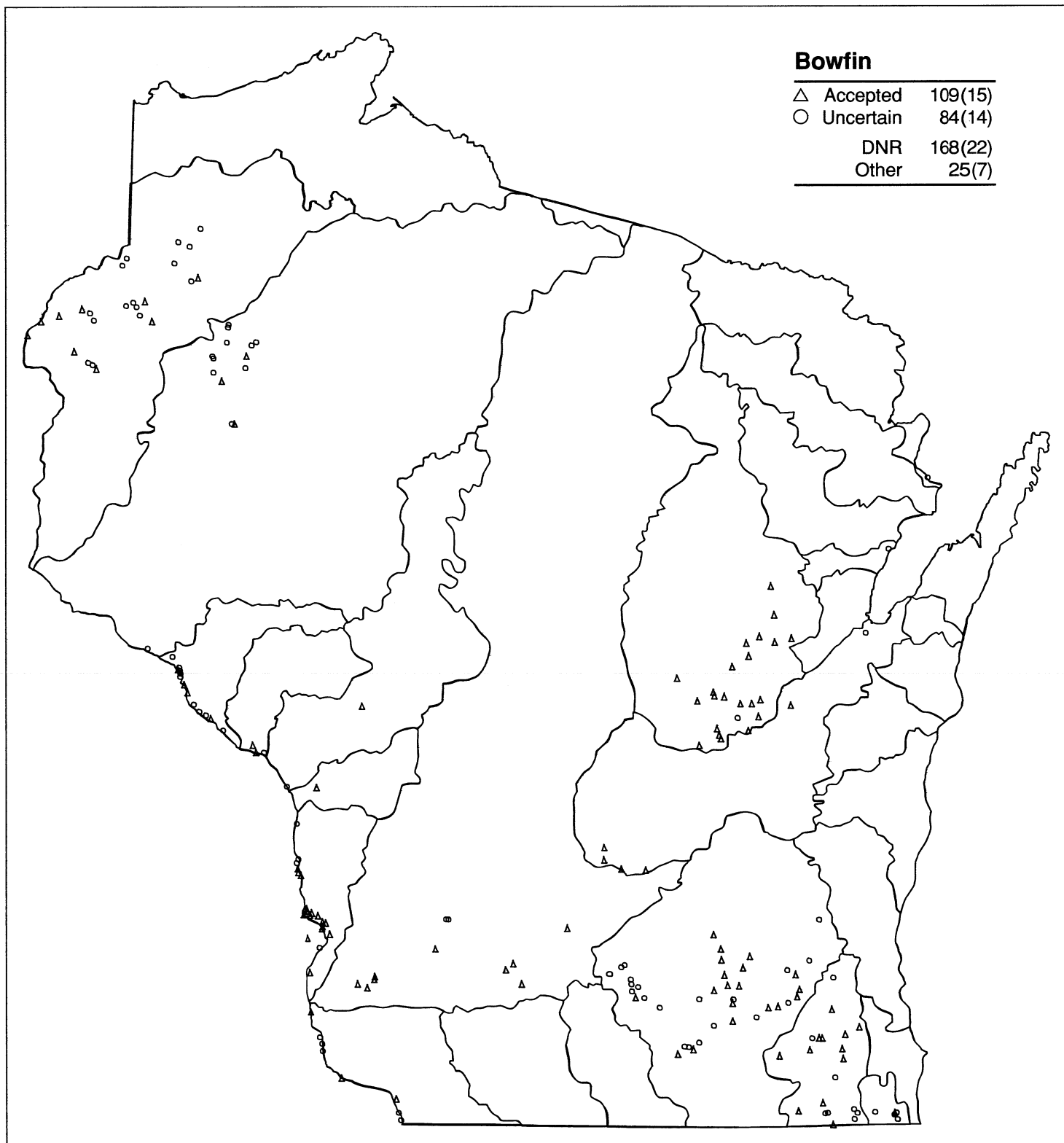
Map 10(L)



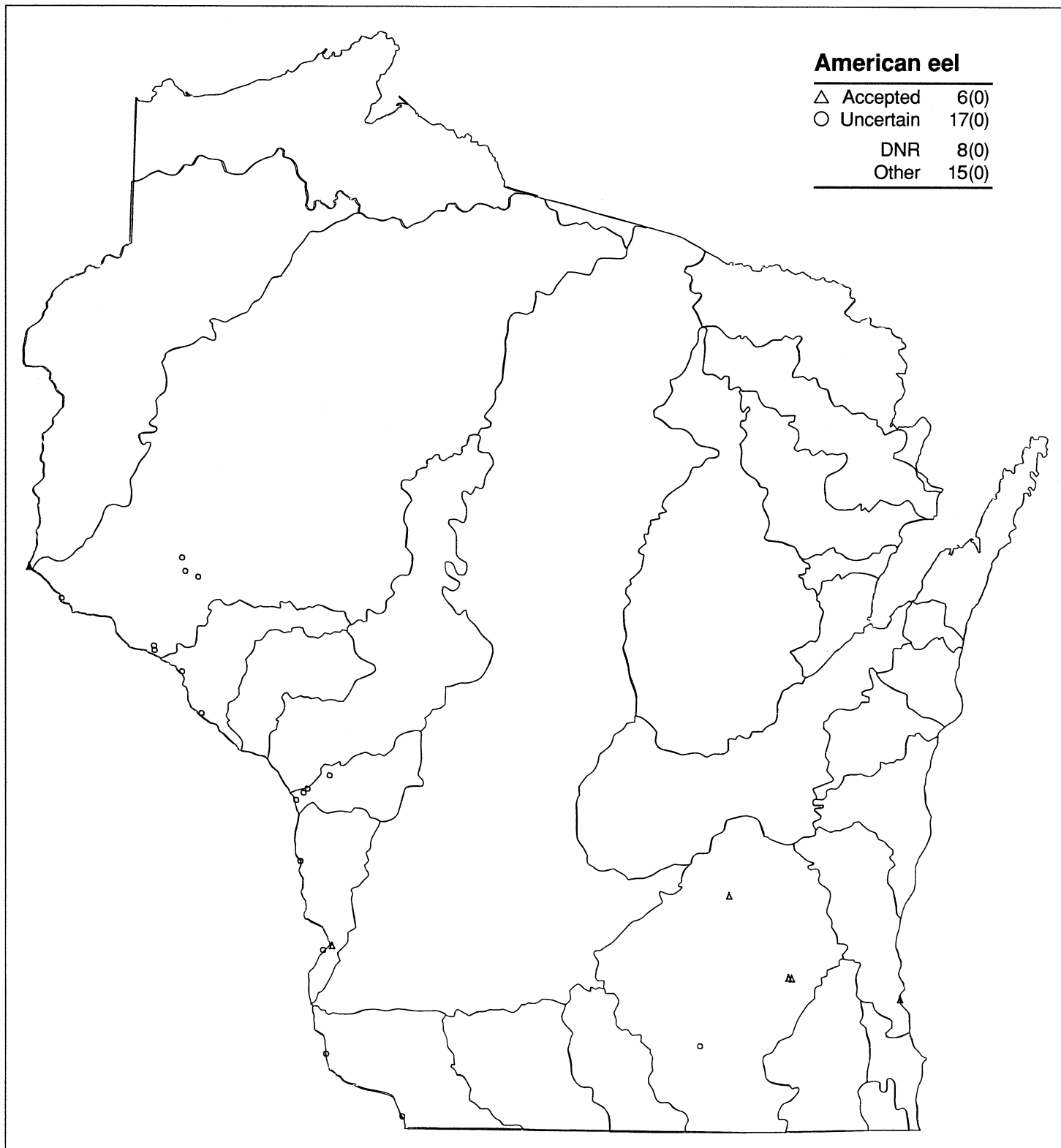
Map 11(E)



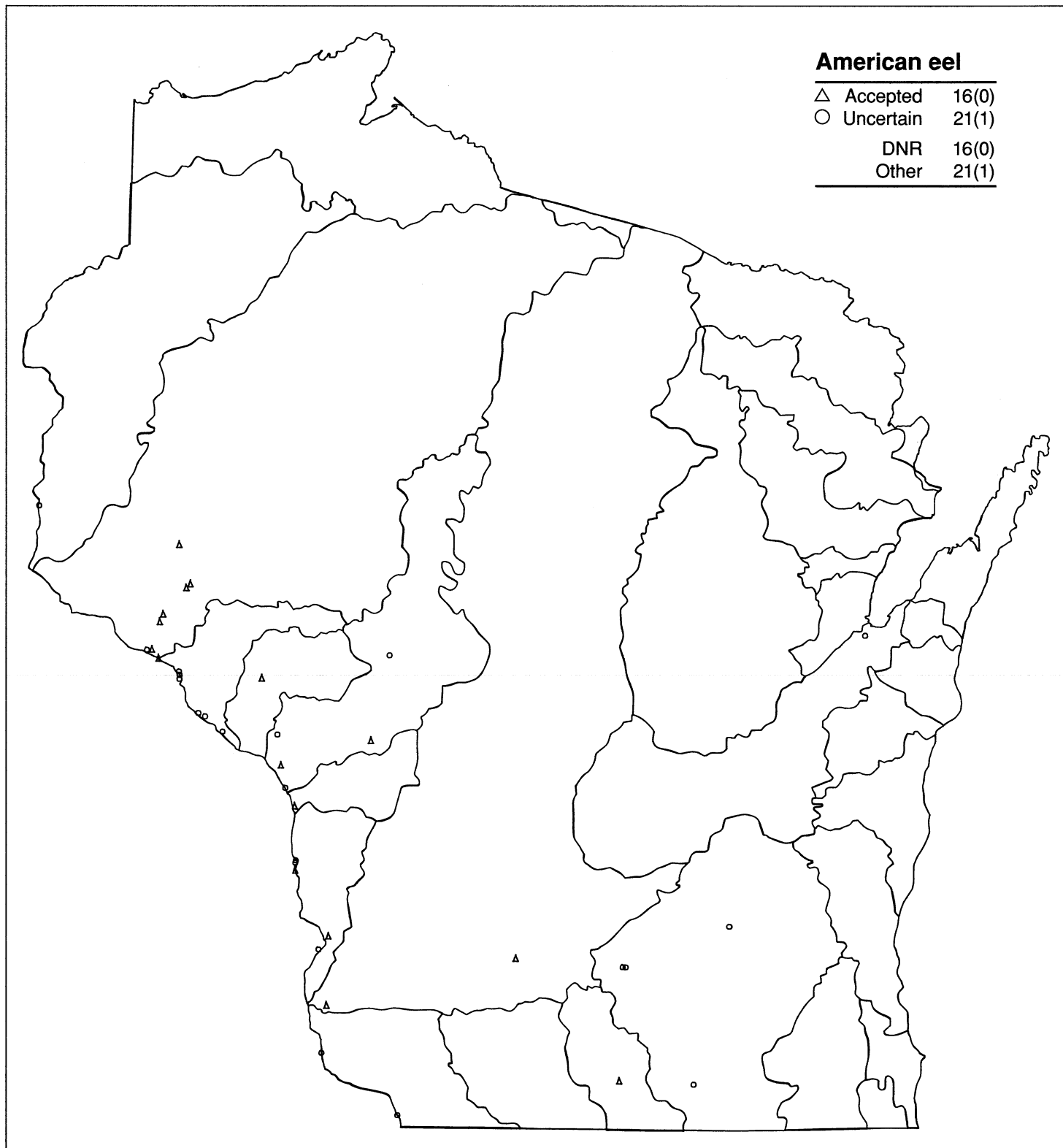
Map 11(L)



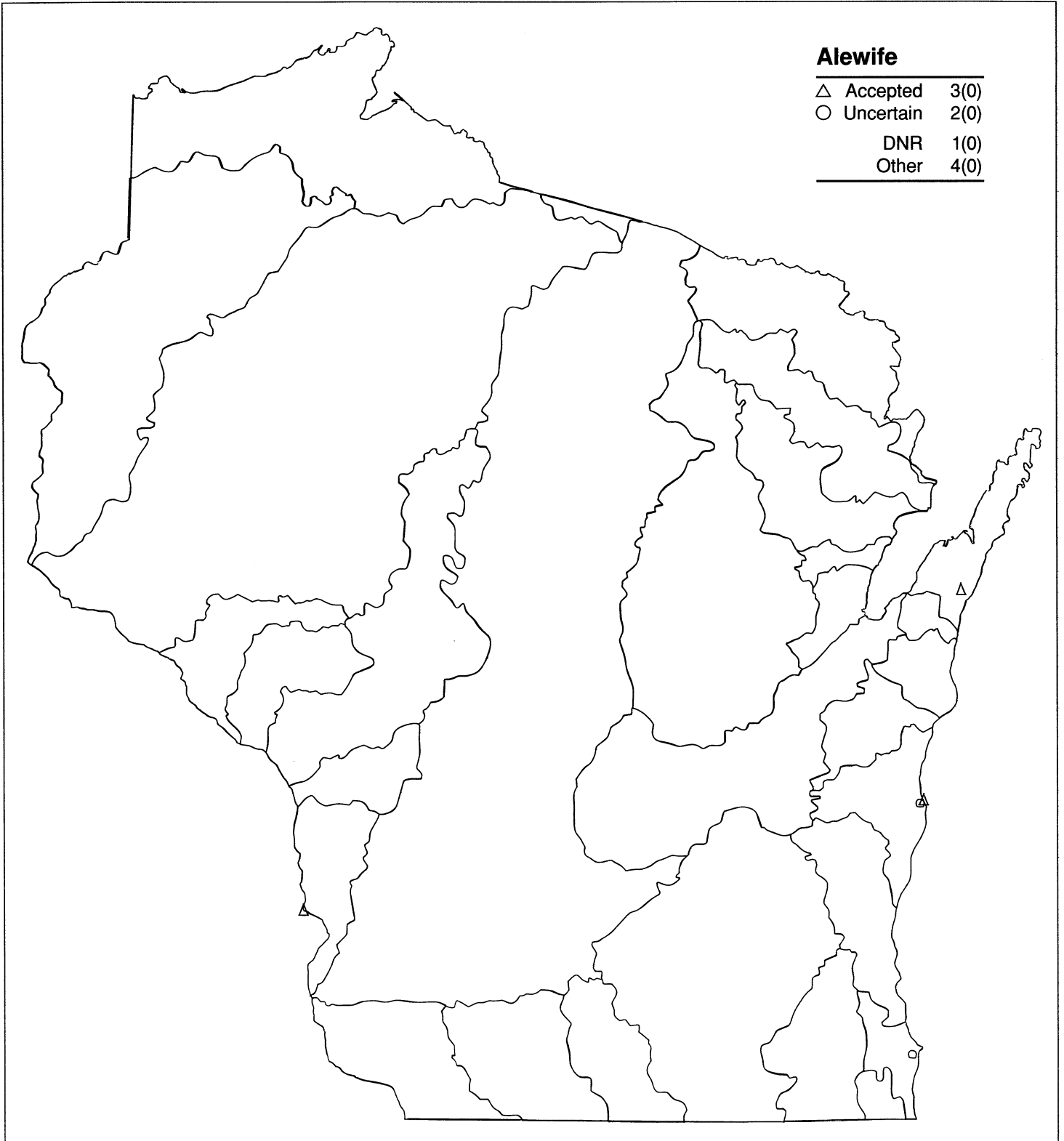
Map 12(E)



Map 12(L)



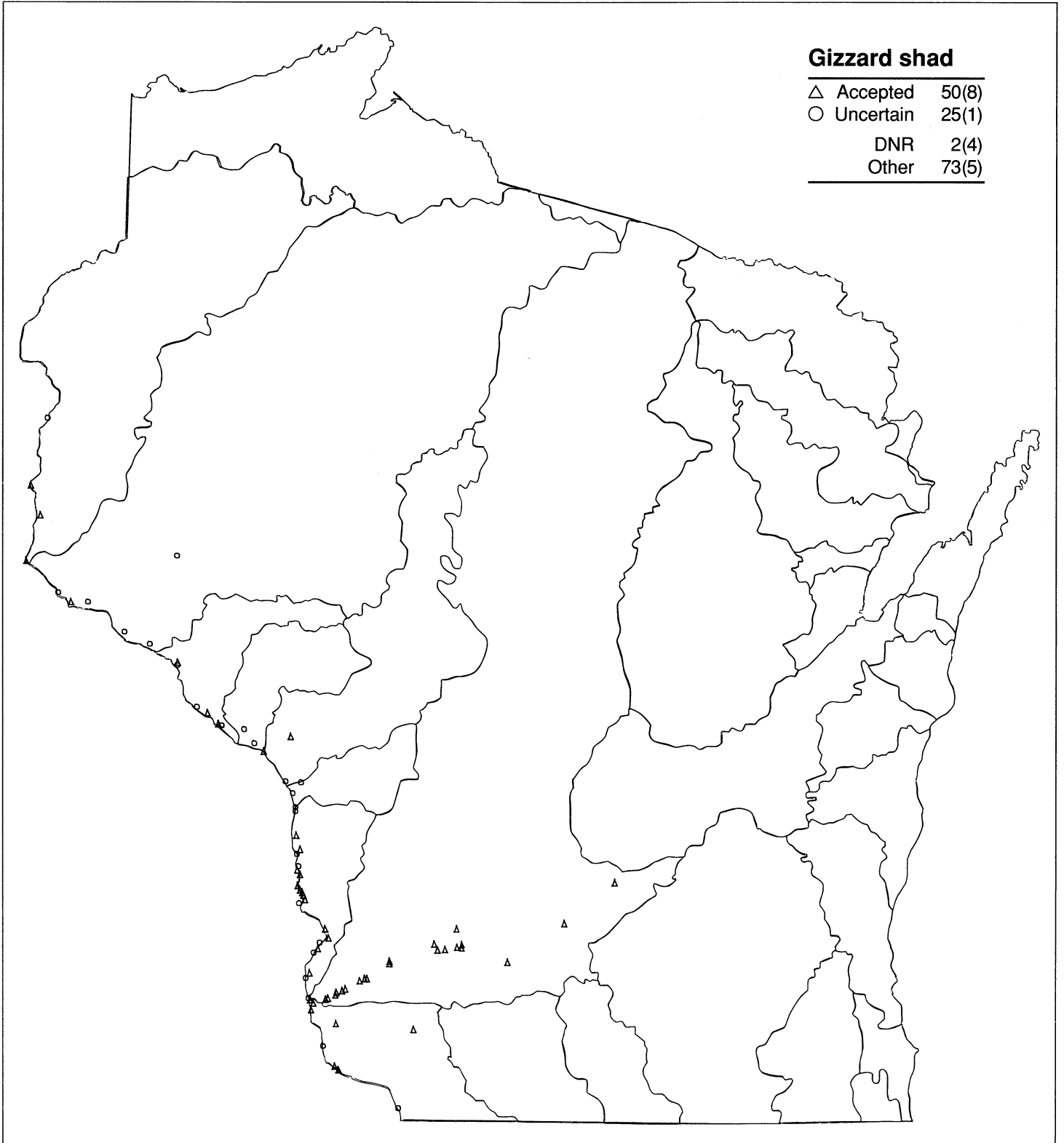
Map 13(E)



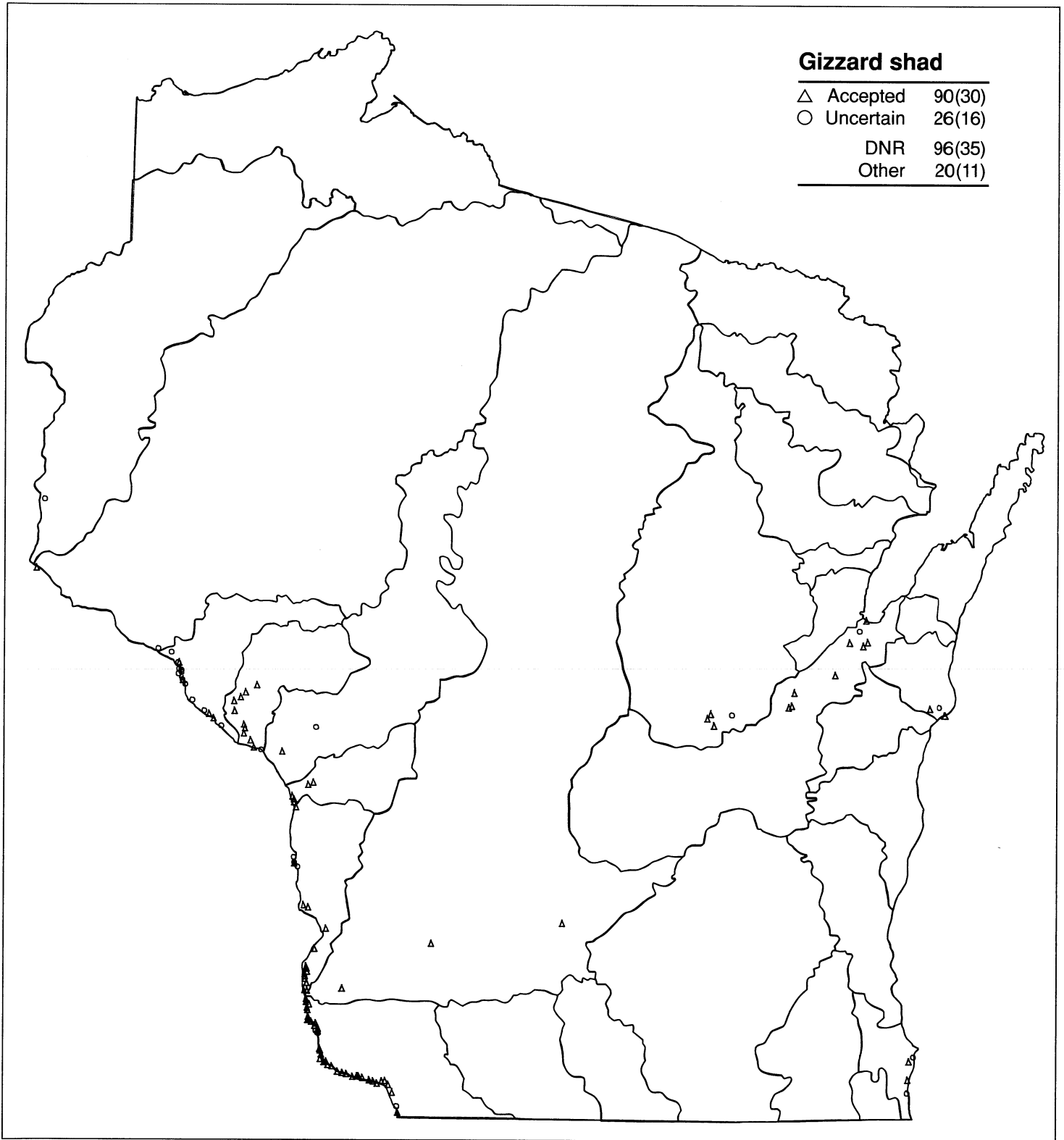
Map 13(L)



Map 14(E)



Map 14(L)



Map 15(E)



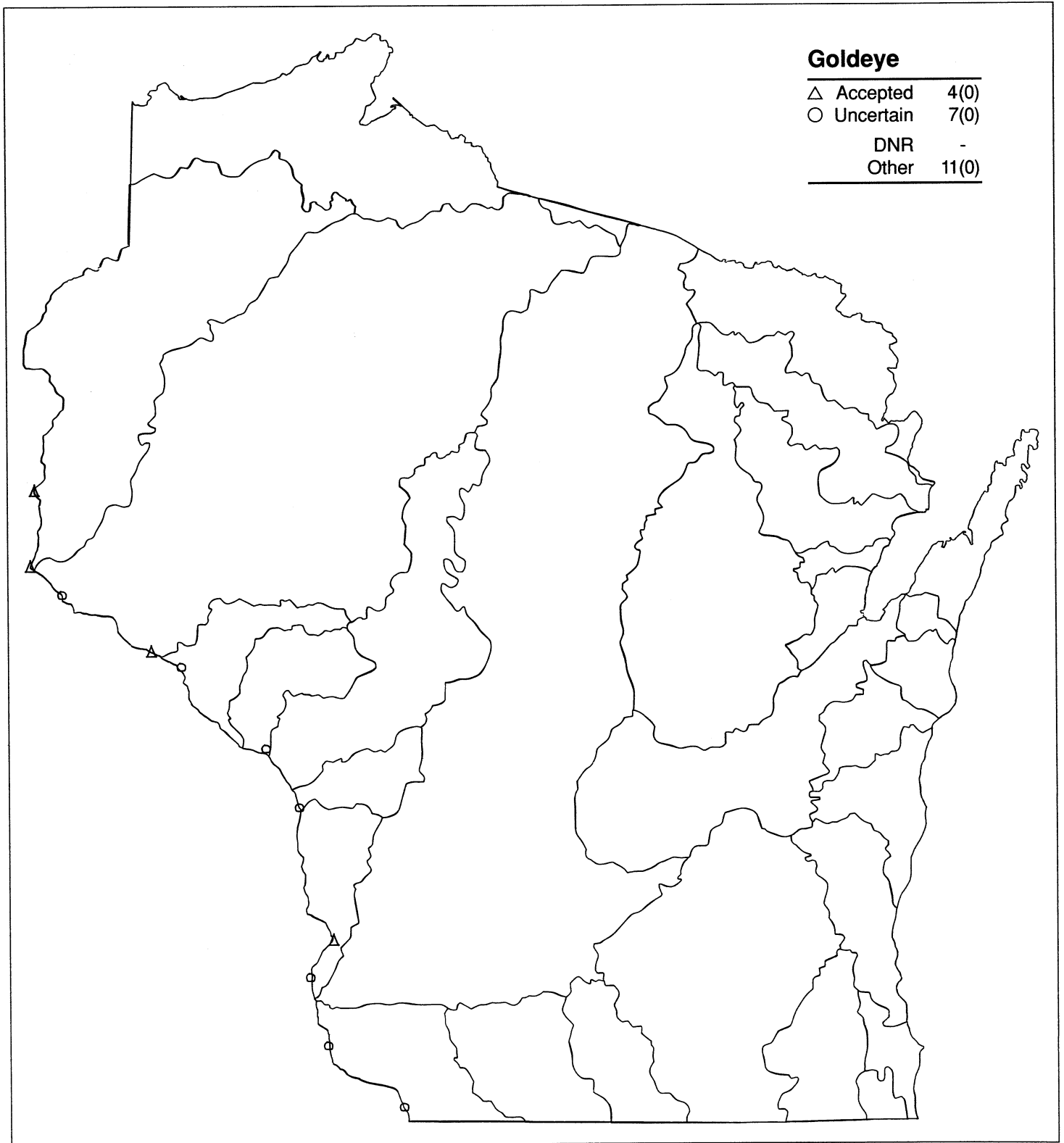
Map 15(L)

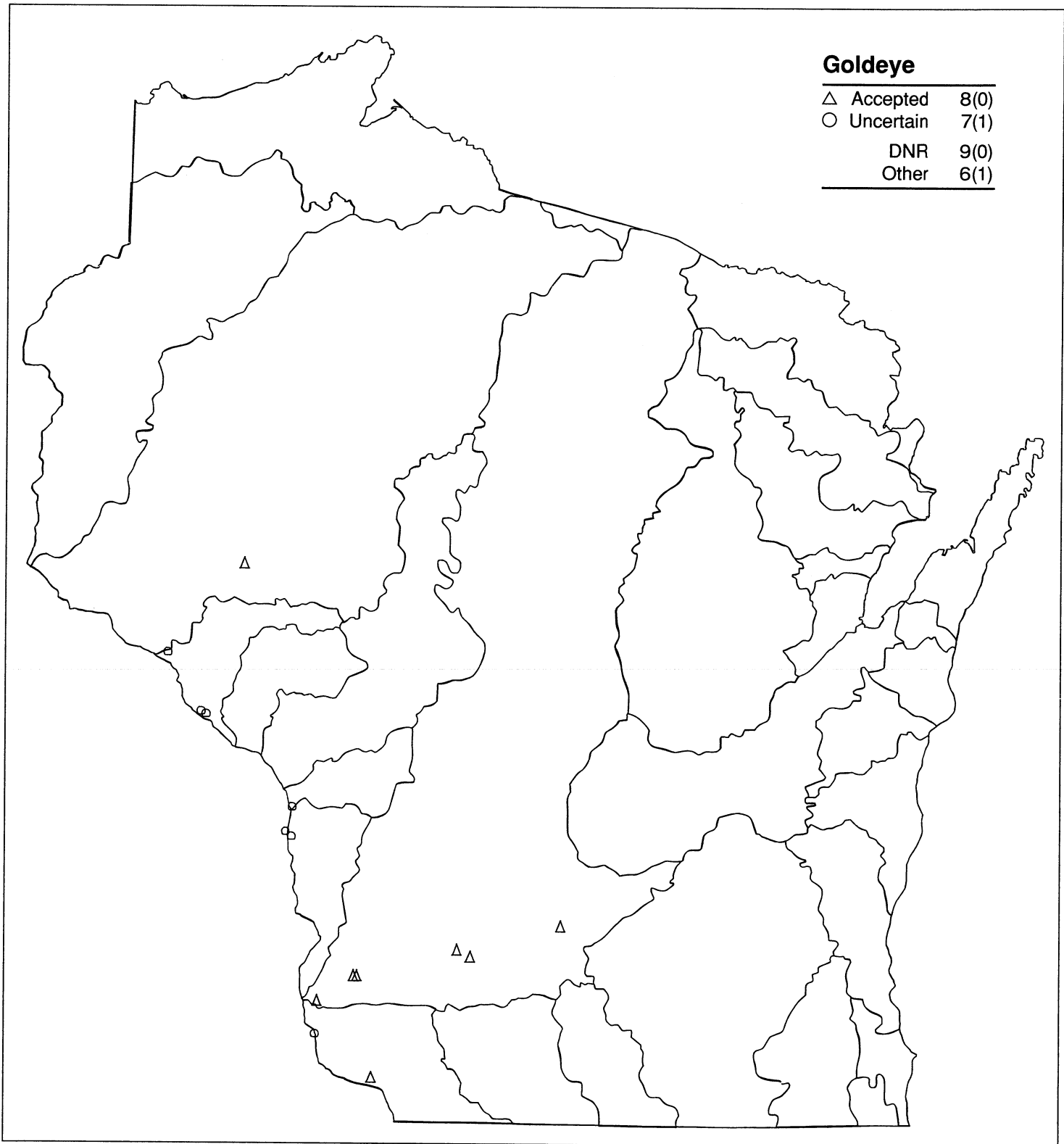
Skipjack herring

| | |
|-------------|------|
| △ Accepted | 0(1) |
| ○ Uncertain | 1(0) |
| DNR | - |
| Other | 1(1) |

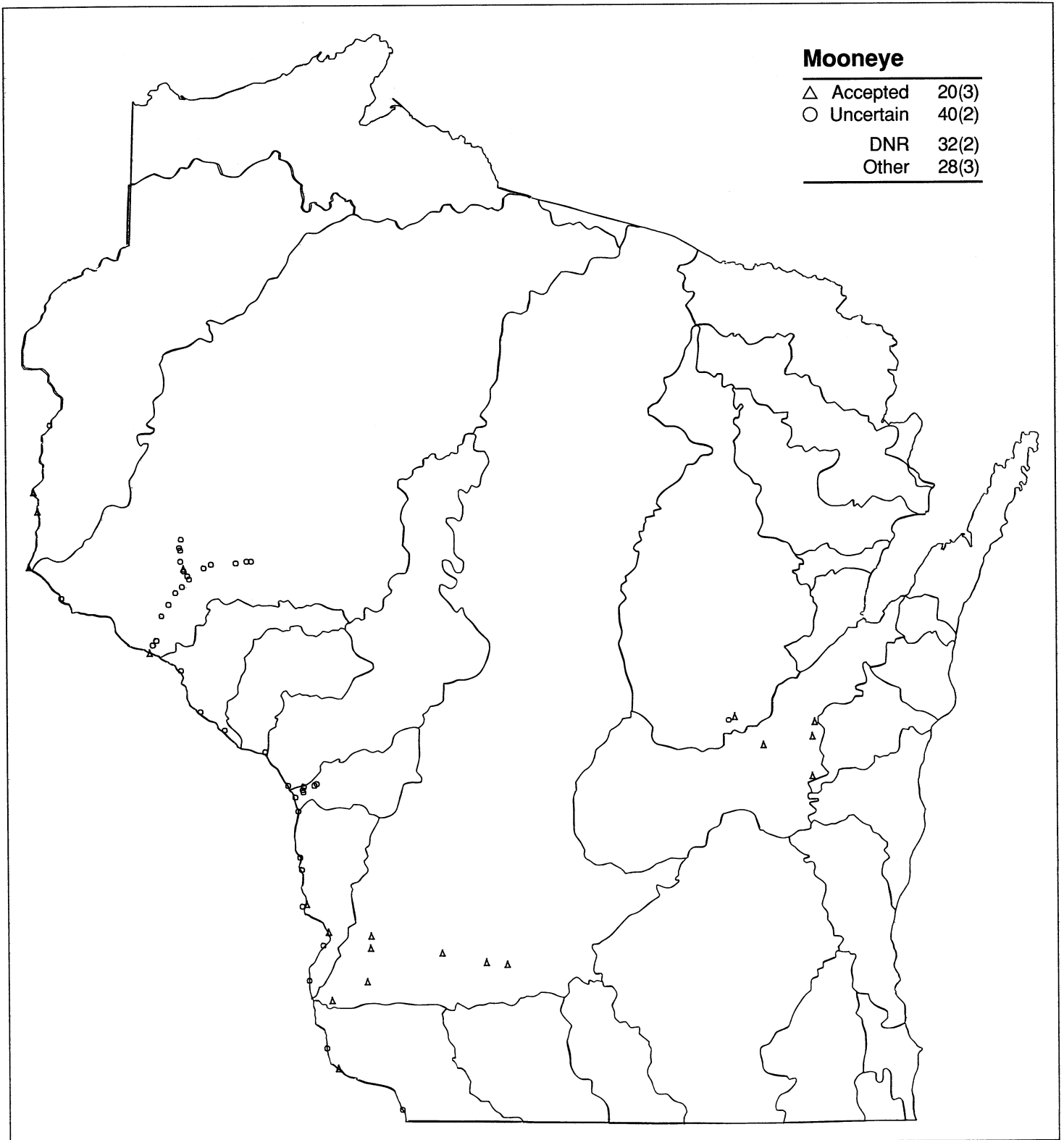


Map 16(E)





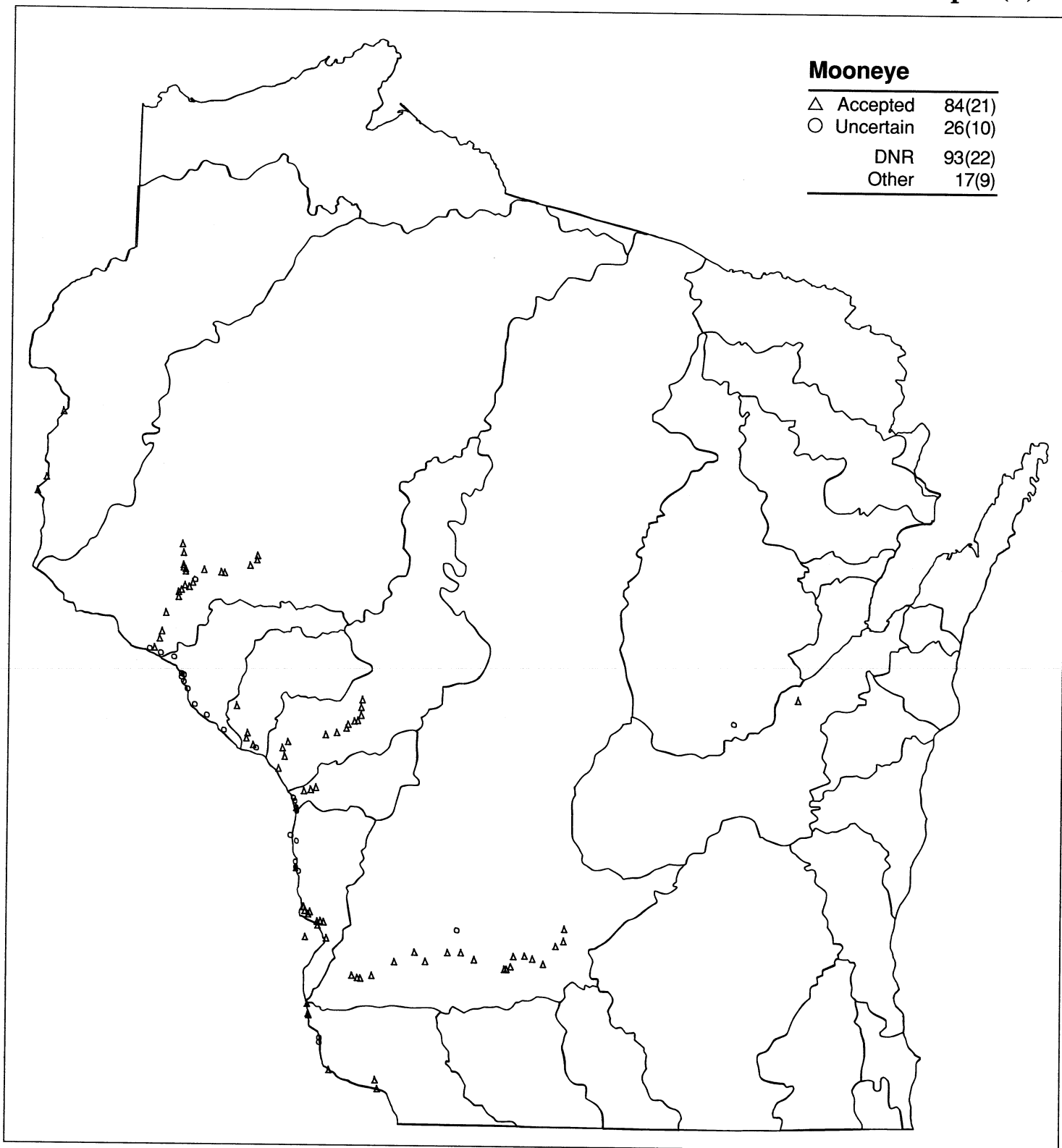
Map 17(E)



Map 17(L)

Mooneye

| | |
|-------------|--------|
| △ Accepted | 84(21) |
| ○ Uncertain | 26(10) |
| DNR | 93(22) |
| Other | 17(9) |



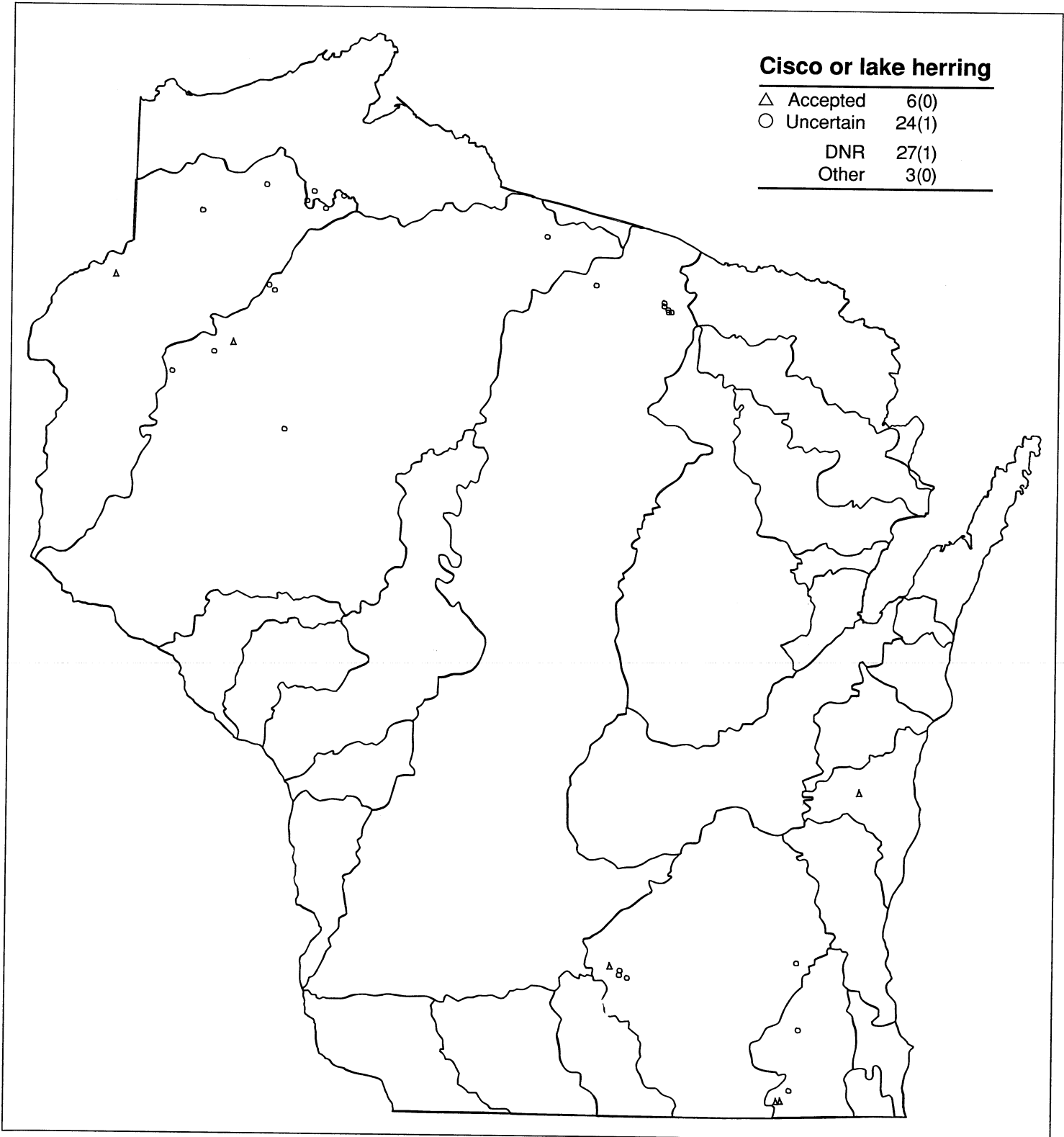
Map 18(E)

Cisco or lake herring

| | | |
|---|-----------|-------|
| △ | Accepted | 29(1) |
| ○ | Uncertain | 8(0) |
| | DNR | 4(1) |
| | Other | 33(0) |



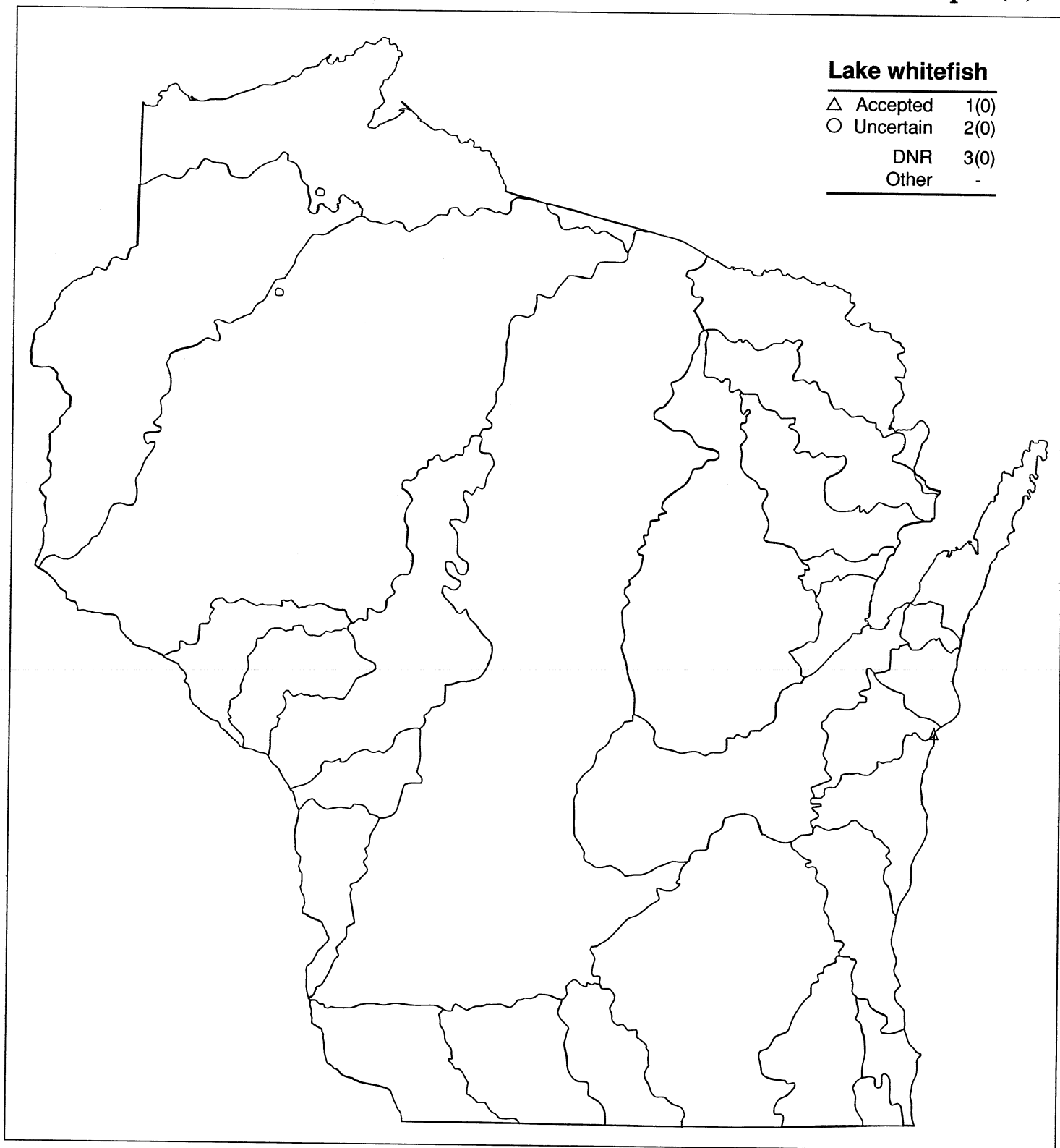
Map 18(L)



Map 19(E)



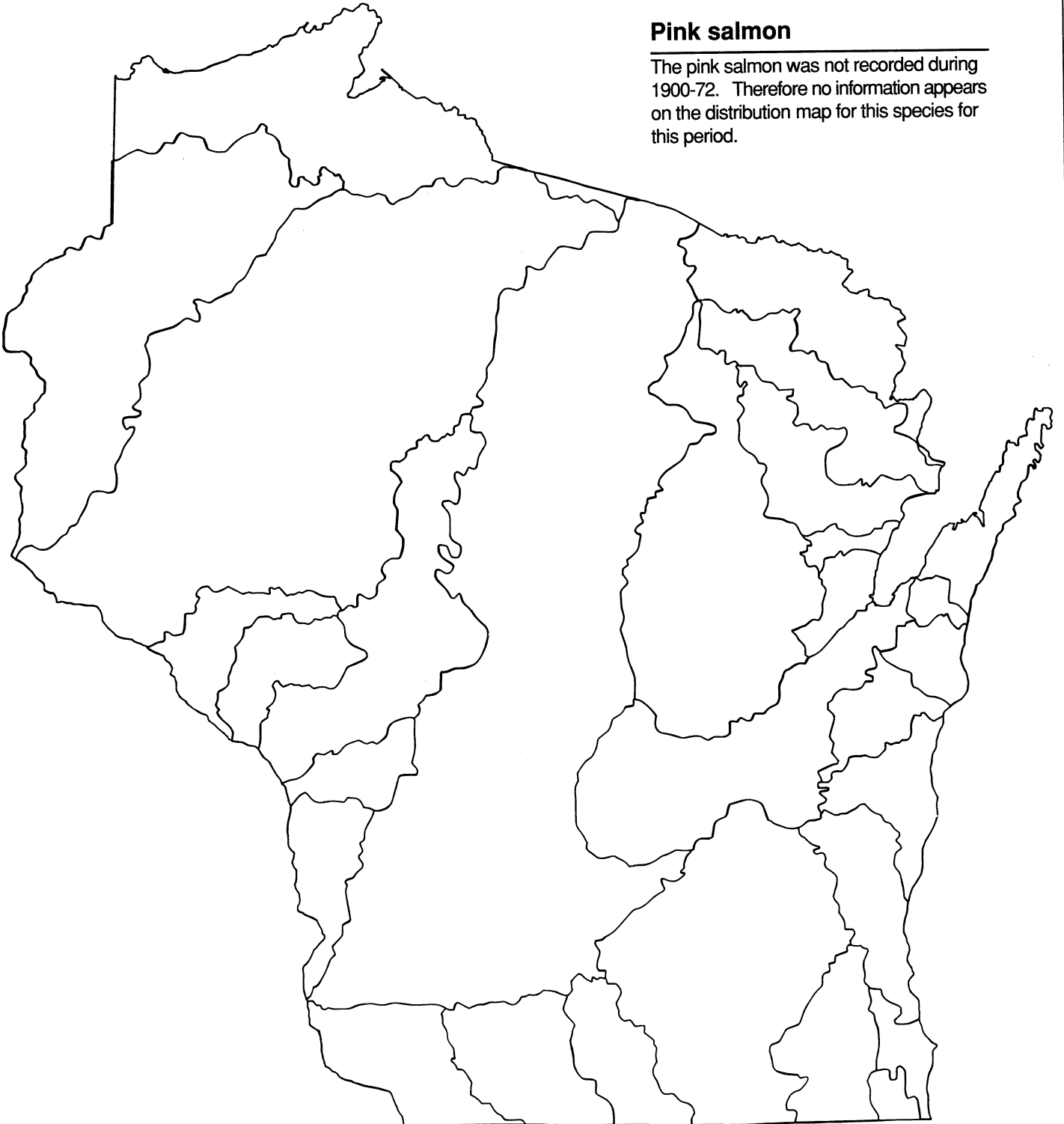
Map 19(L)



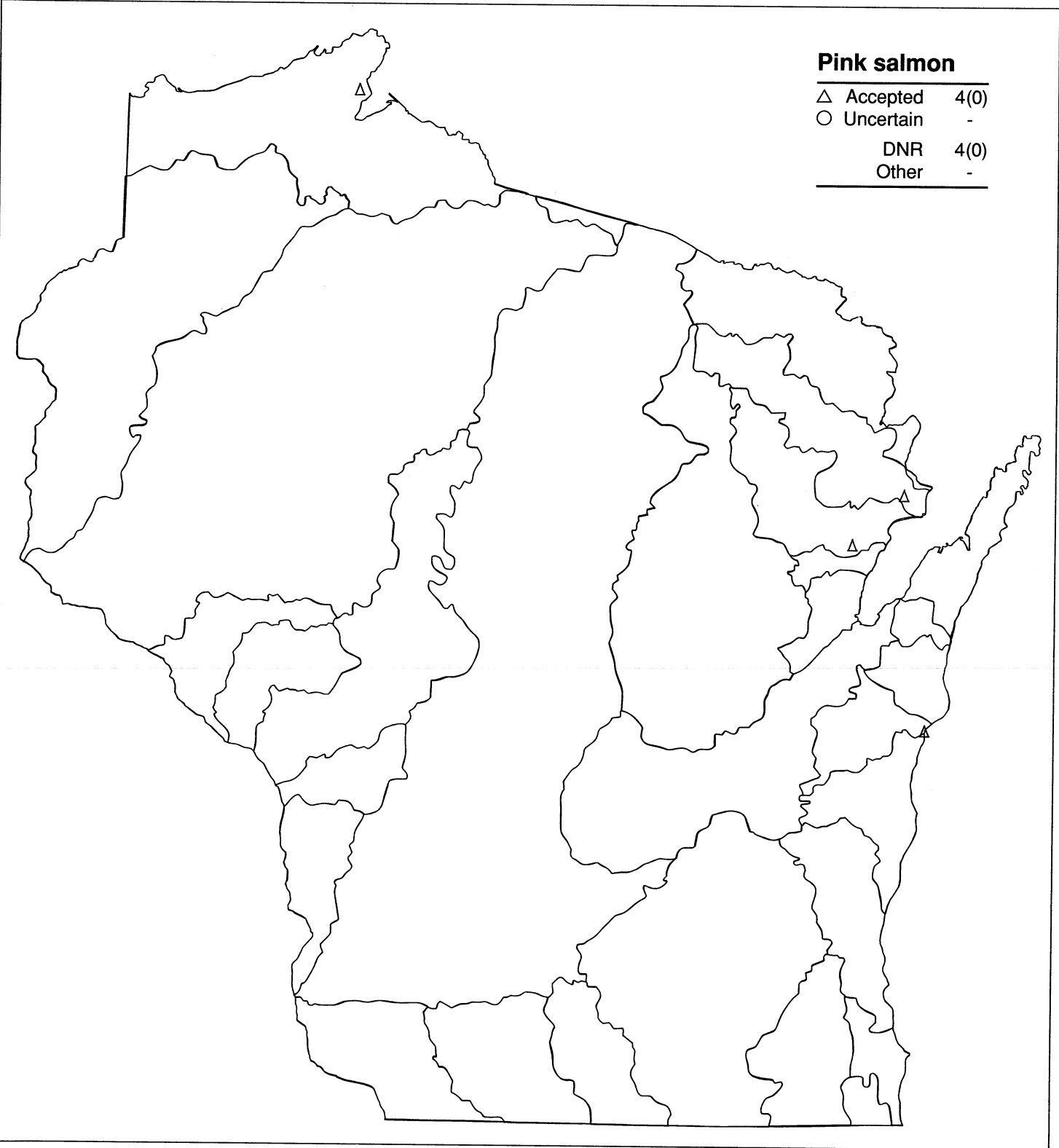
Map 20(E)

Pink salmon

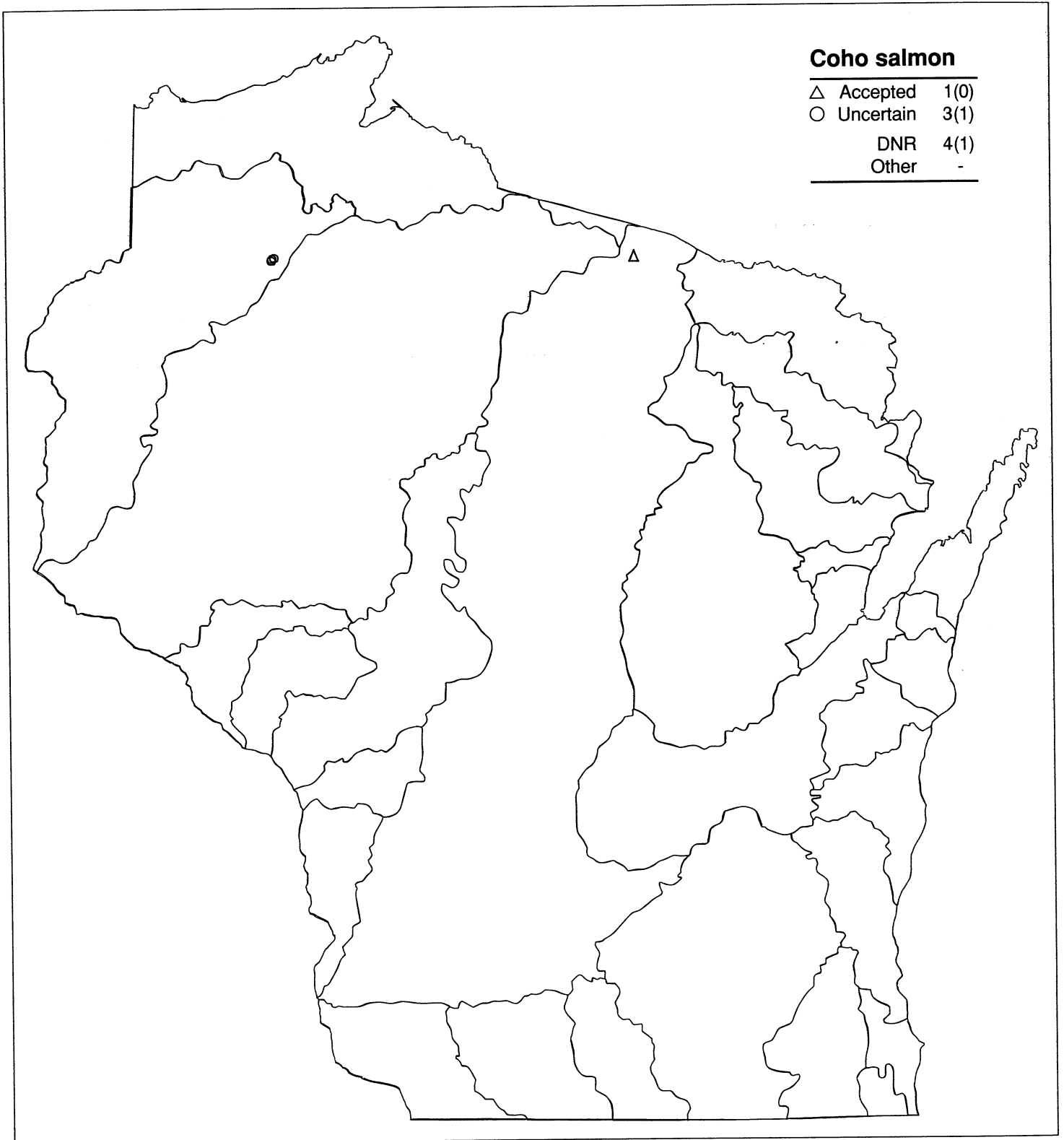
The pink salmon was not recorded during 1900-72. Therefore no information appears on the distribution map for this species for this period.



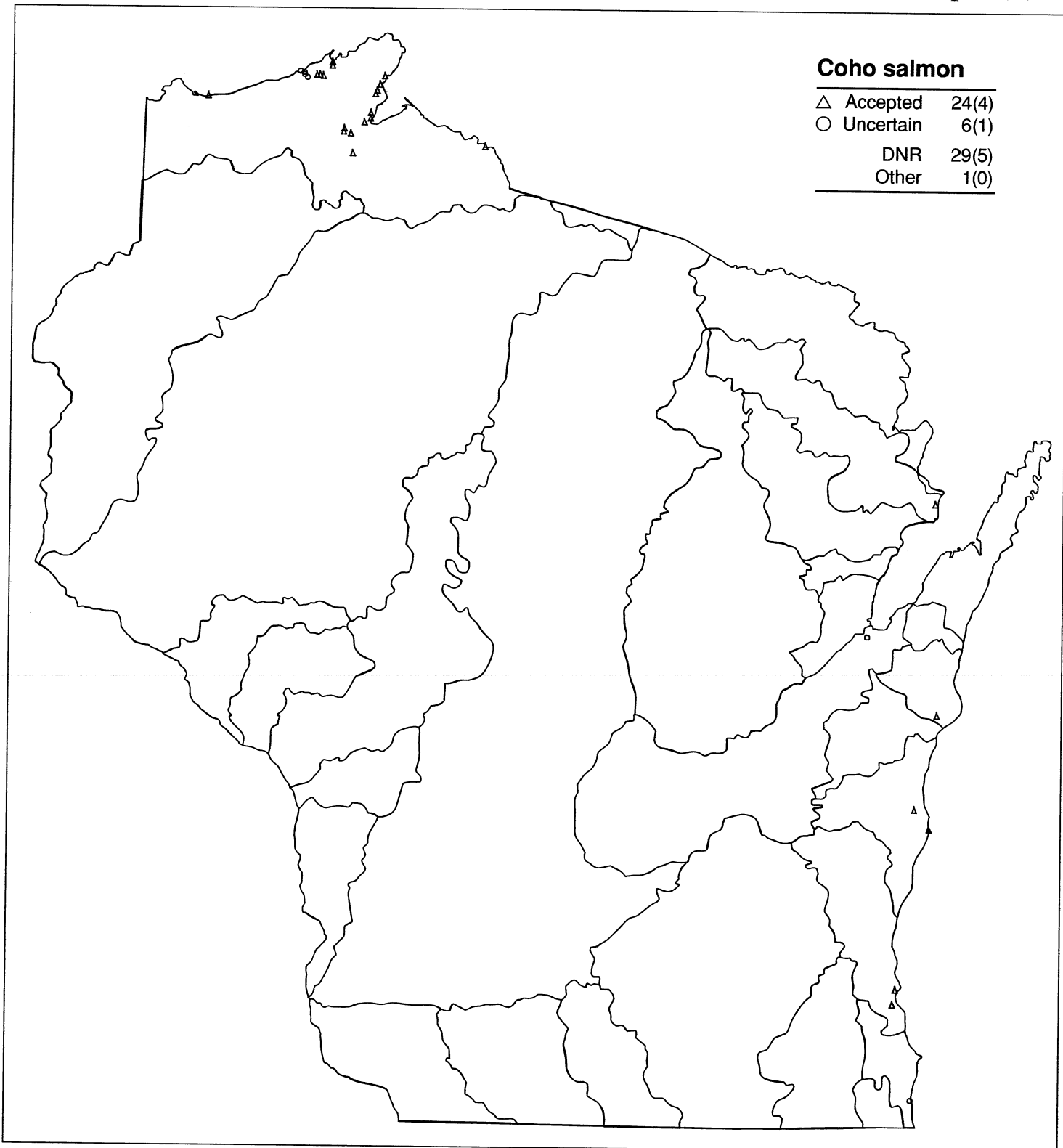
Map 20(L)



Map 21(E)



Map 21(L)



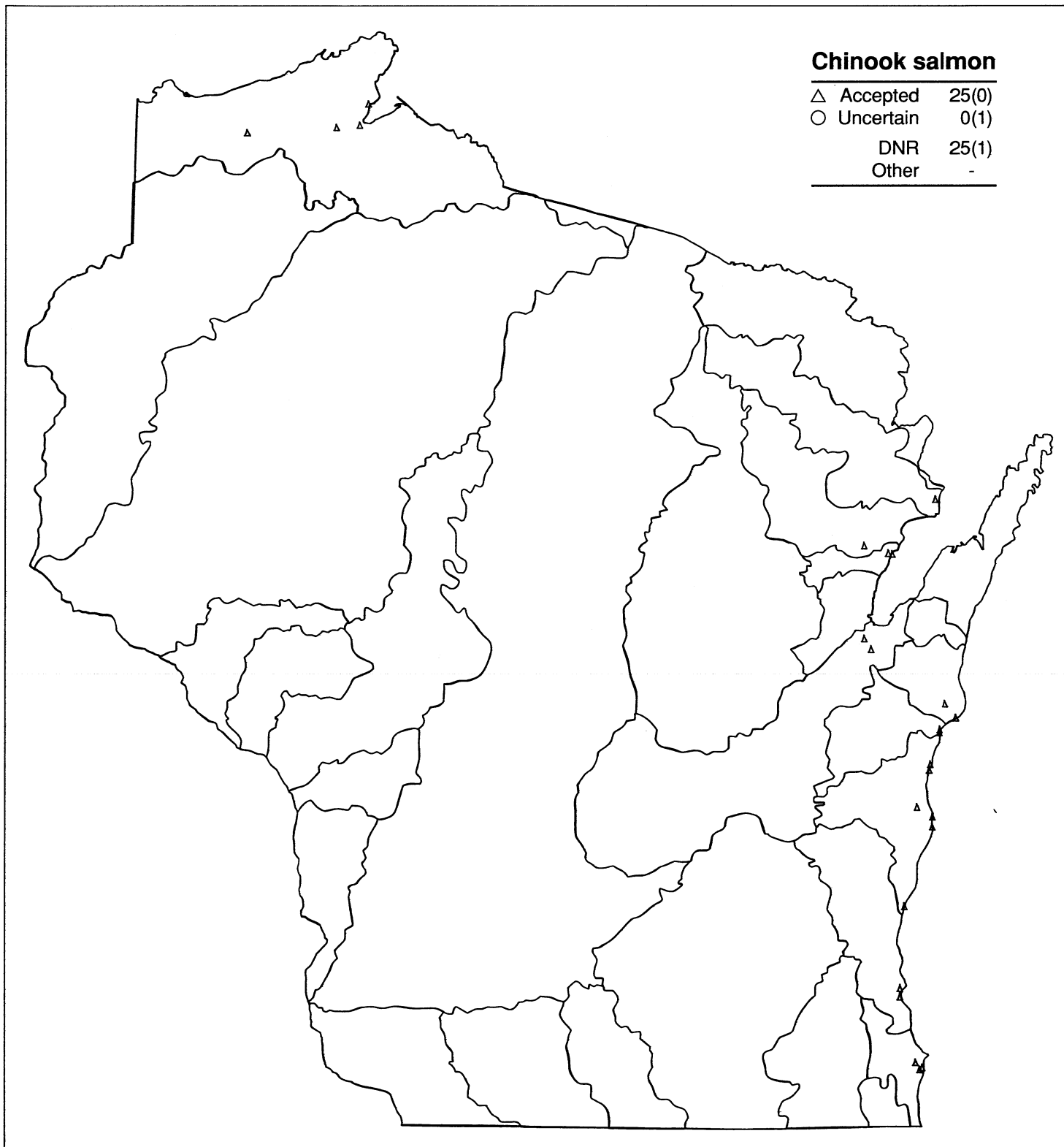
Map 22(E)

Chinook salmon

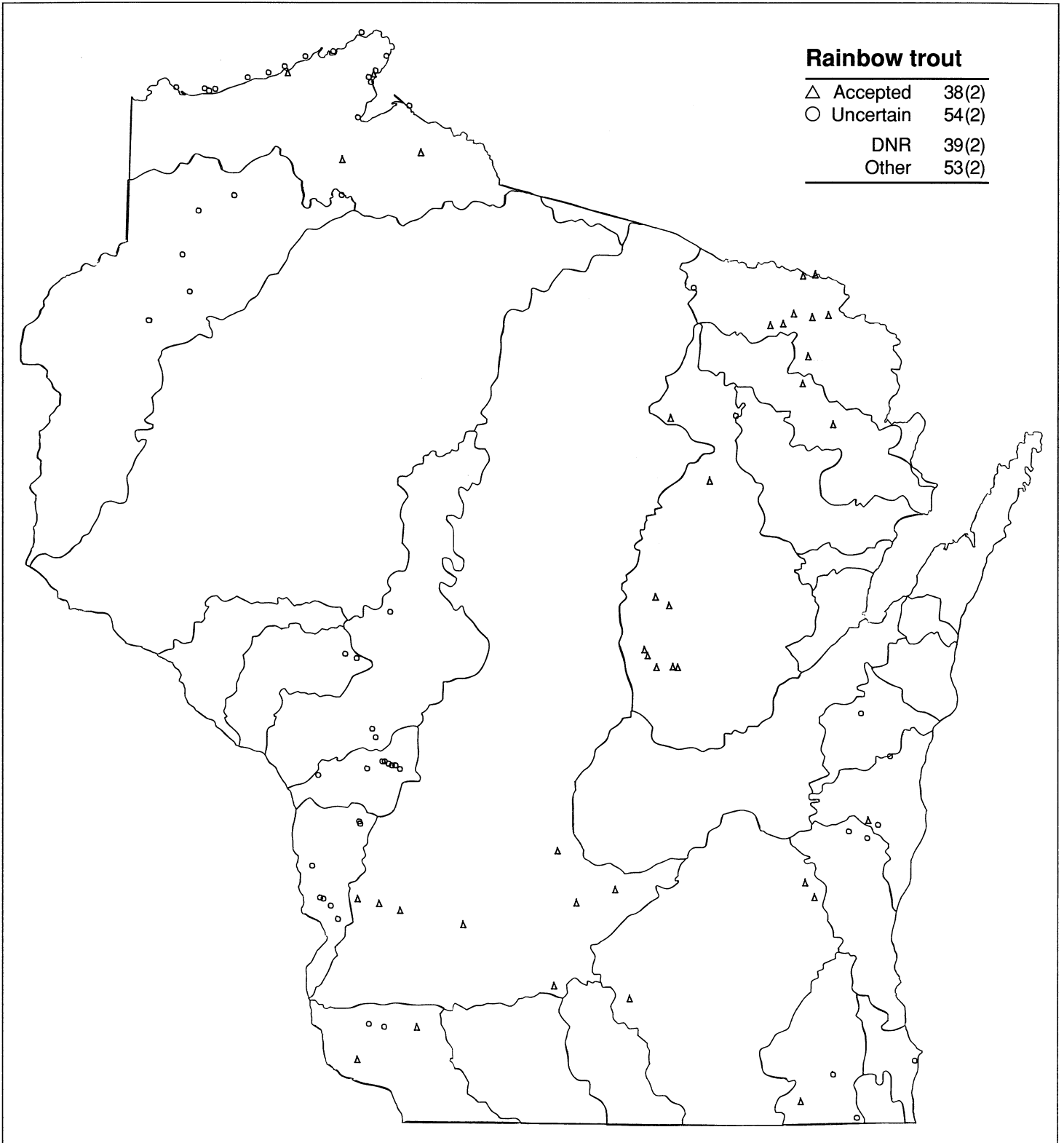
The chinook salmon was not recorded during 1900-72. Therefore no information appears on the distribution map for this species for this period.

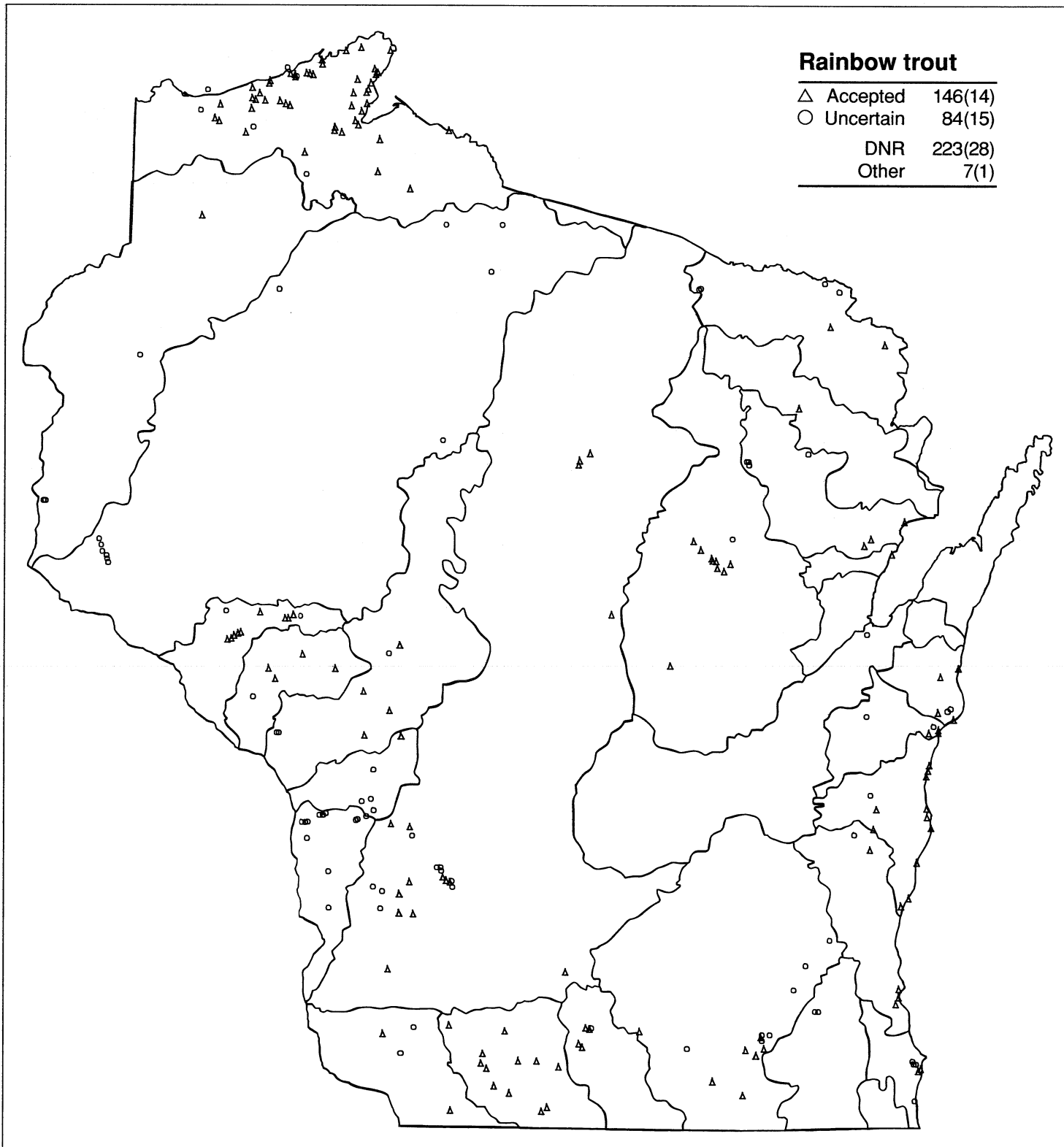


Map 22(L)

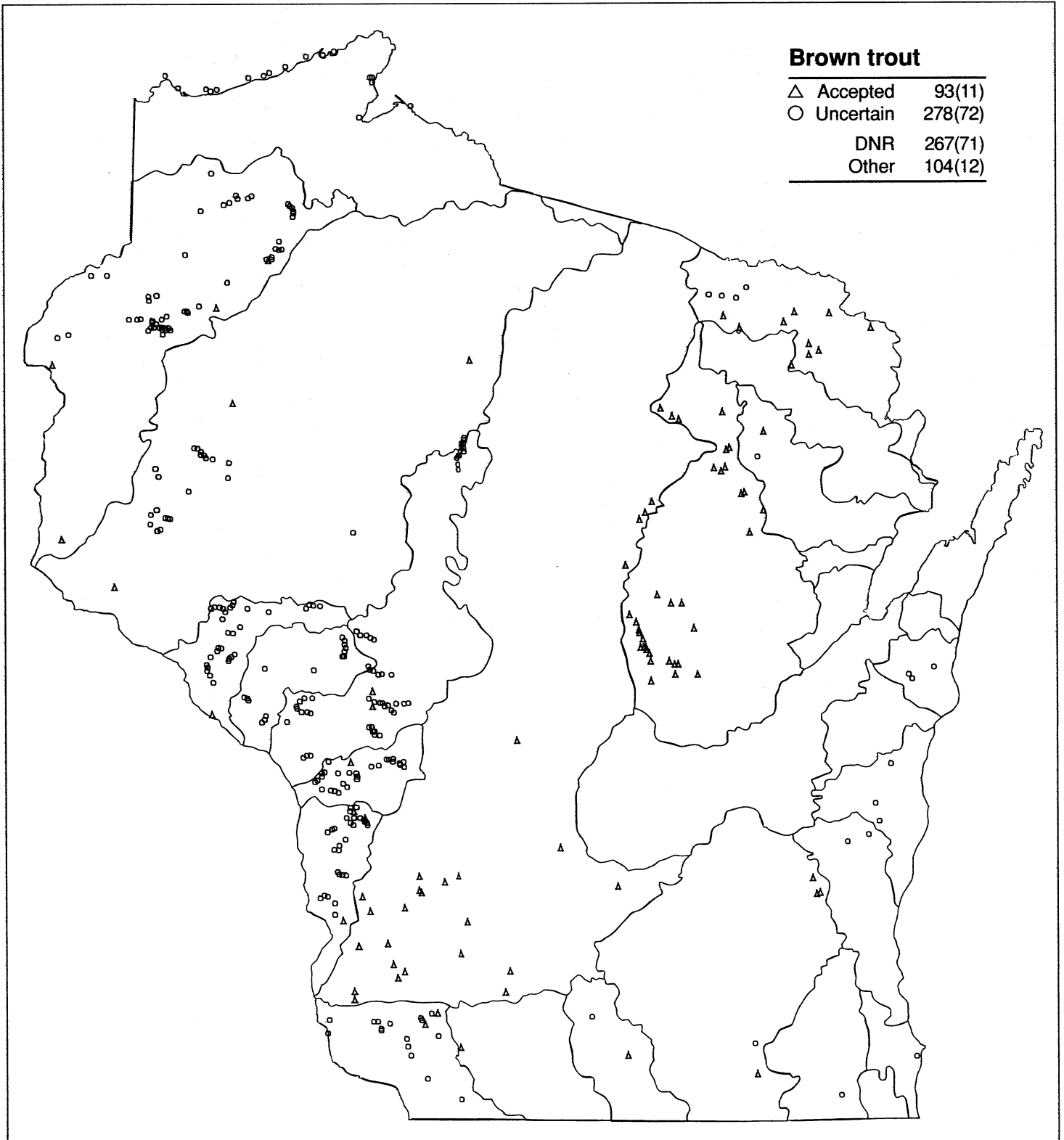


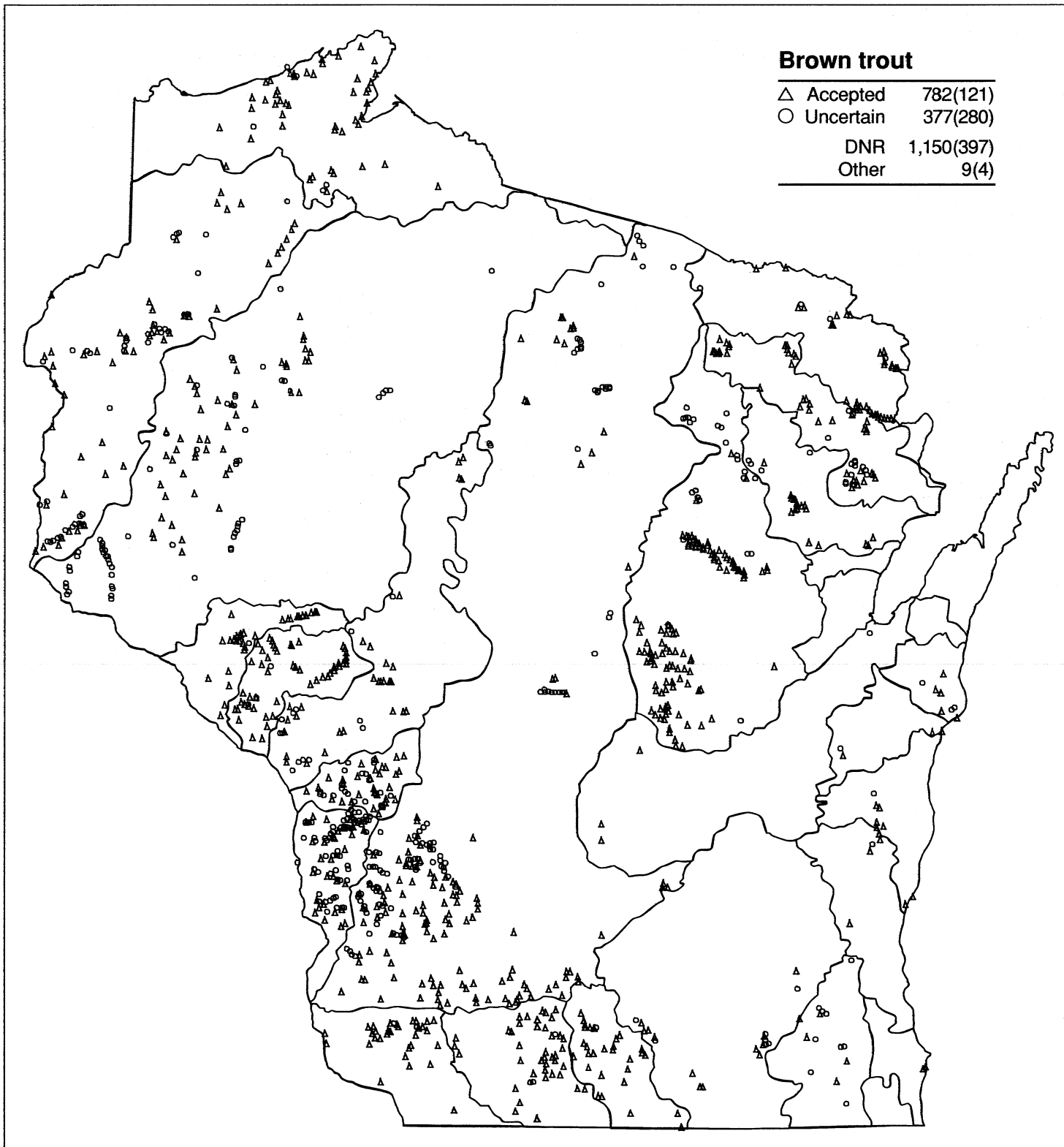
Map 23(E)



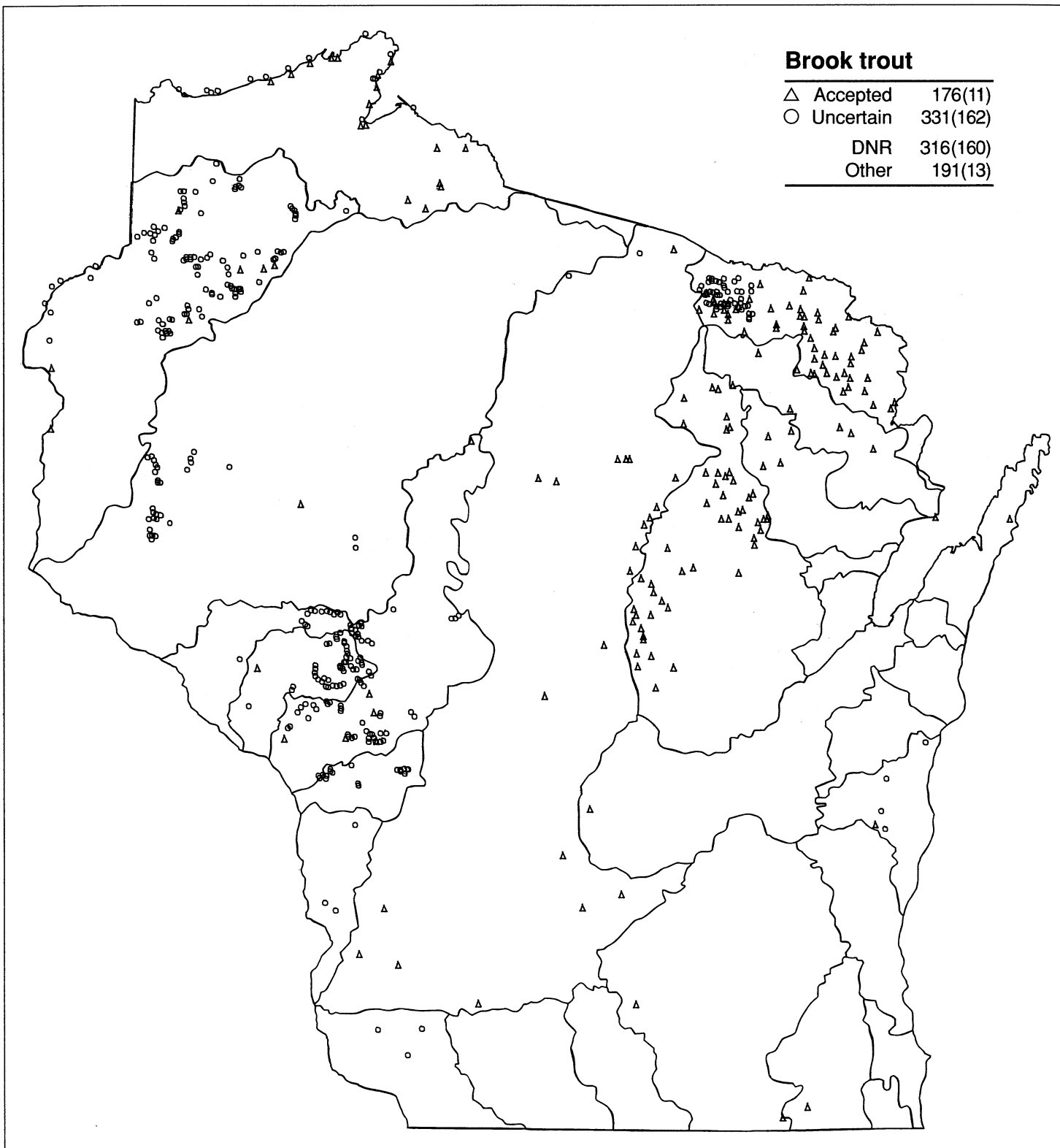


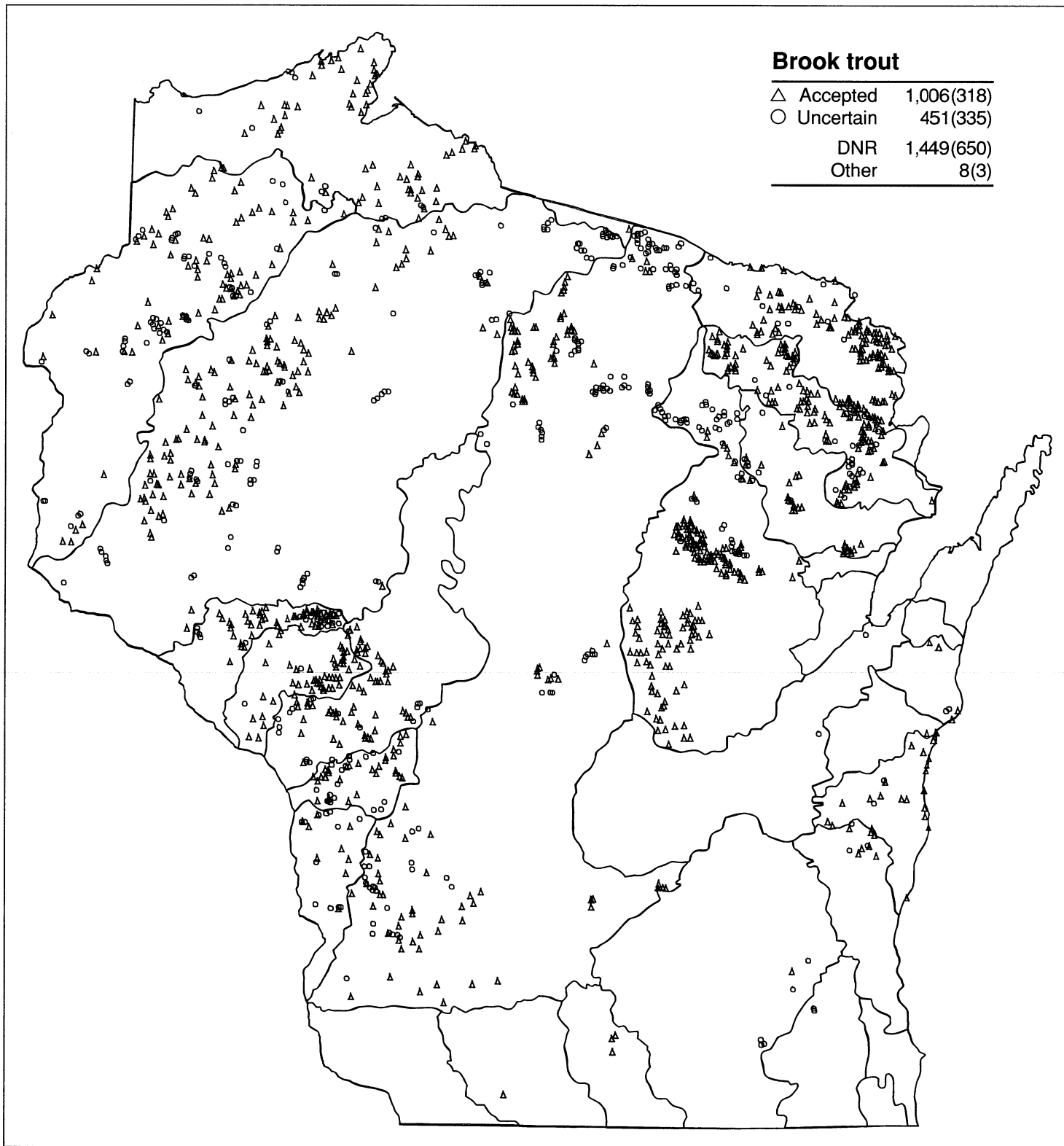
Map 24(E)



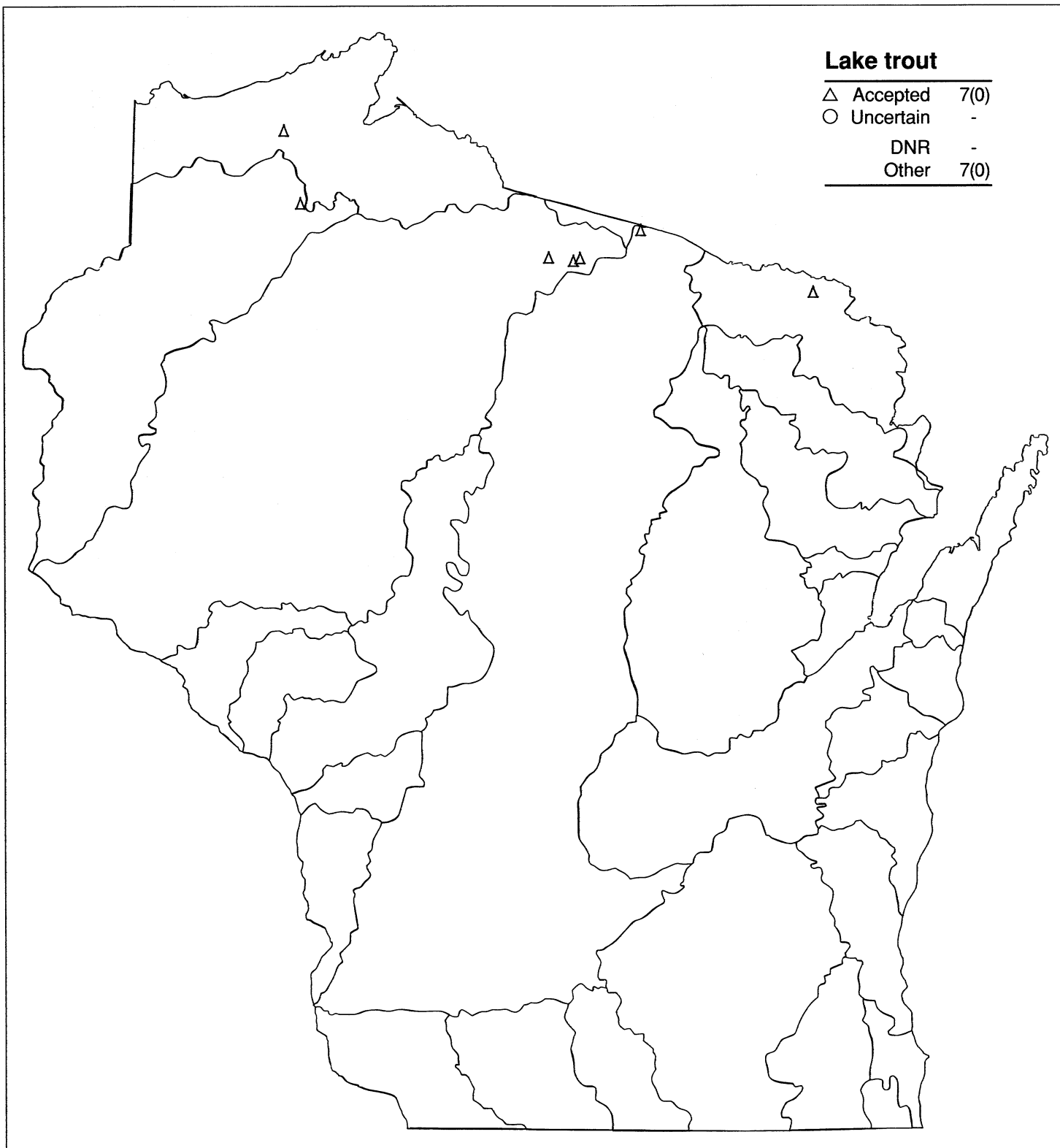


Map 25(E)

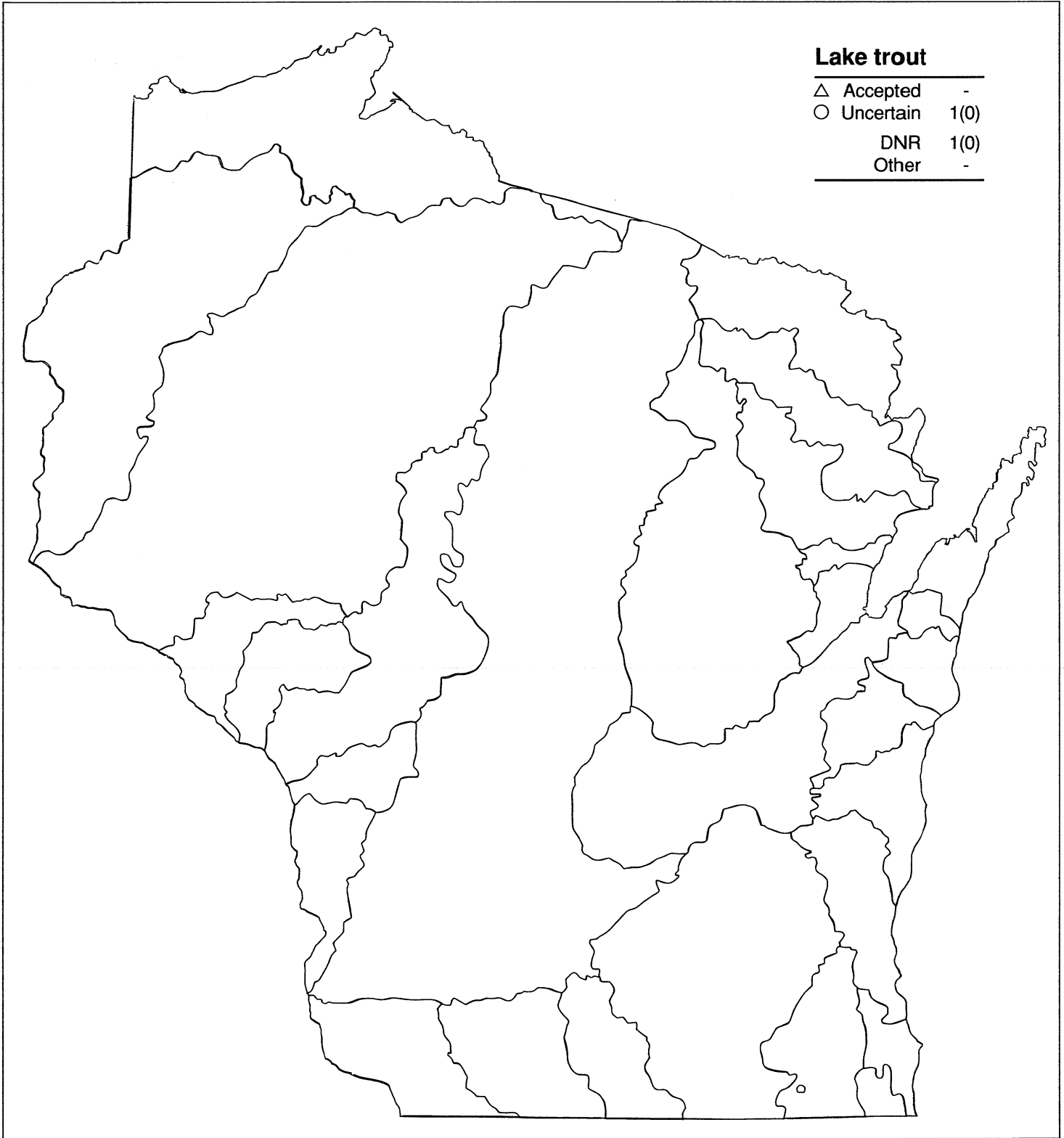




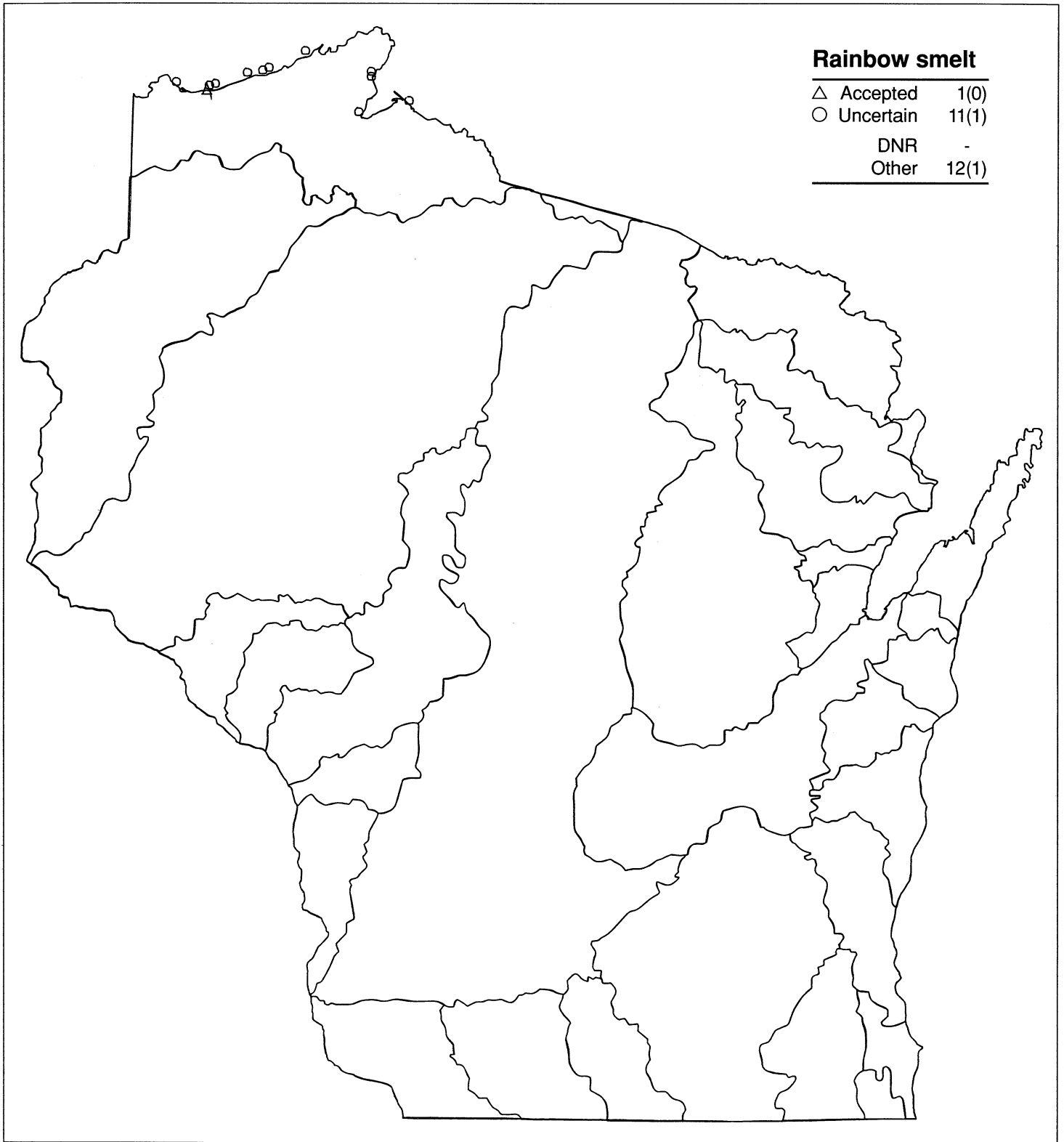
Map 26(E)



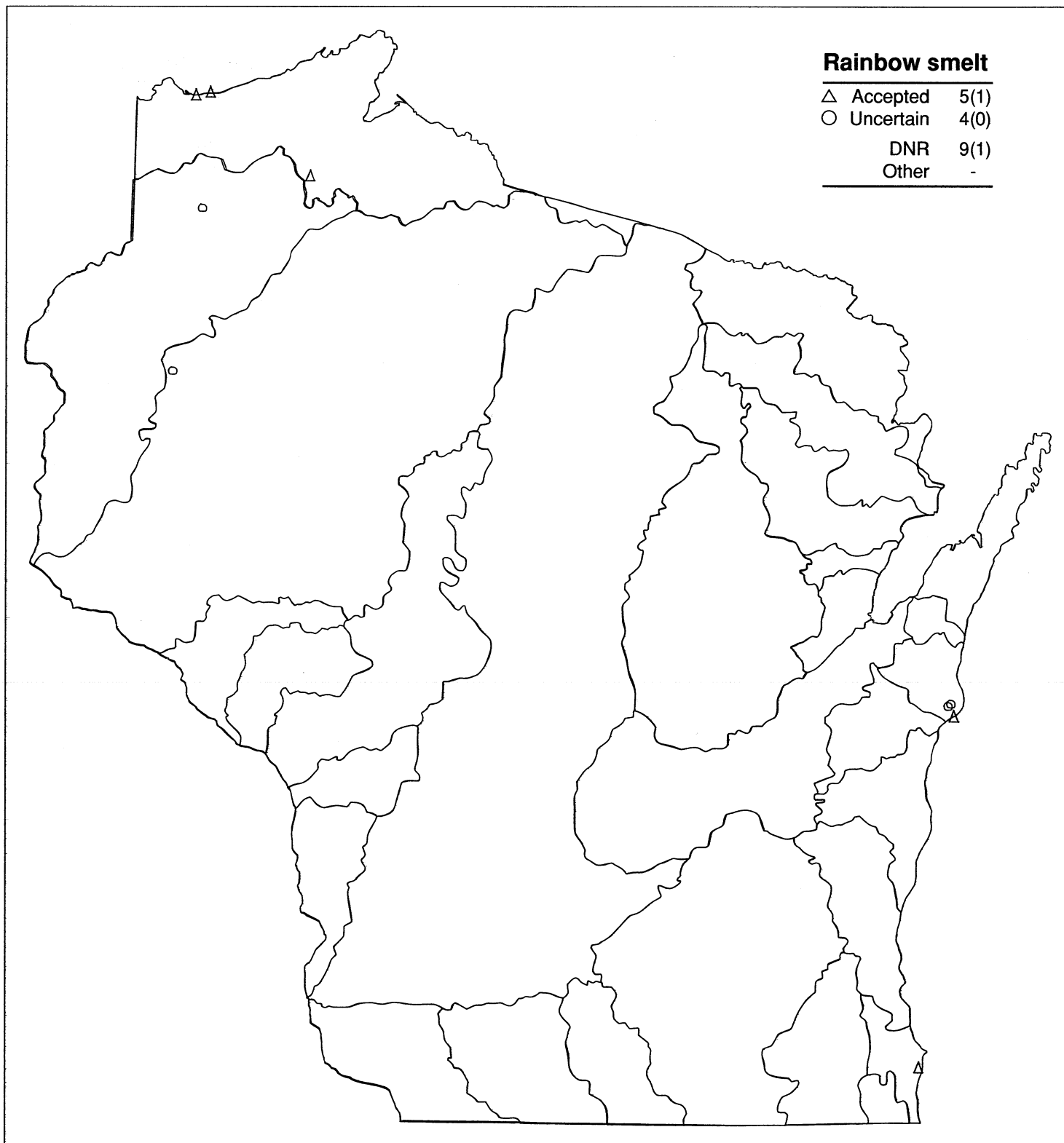
Map 26(L)



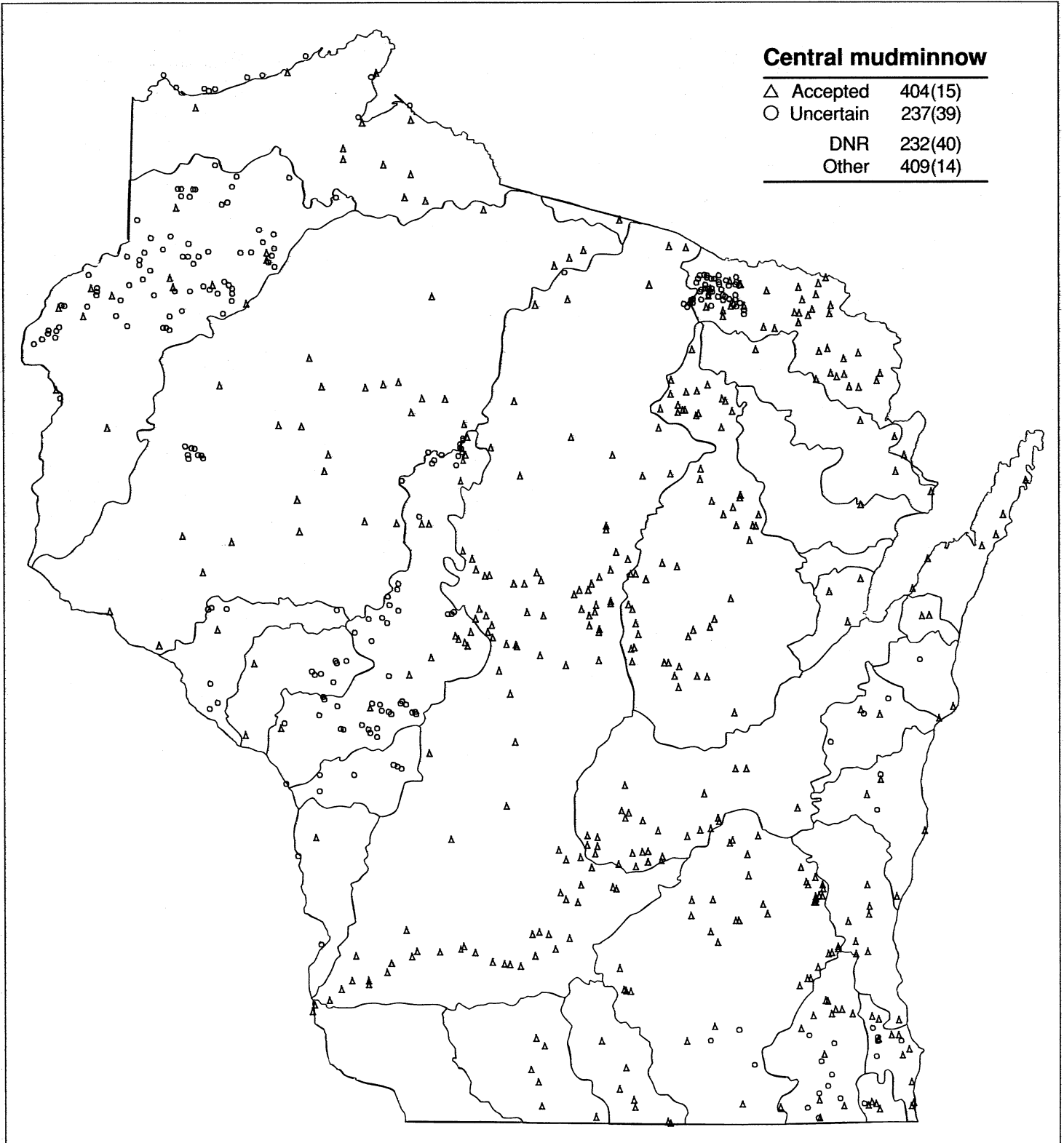
Map 27(E)

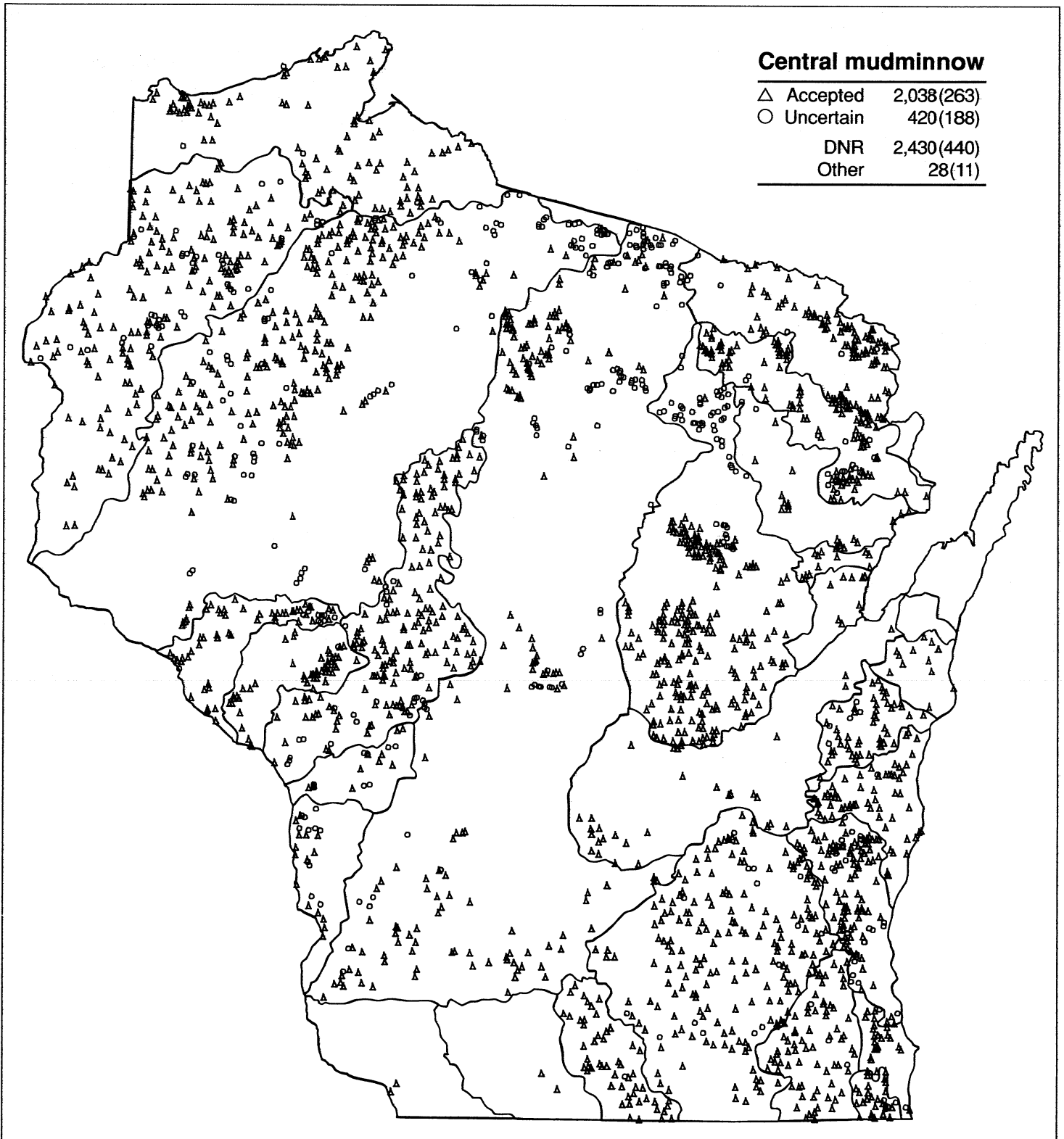


Map 27(L)

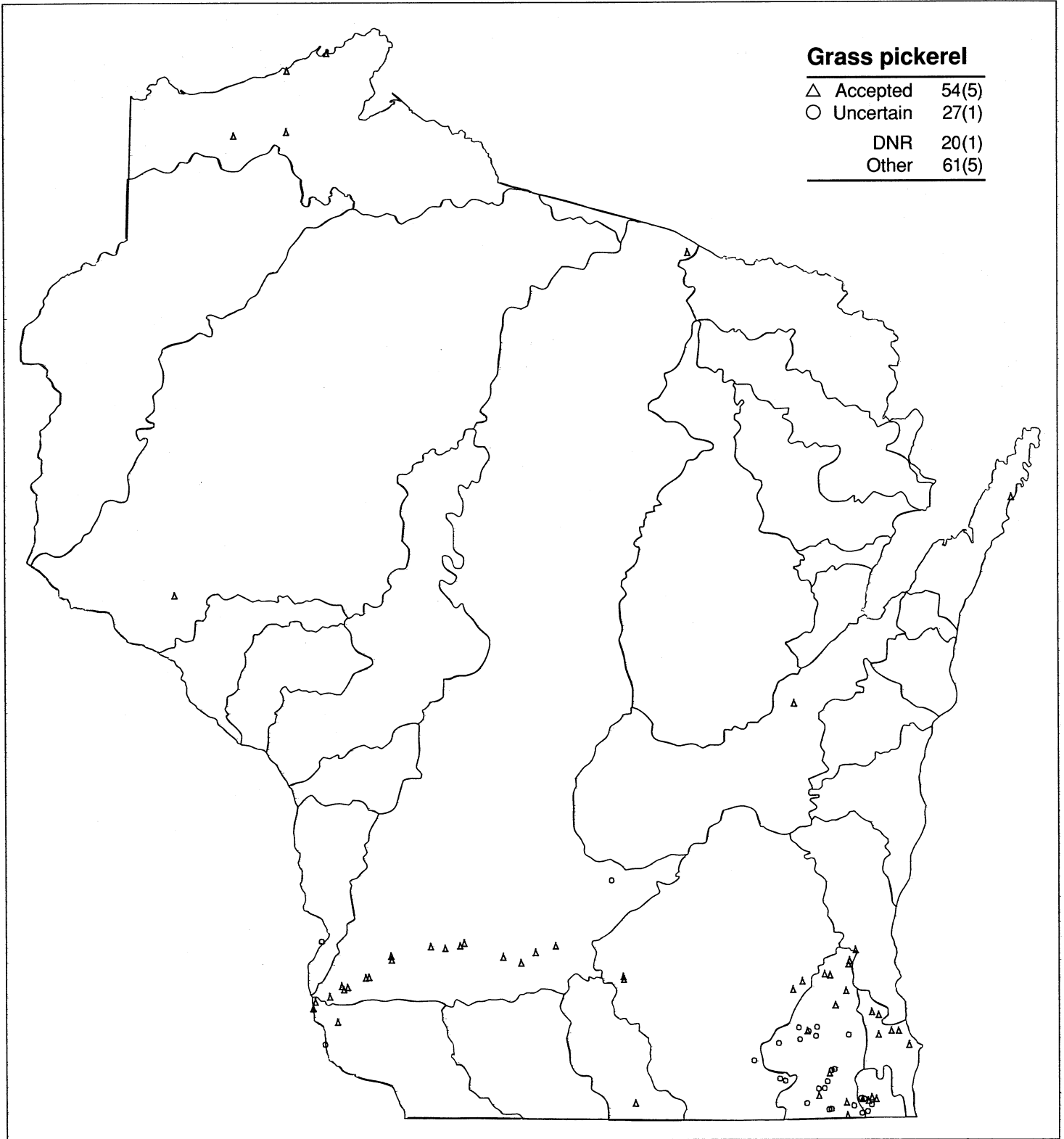


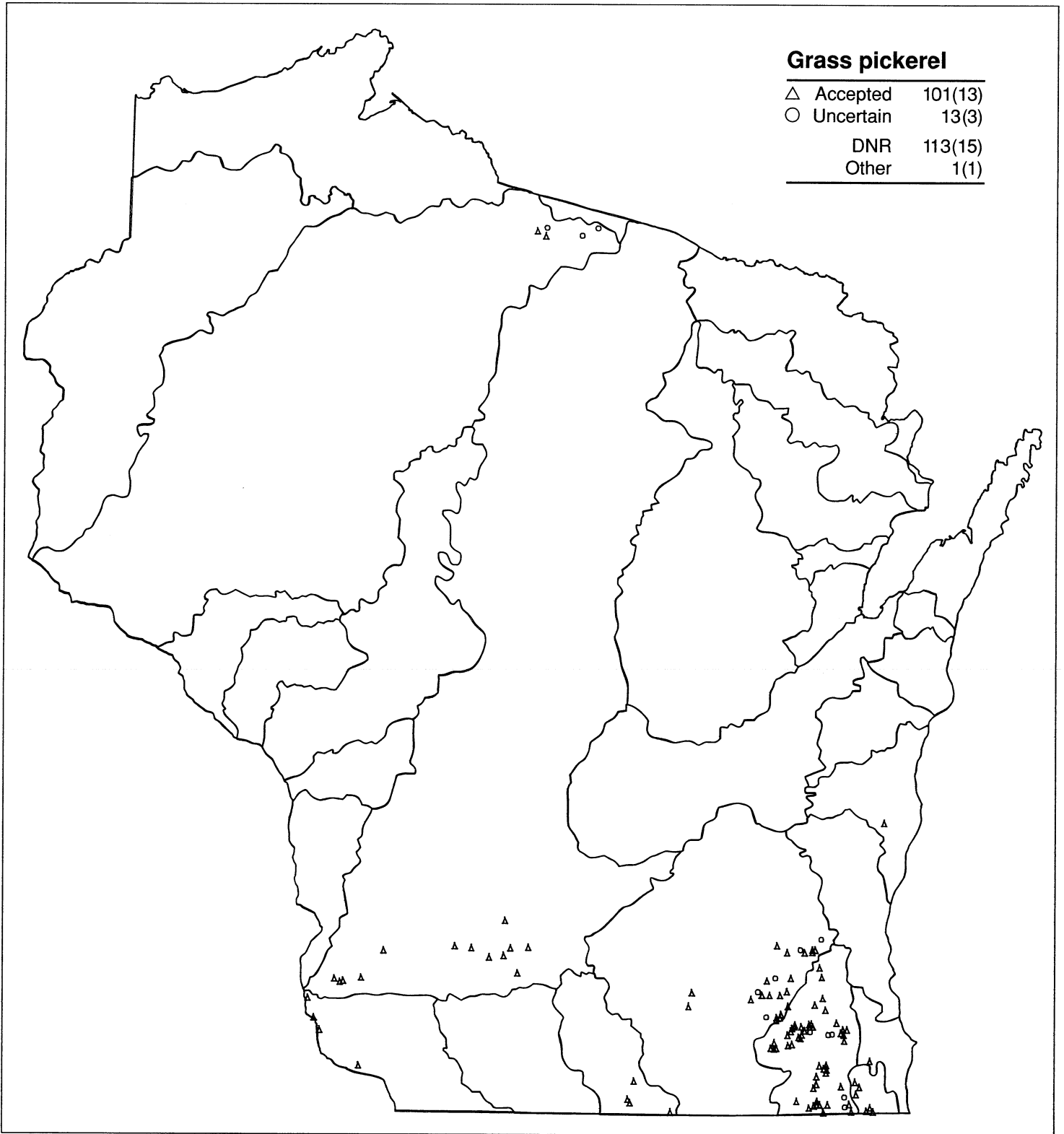
Map 28(E)



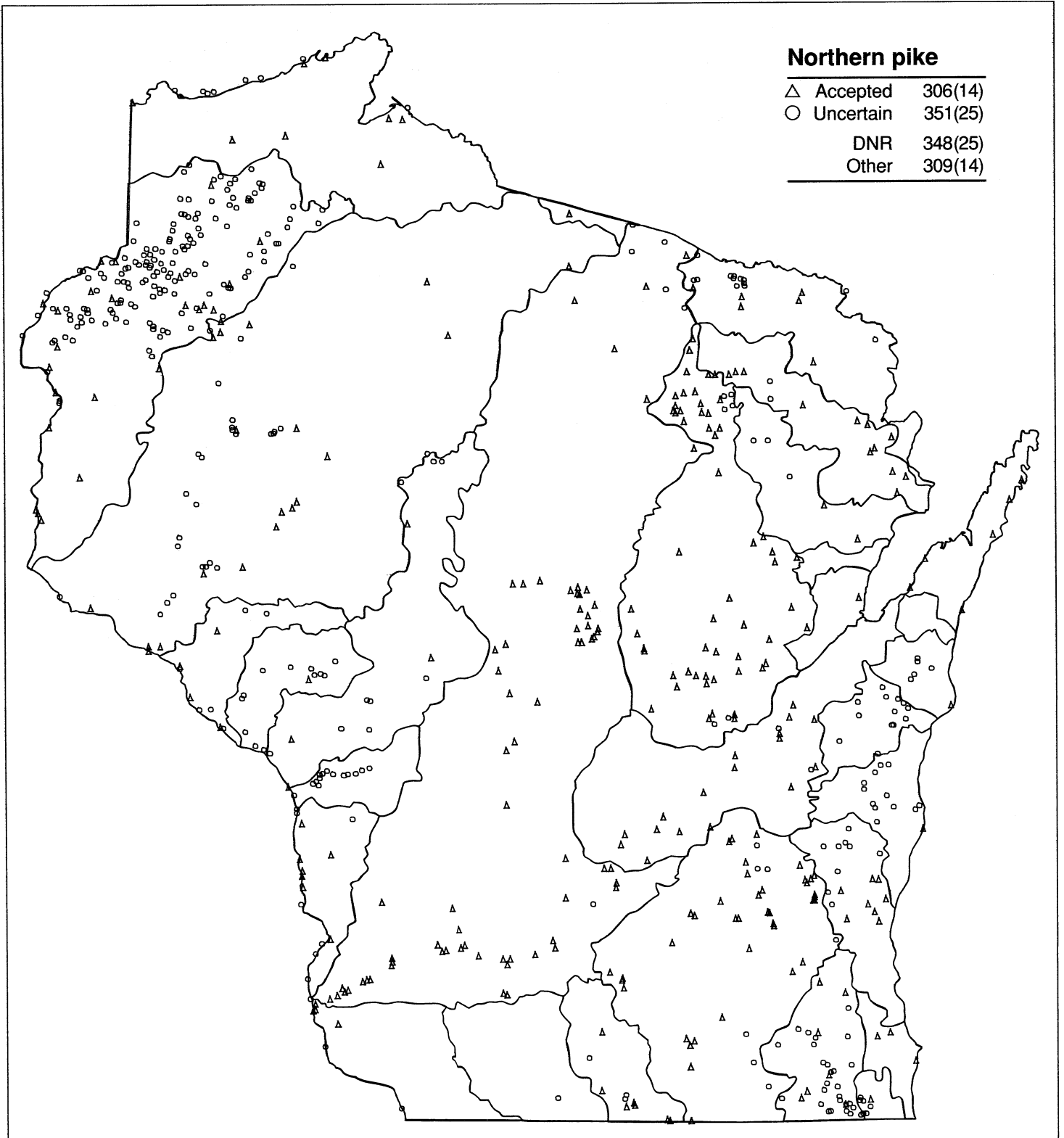


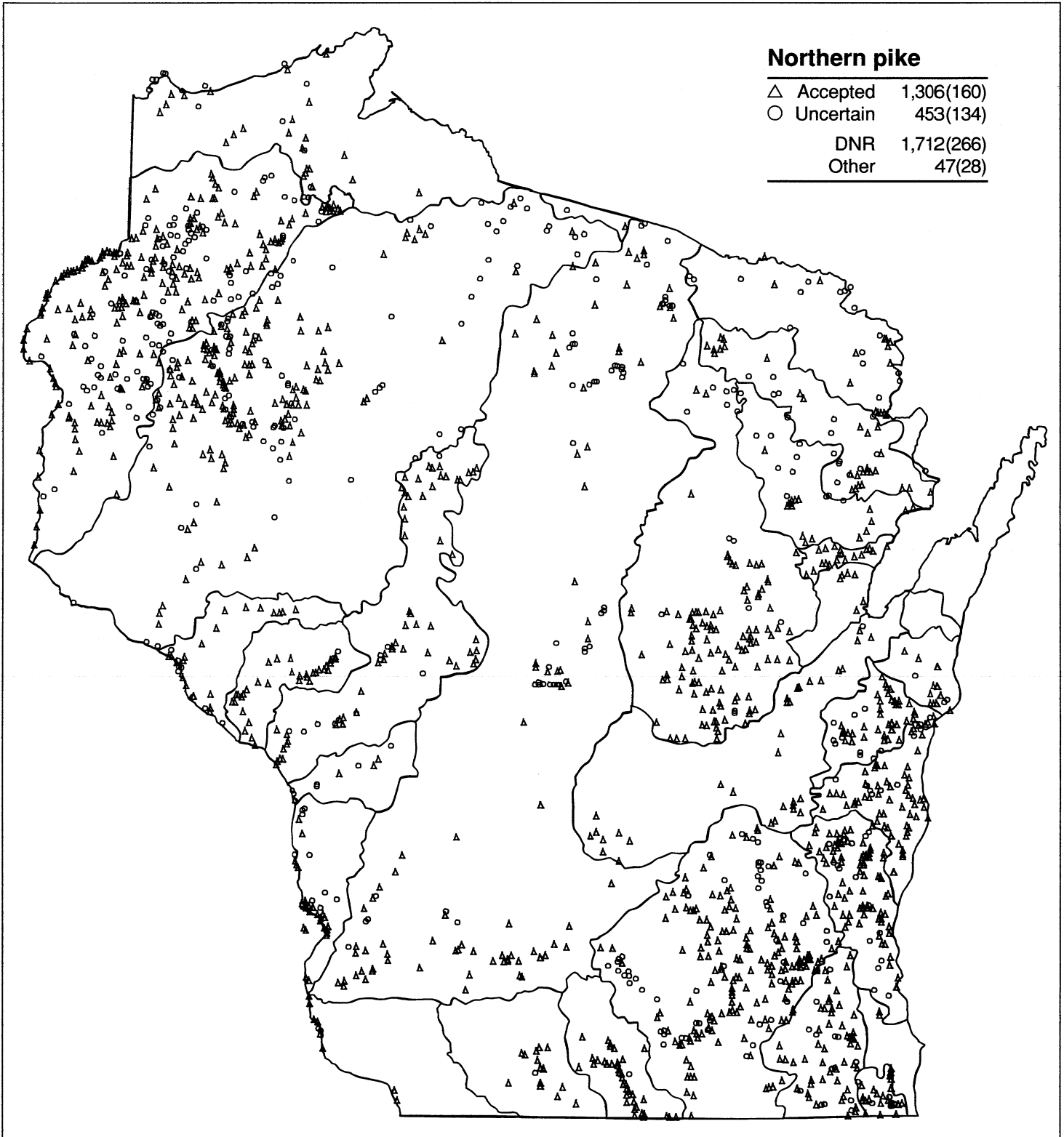
Map 29(E)





Map 30(E)



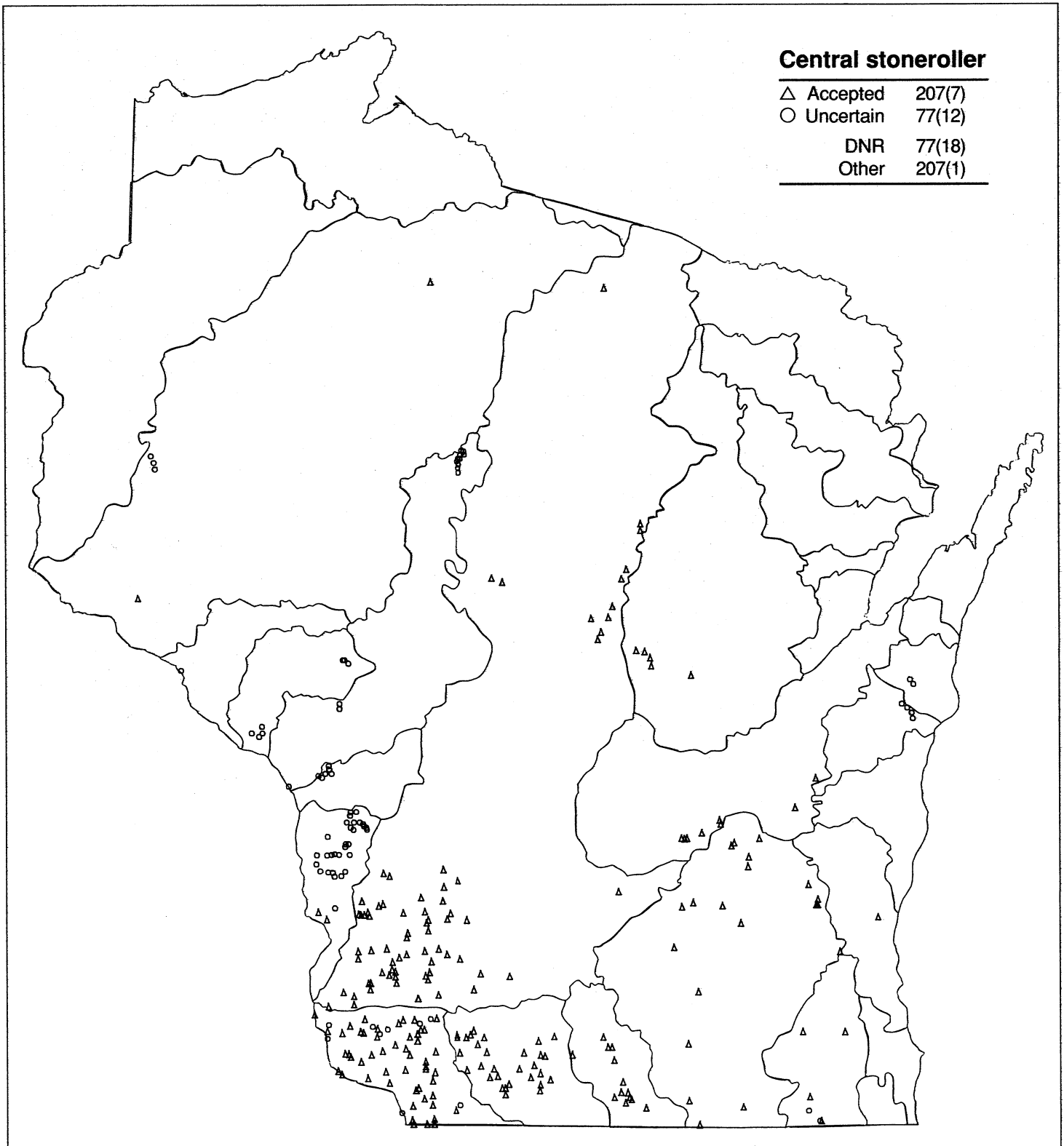


Map 31(E)



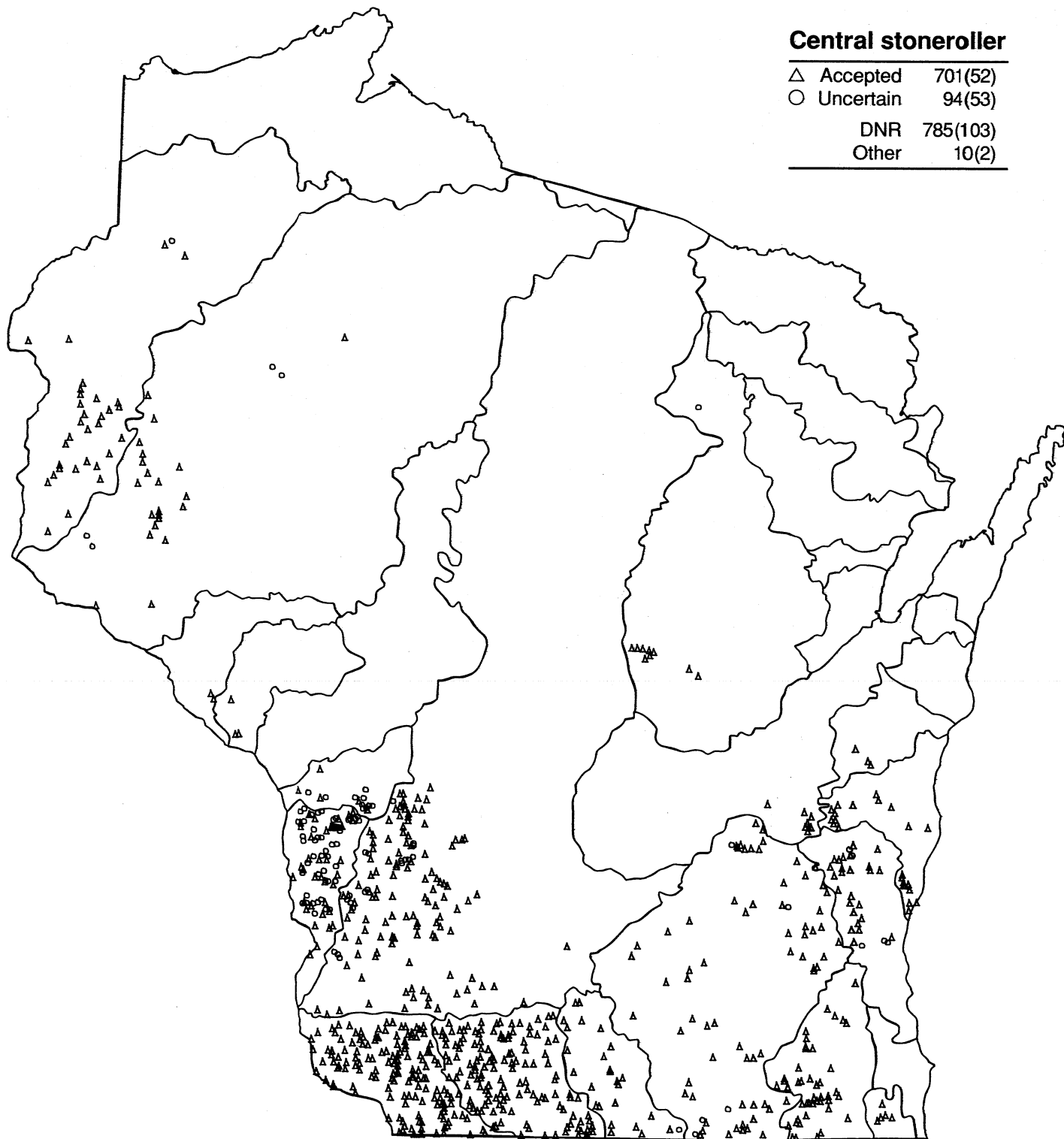


Map 32(E)

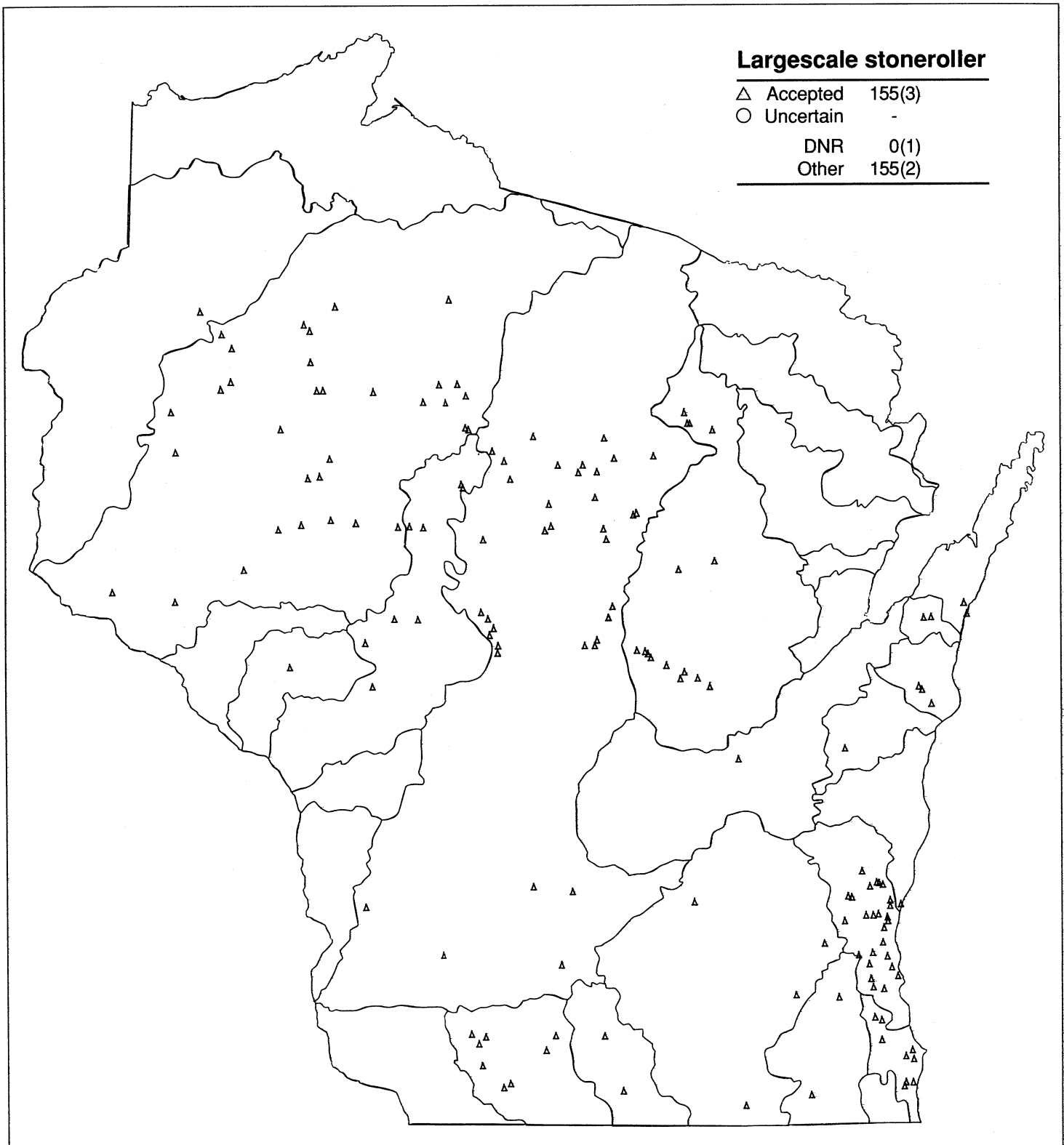


Central stoneroller

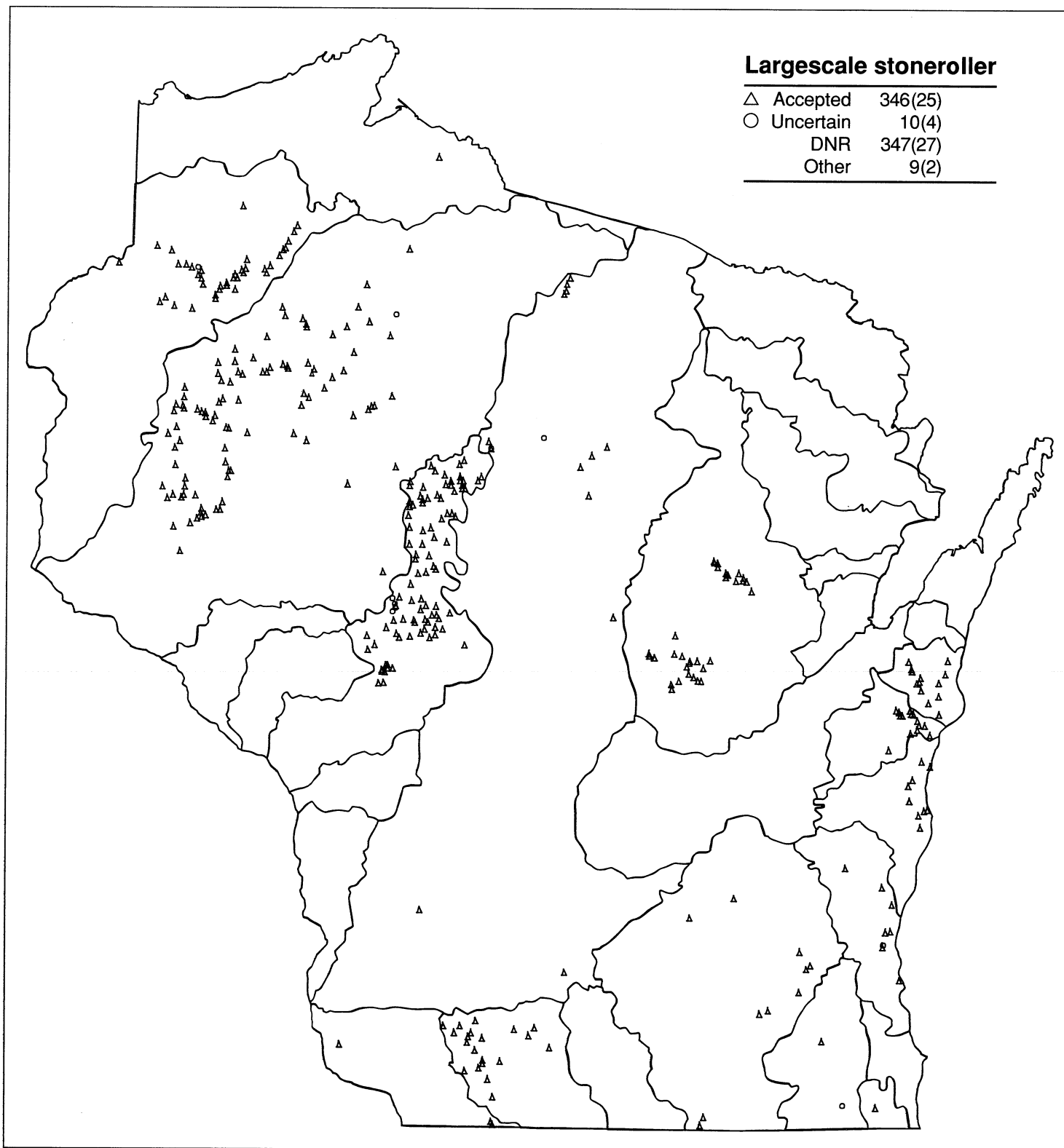
| | | |
|---|-----------|----------|
| △ | Accepted | 701(52) |
| ○ | Uncertain | 94(53) |
| | DNR | 785(103) |
| | Other | 10(2) |



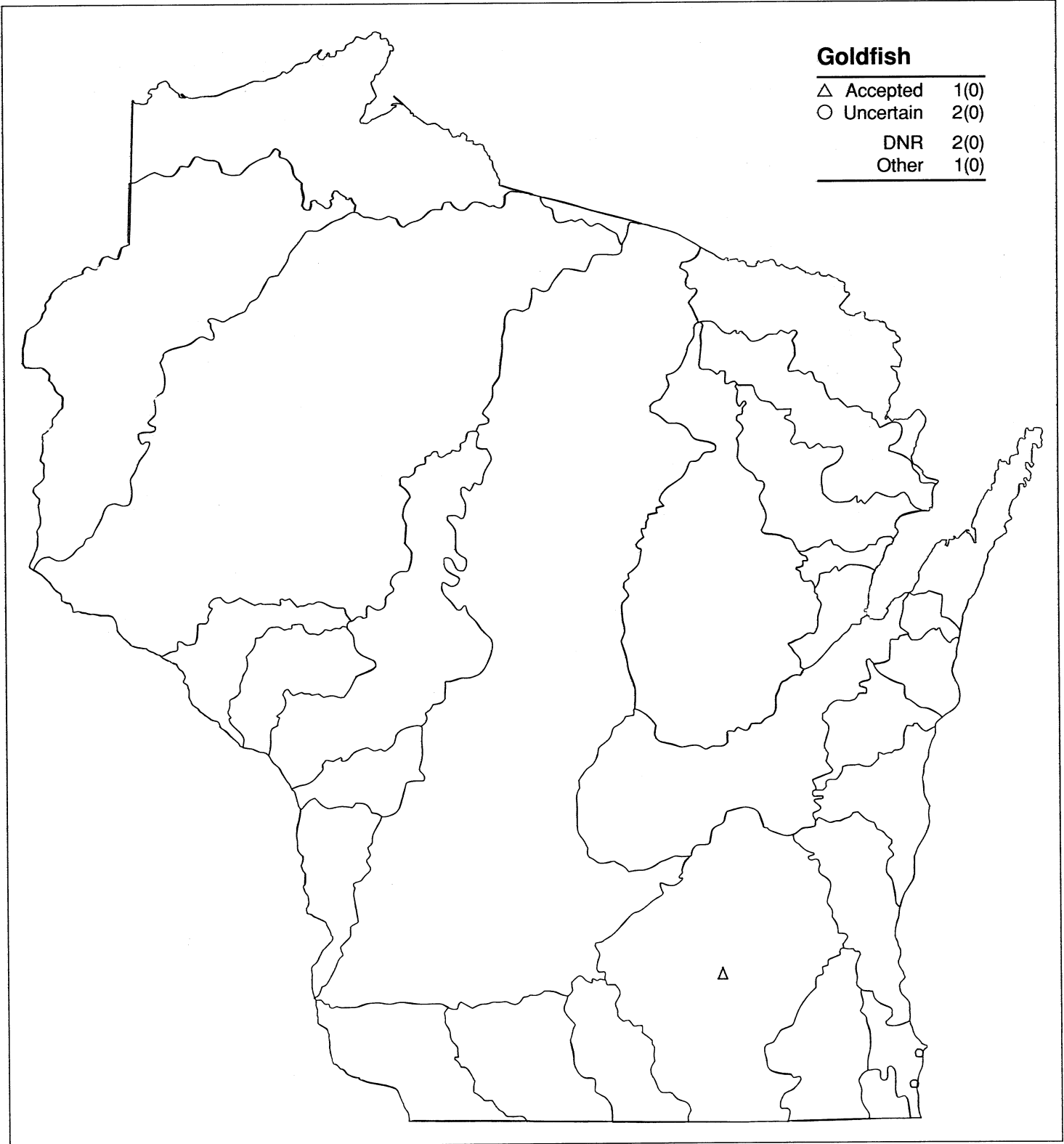
Map 33(E)



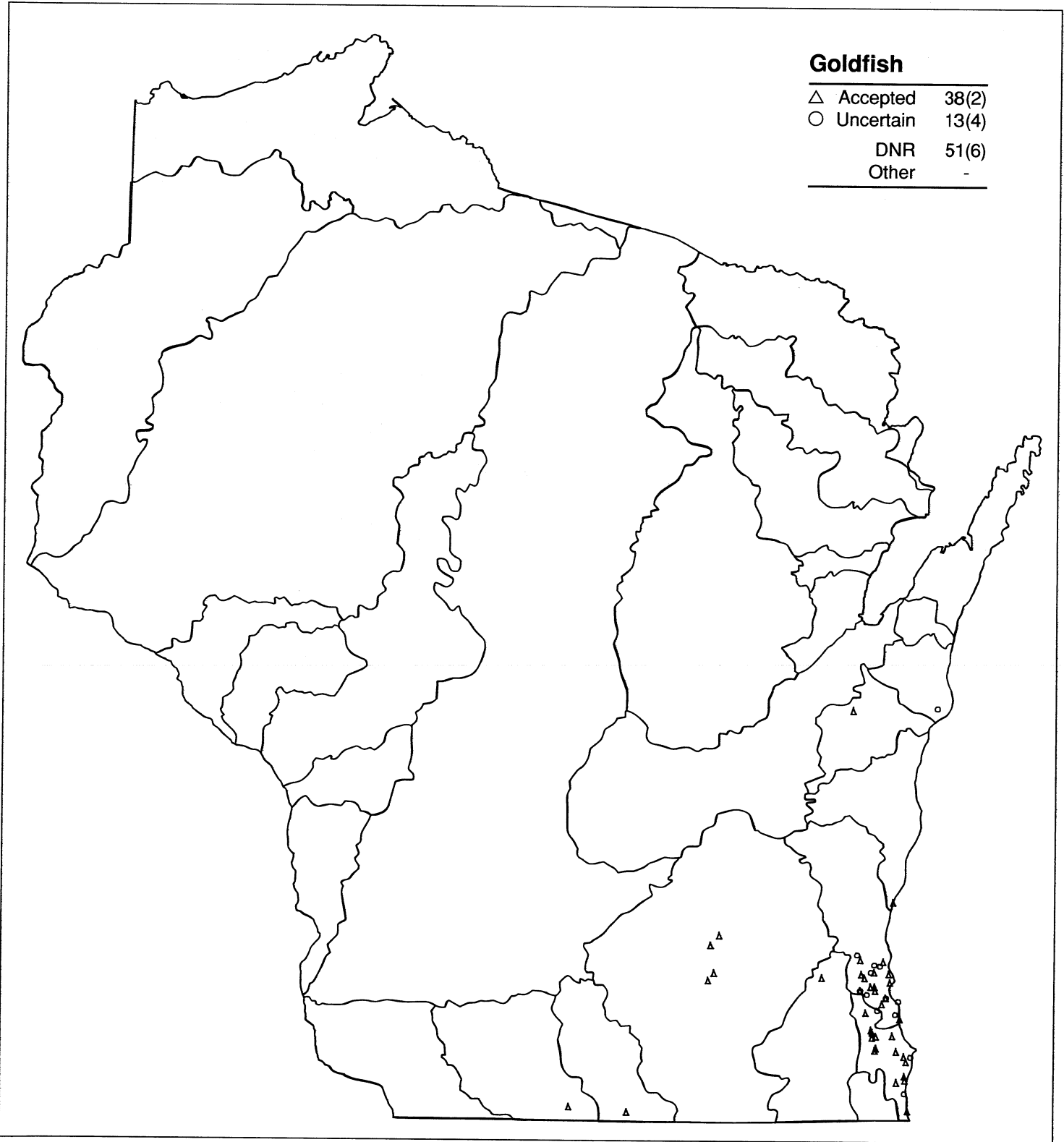
Map 33(L)



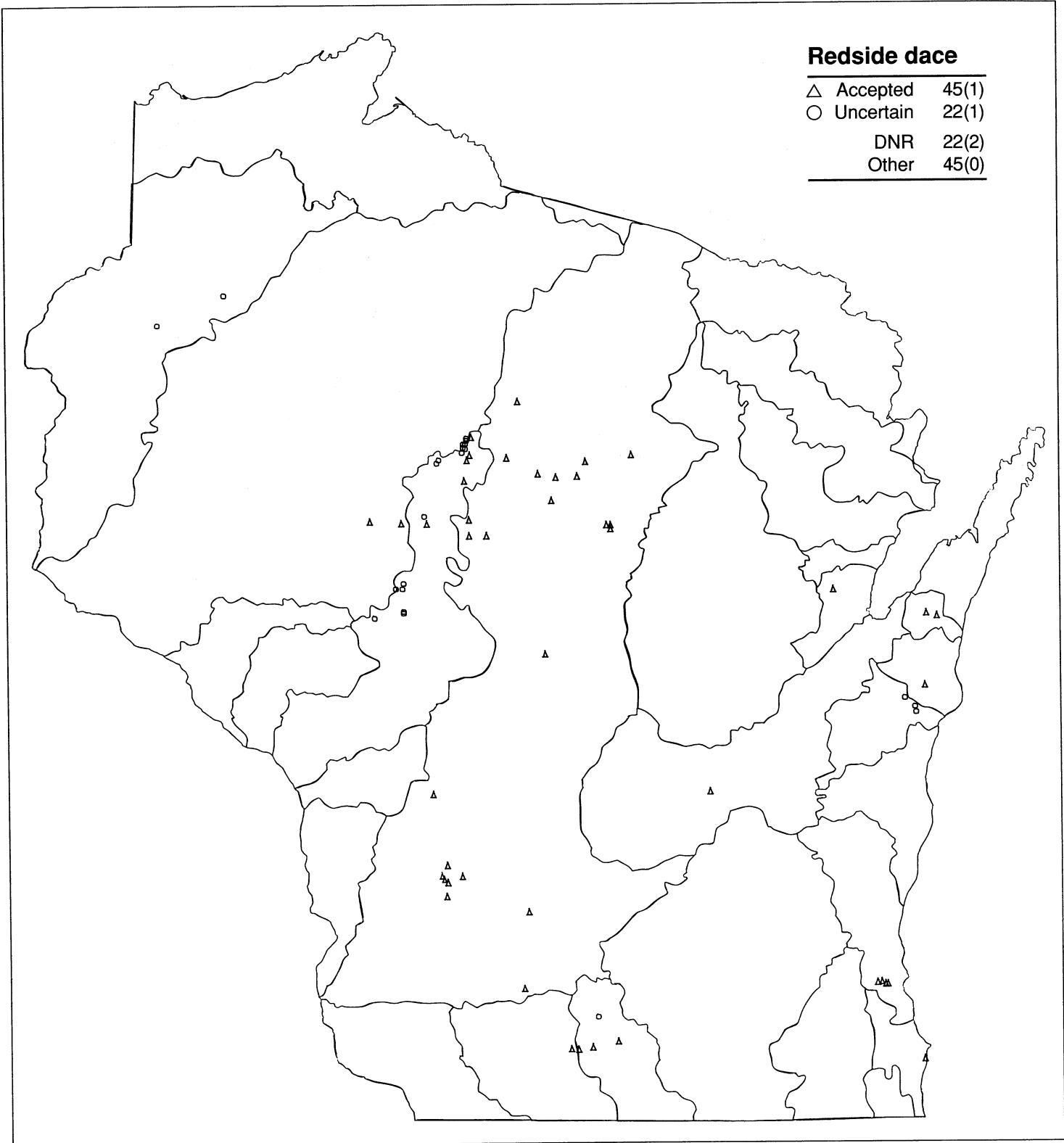
Map 34(E)



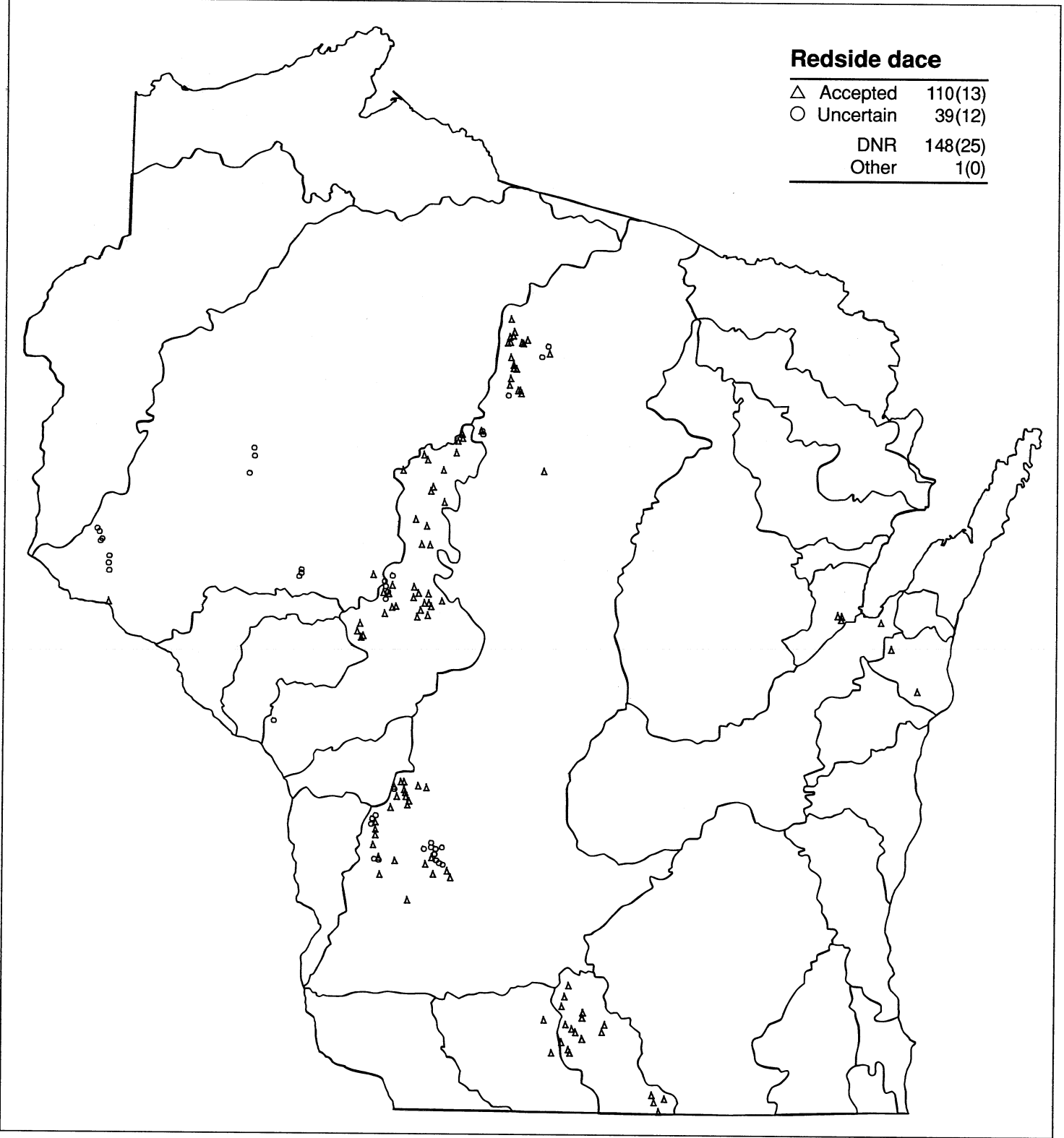
Map 34(L)



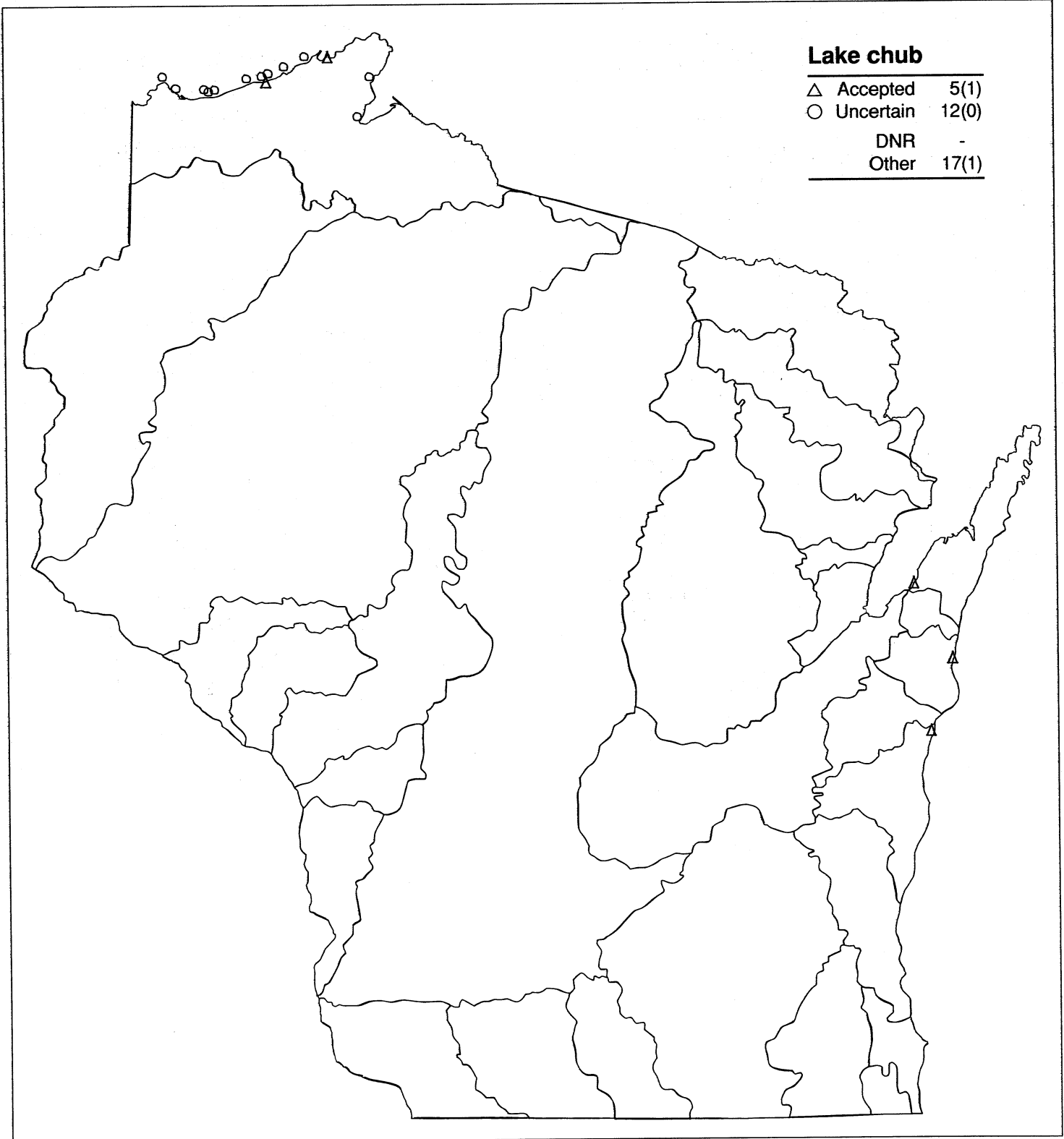
Map 35(E)



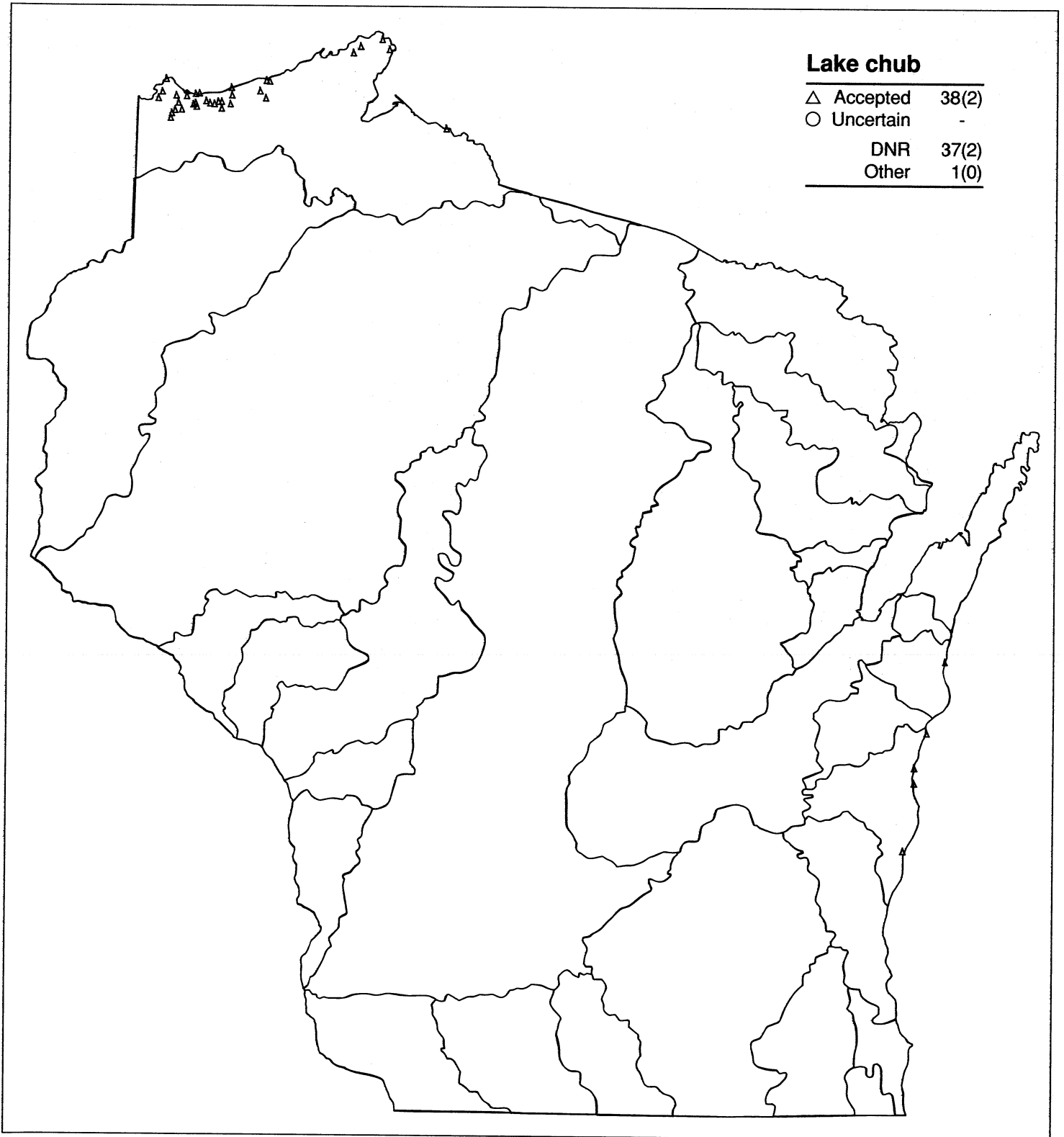
Map 35(L)



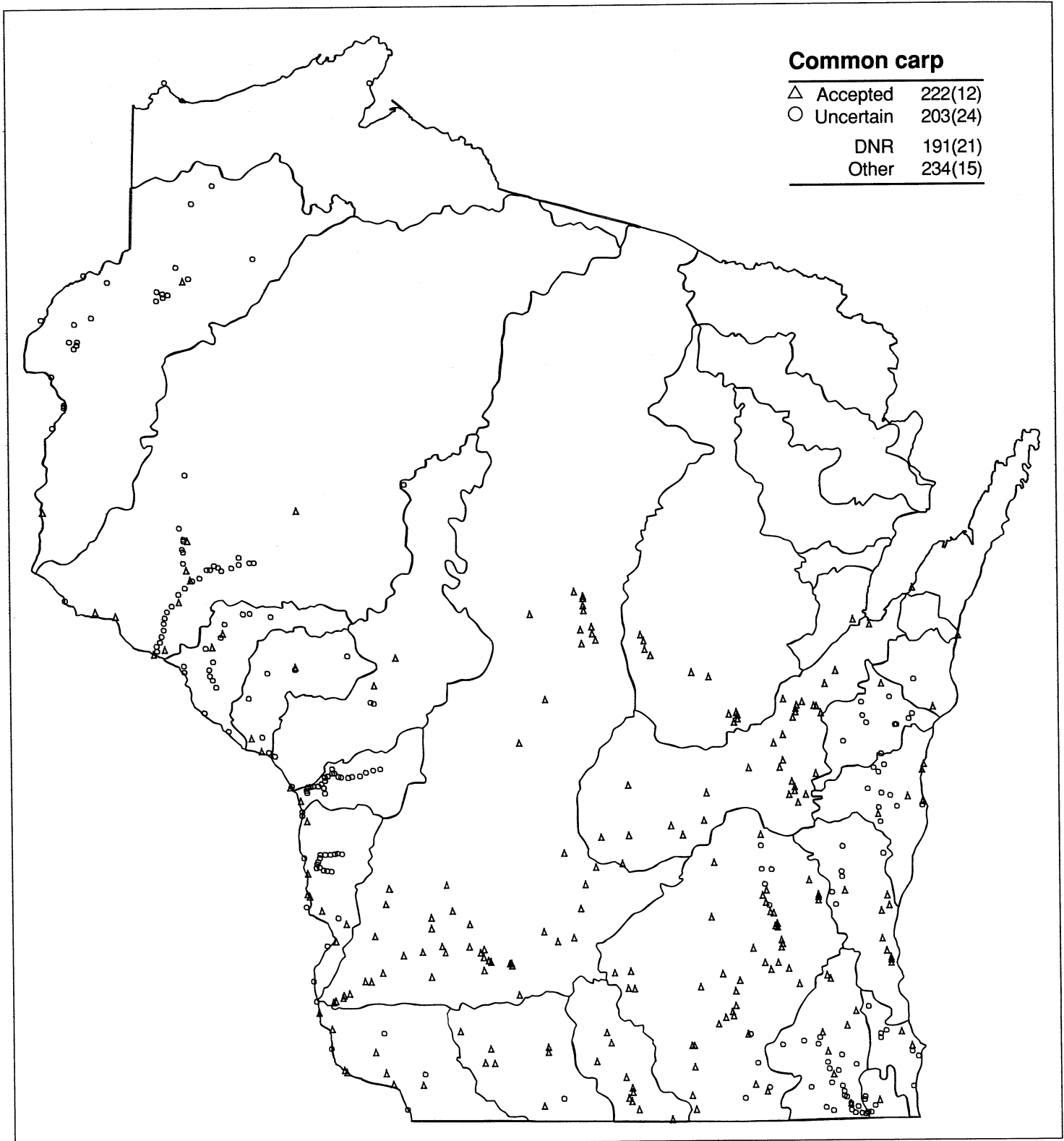
Map 36(E)

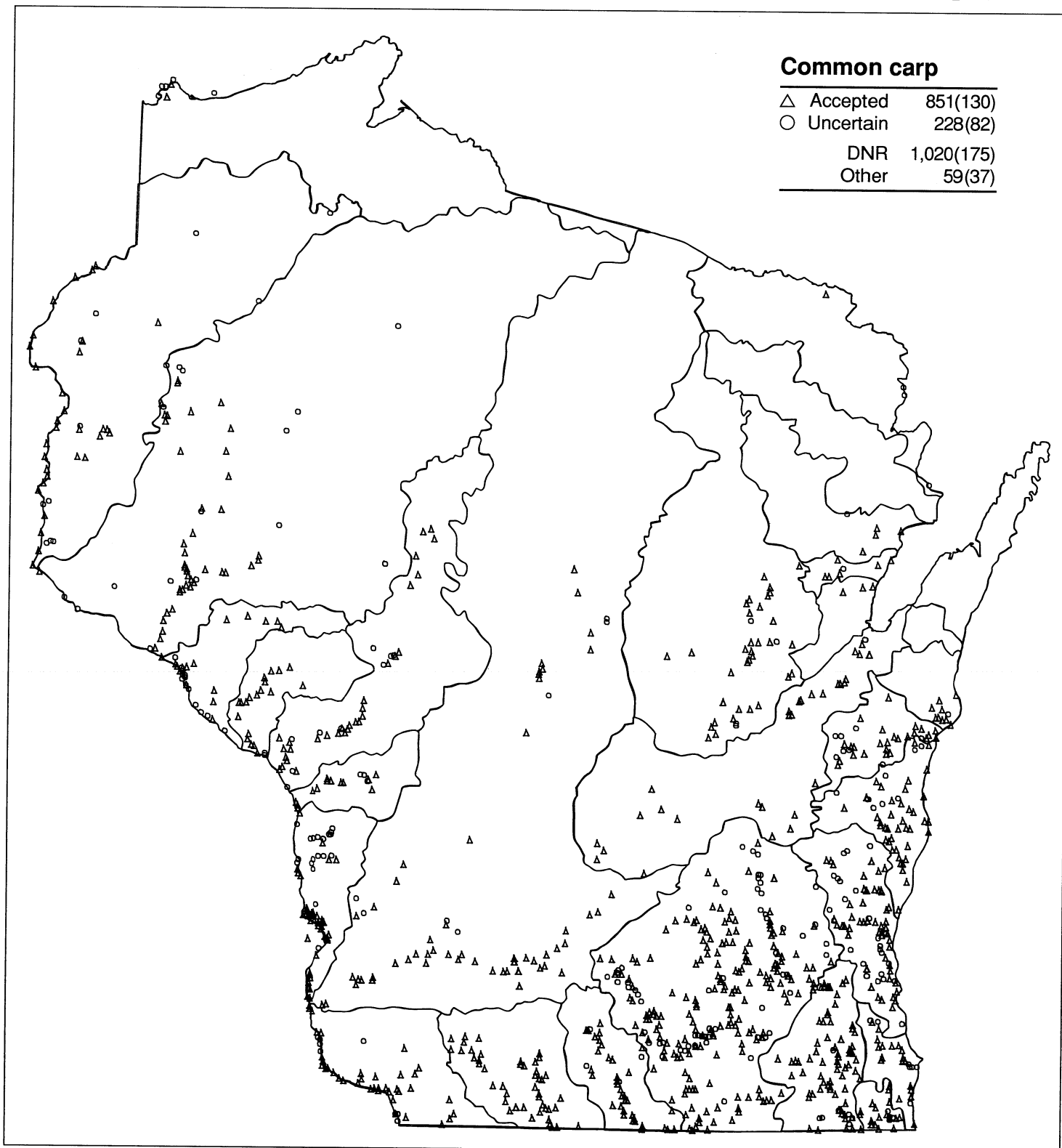


Map 36(L)

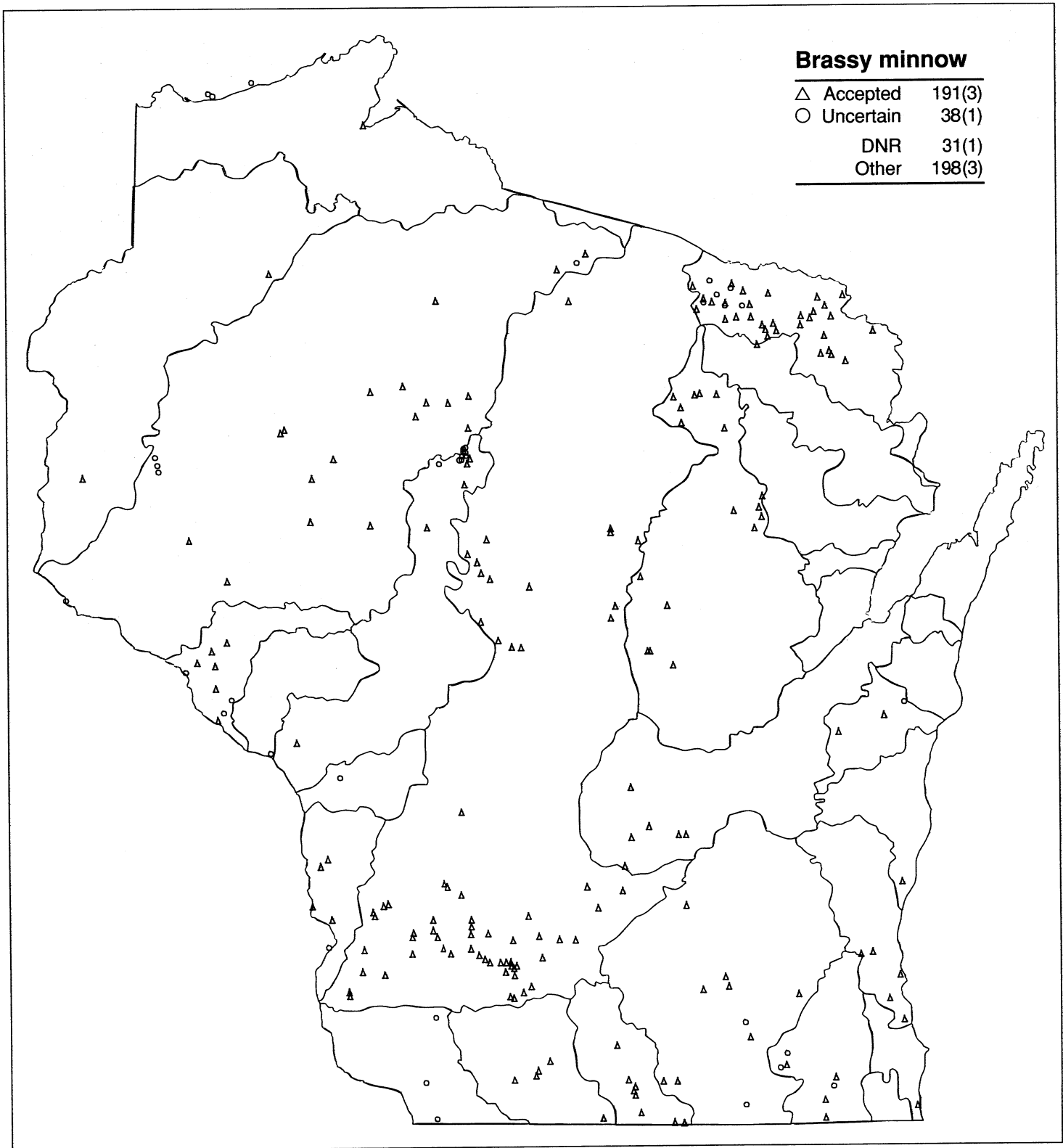


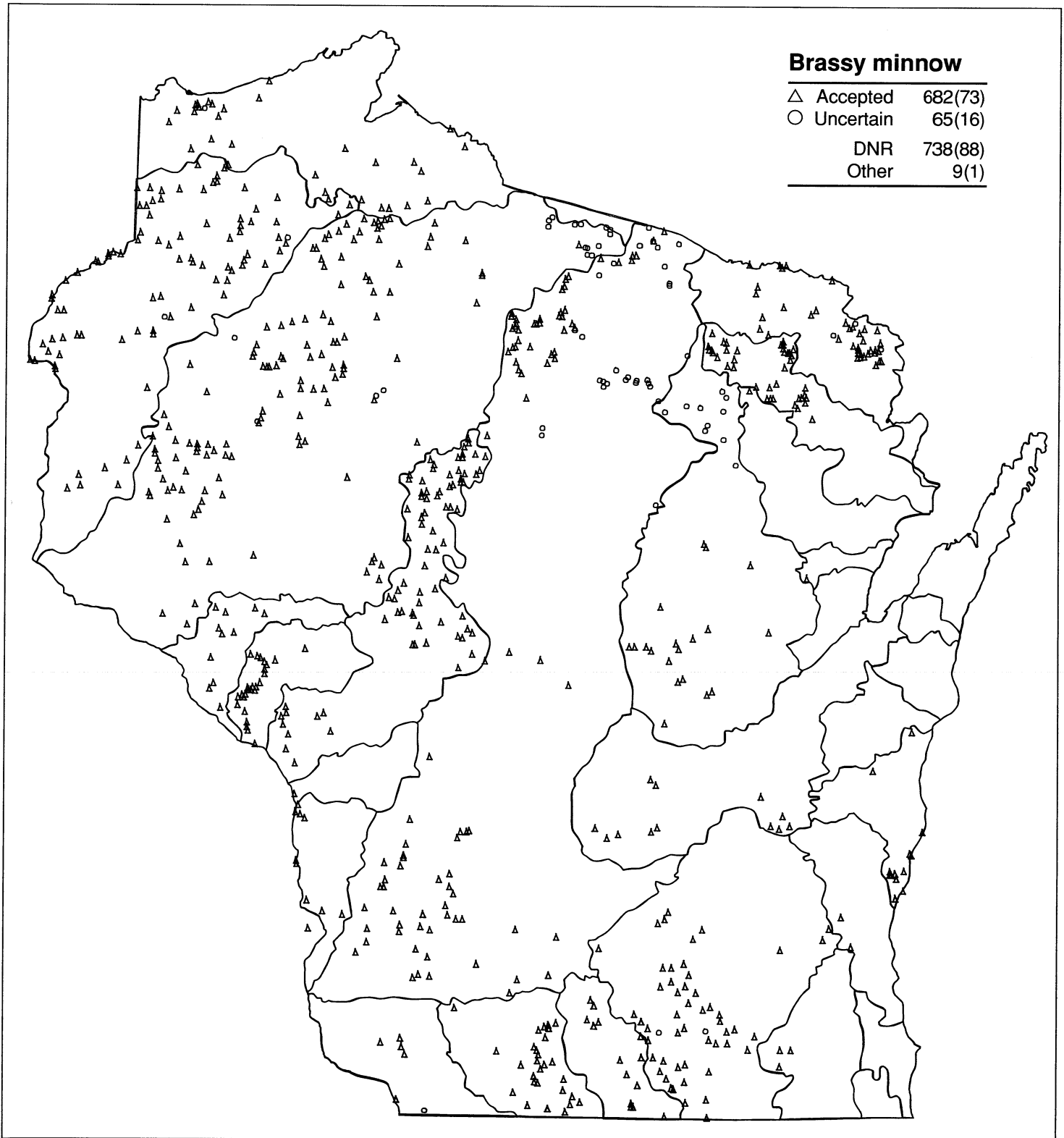
Map 37(E)



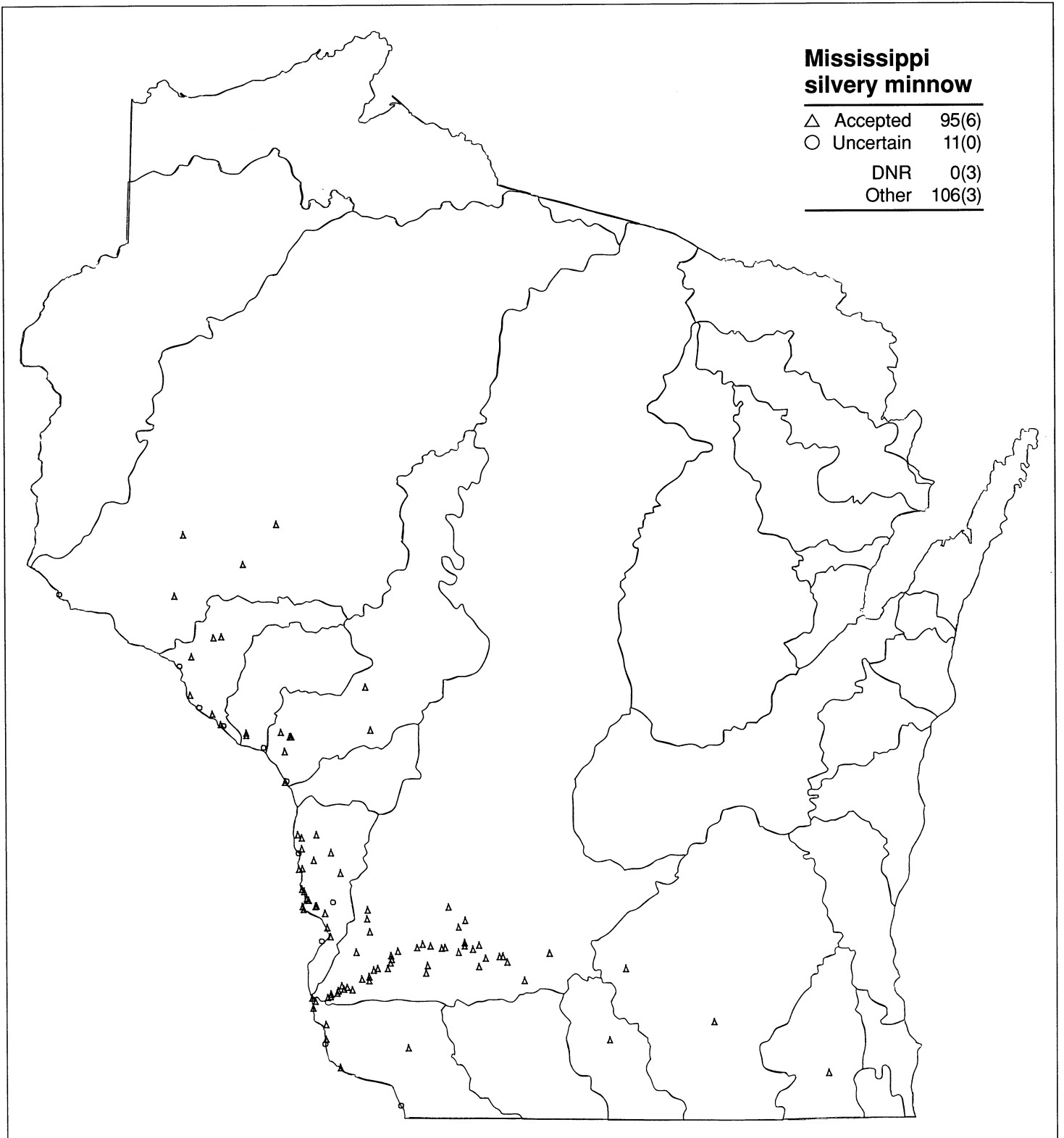


Map 38(E)



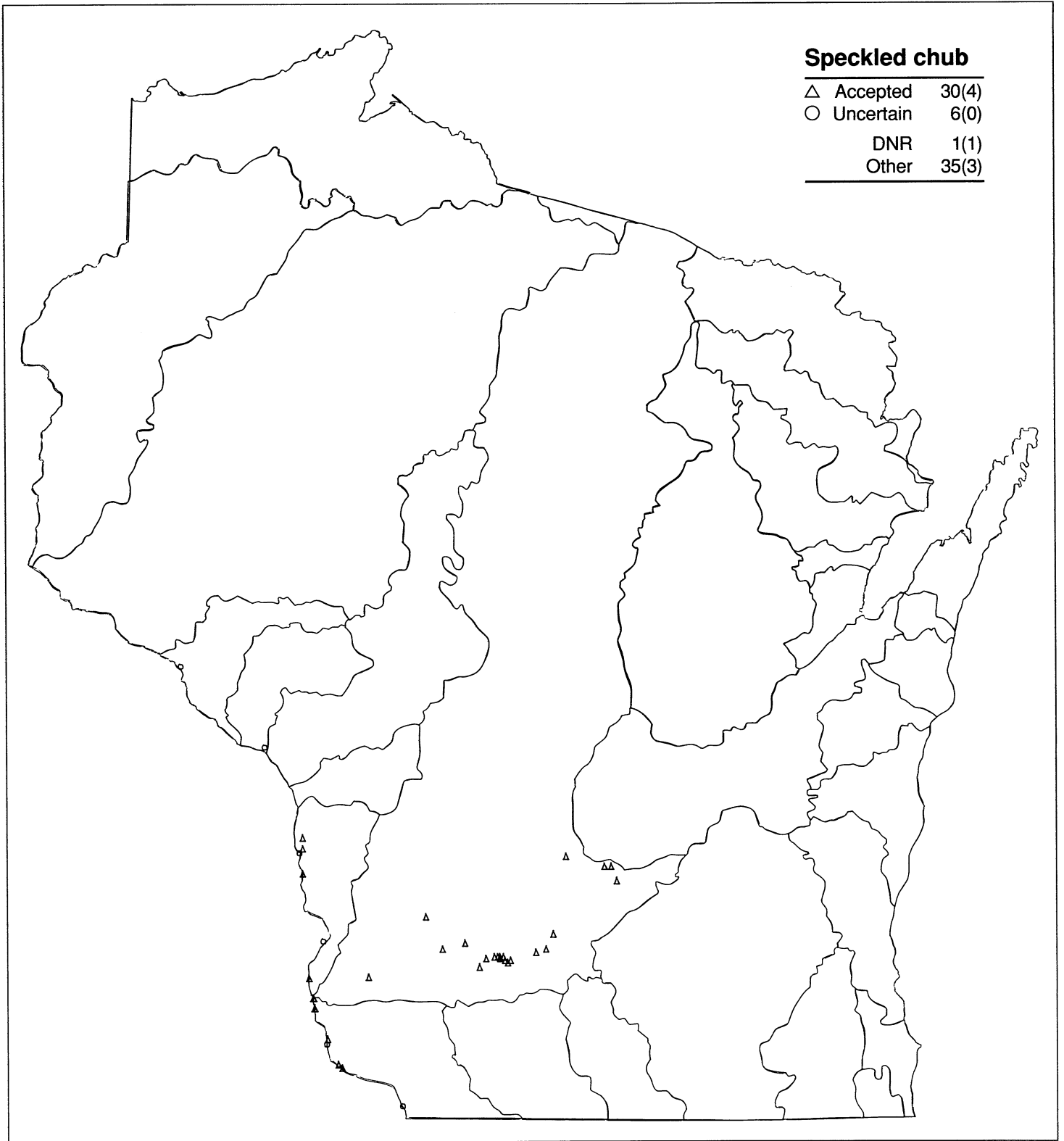


Map 39(E)

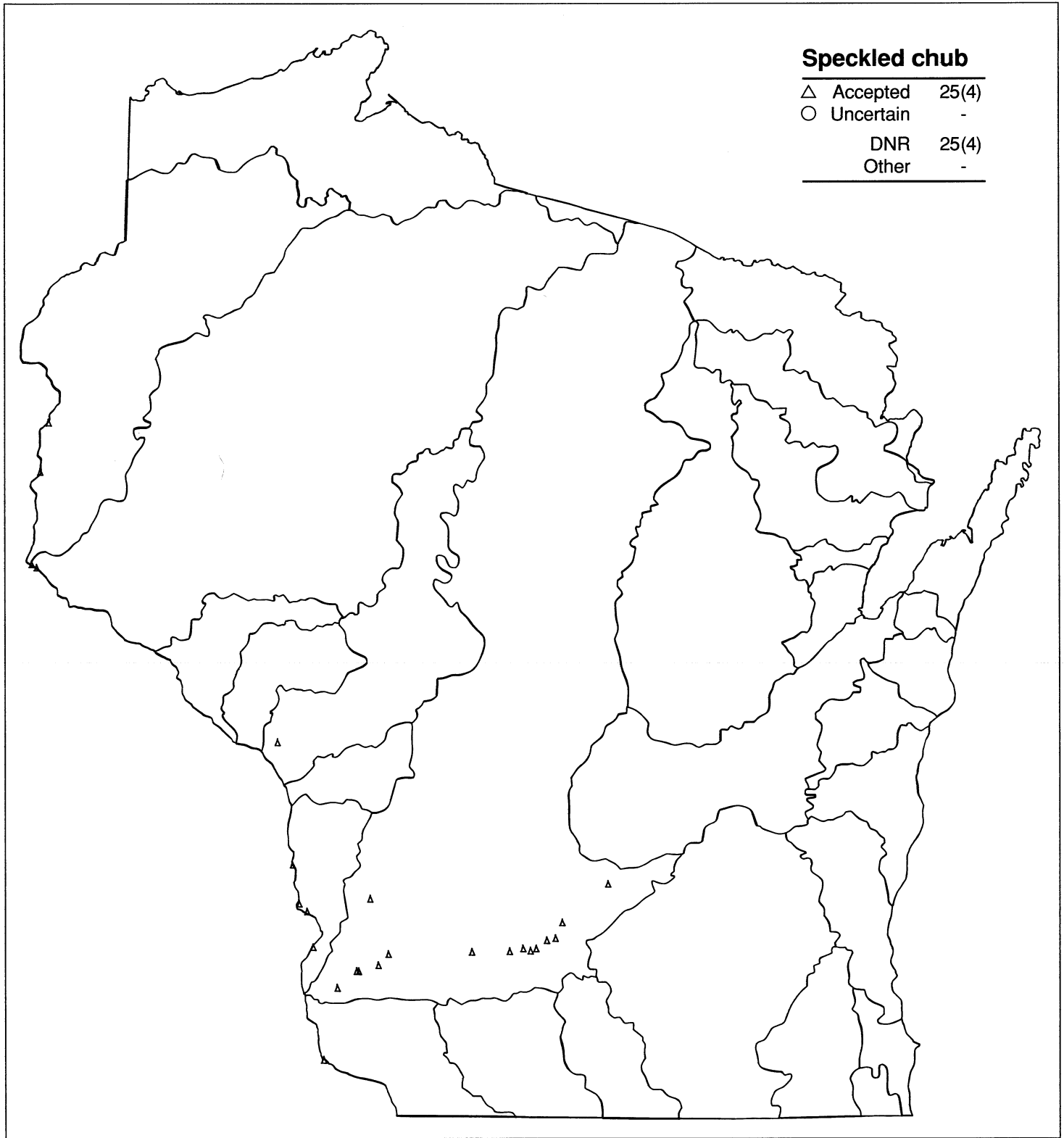




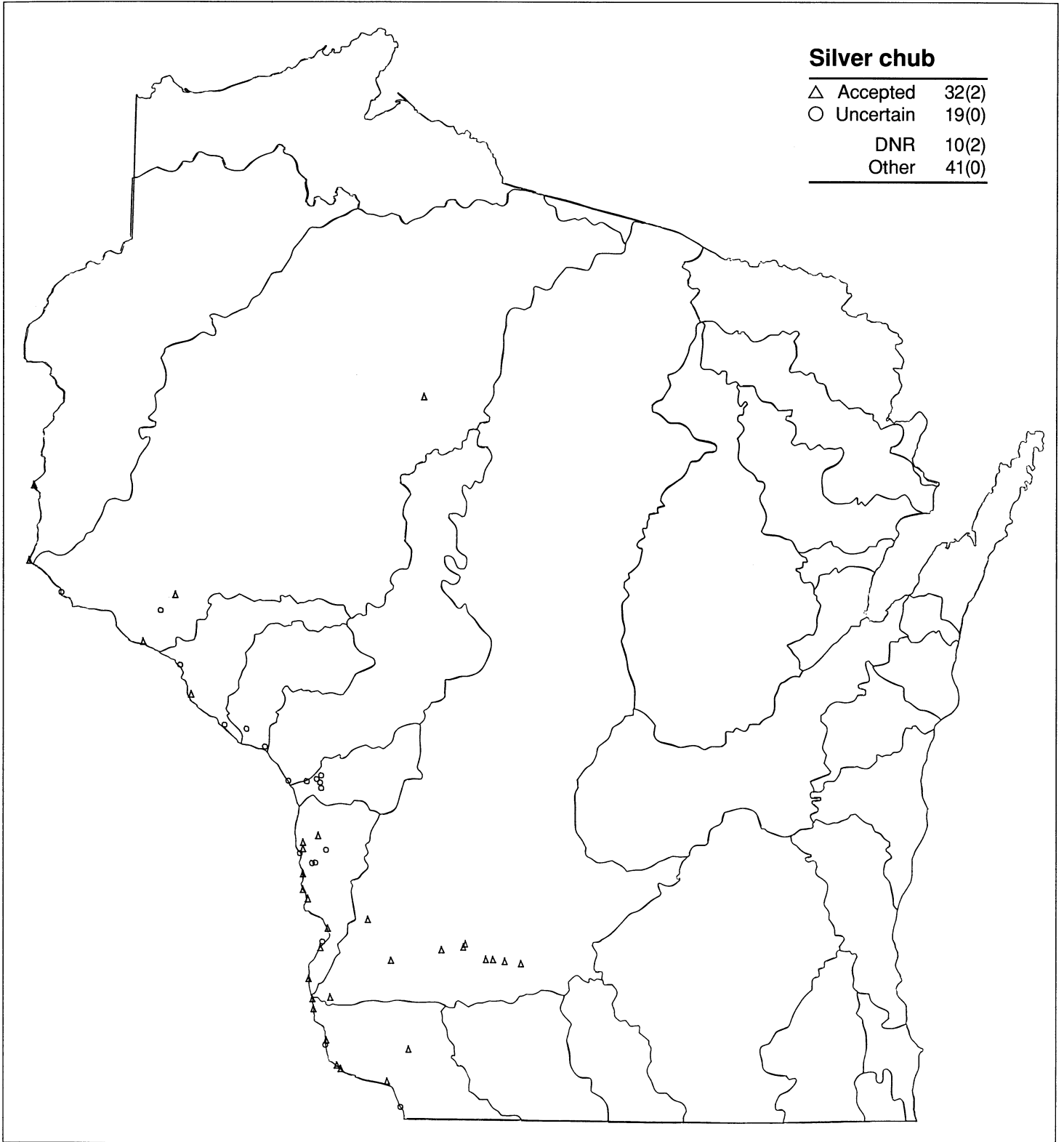
Map 40(E)



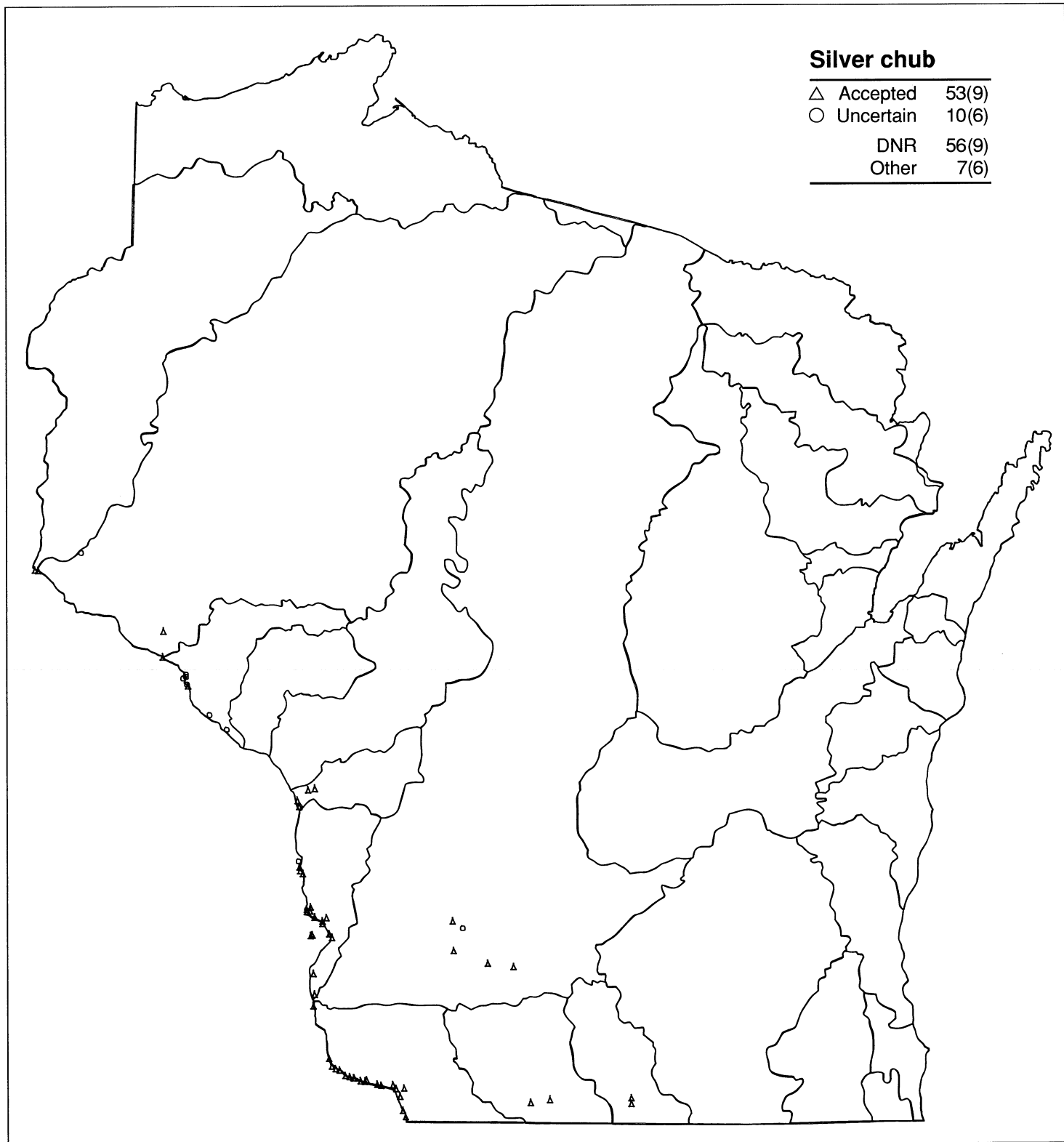
Map 40(L)



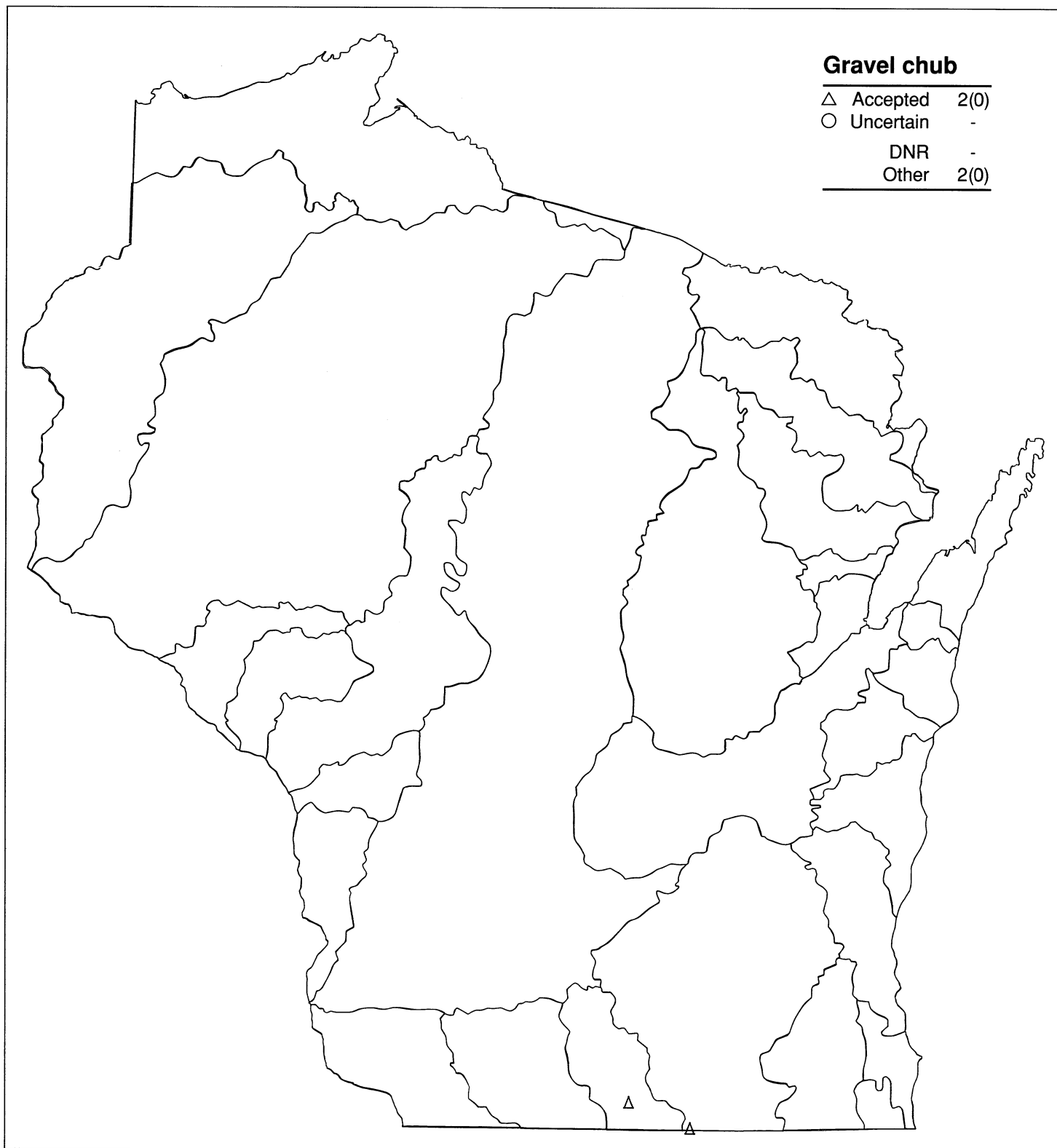
Map 41(E)

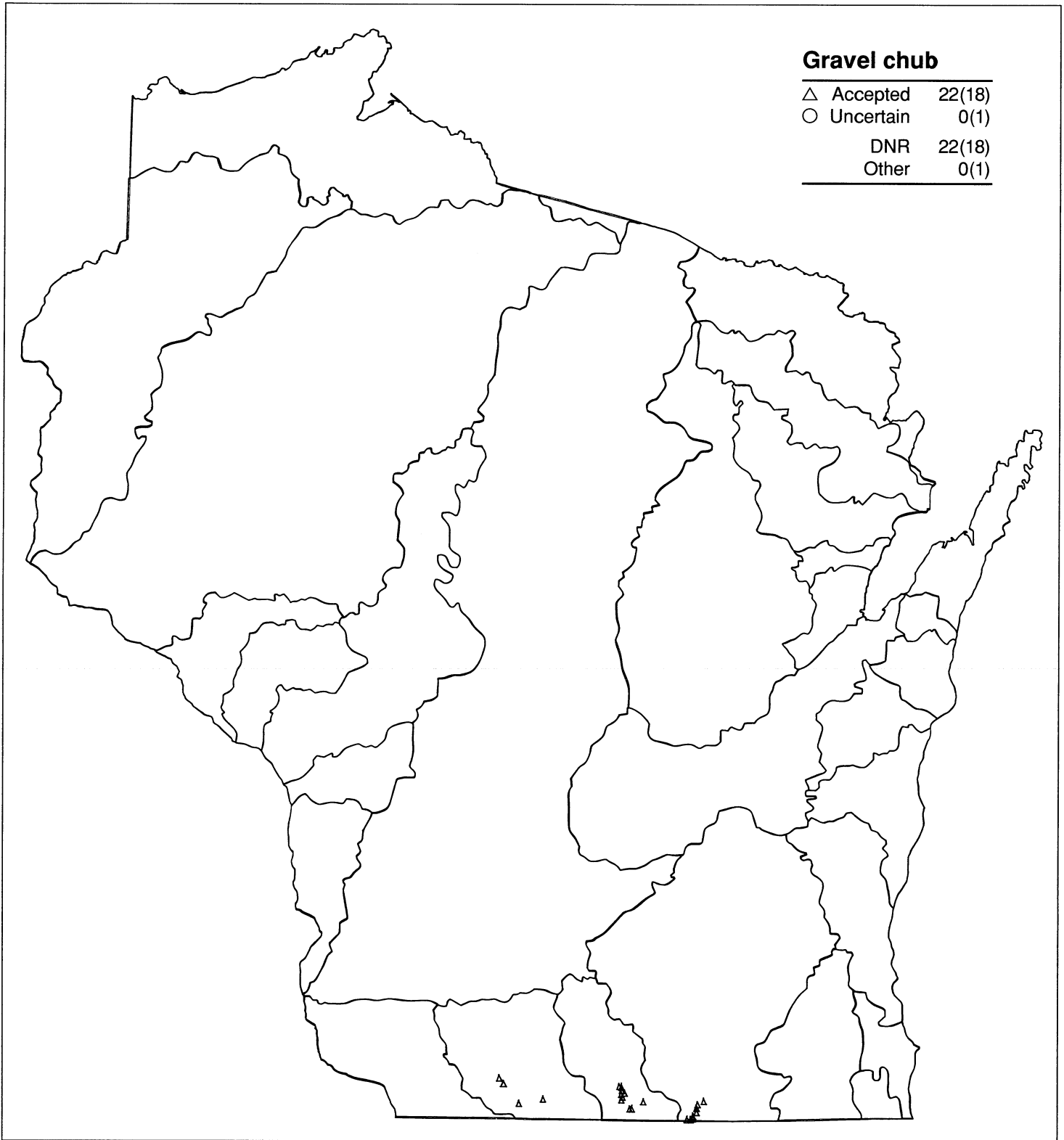


Map 41(L)

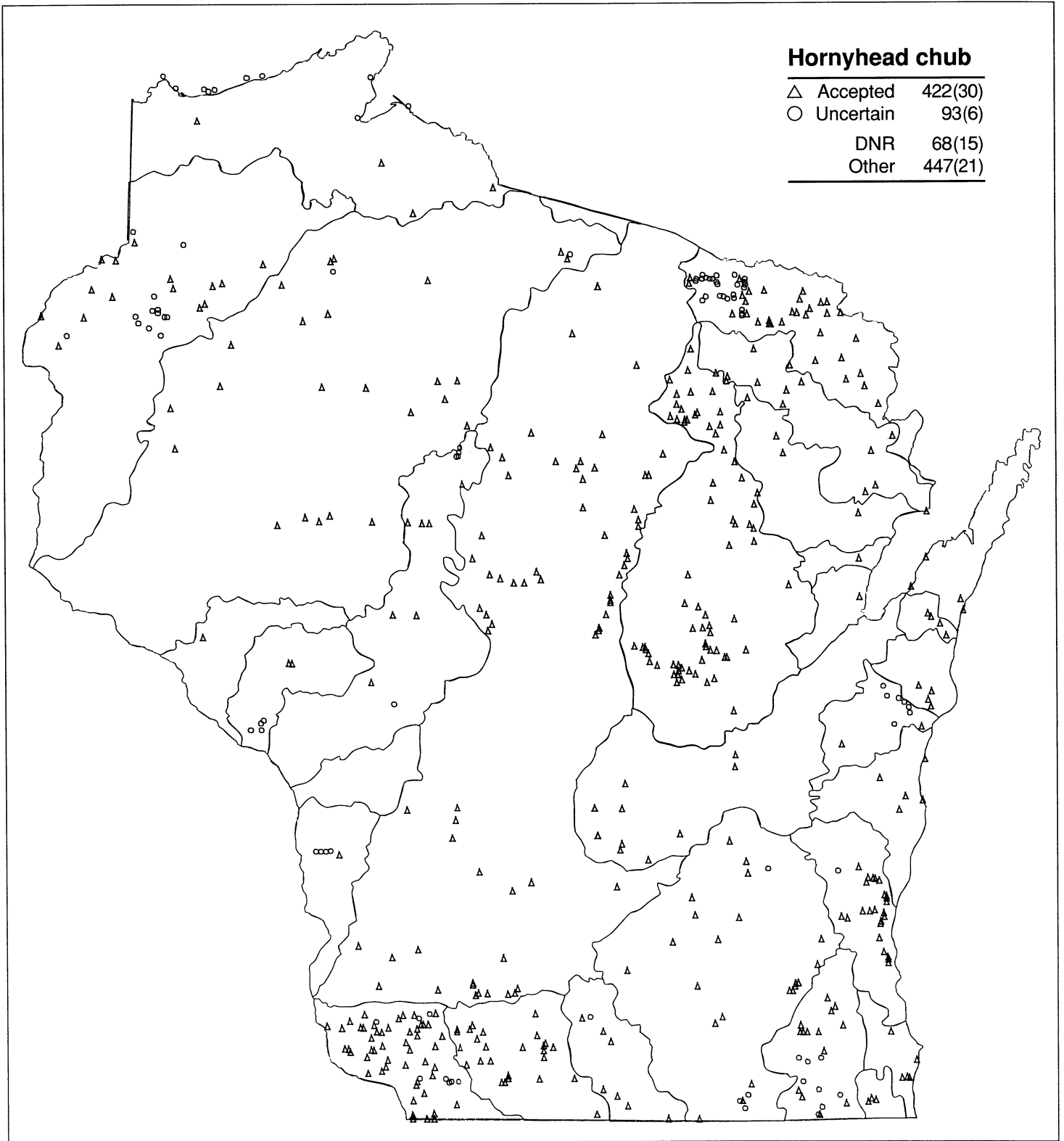


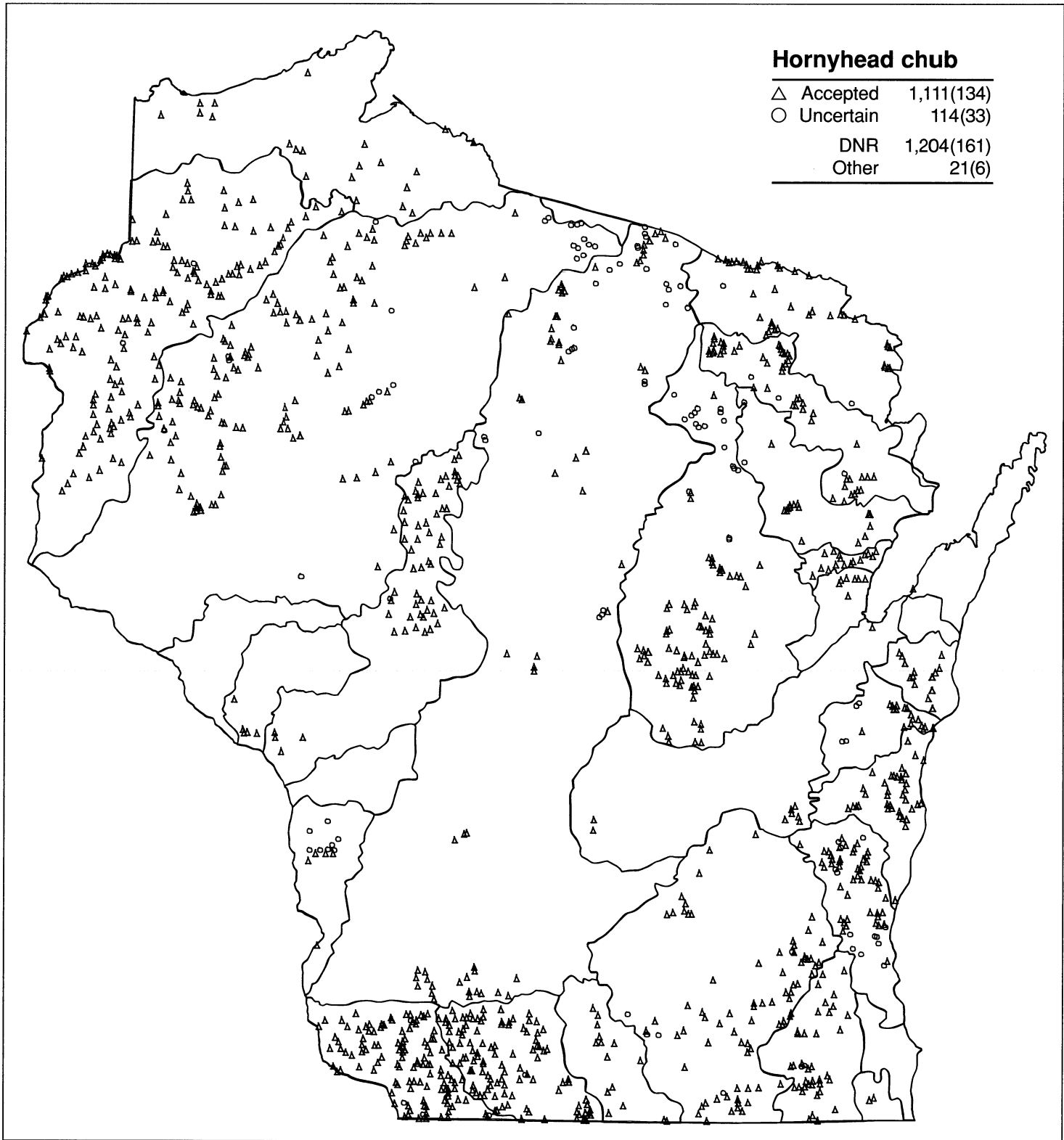
Map 42(E)



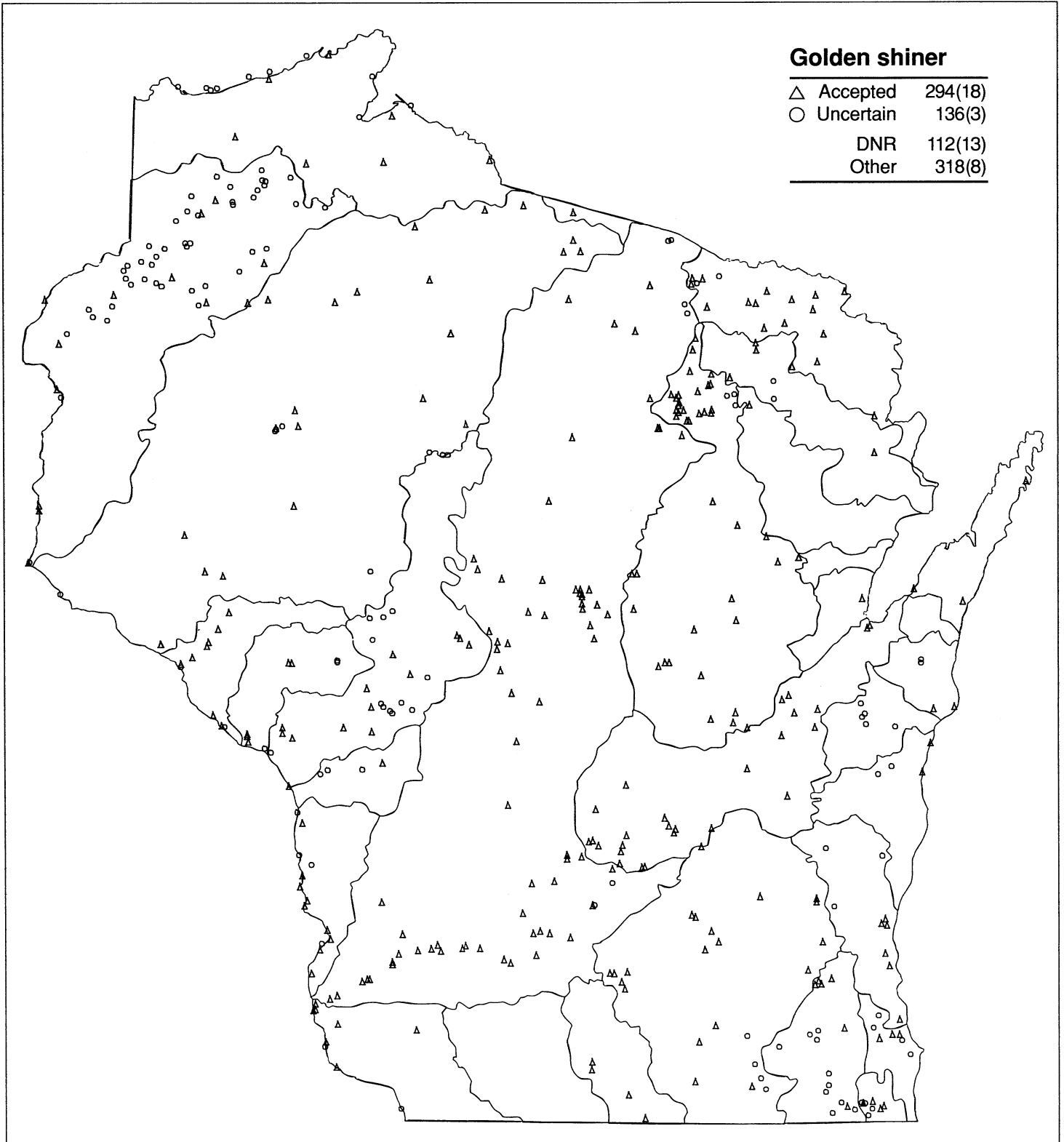


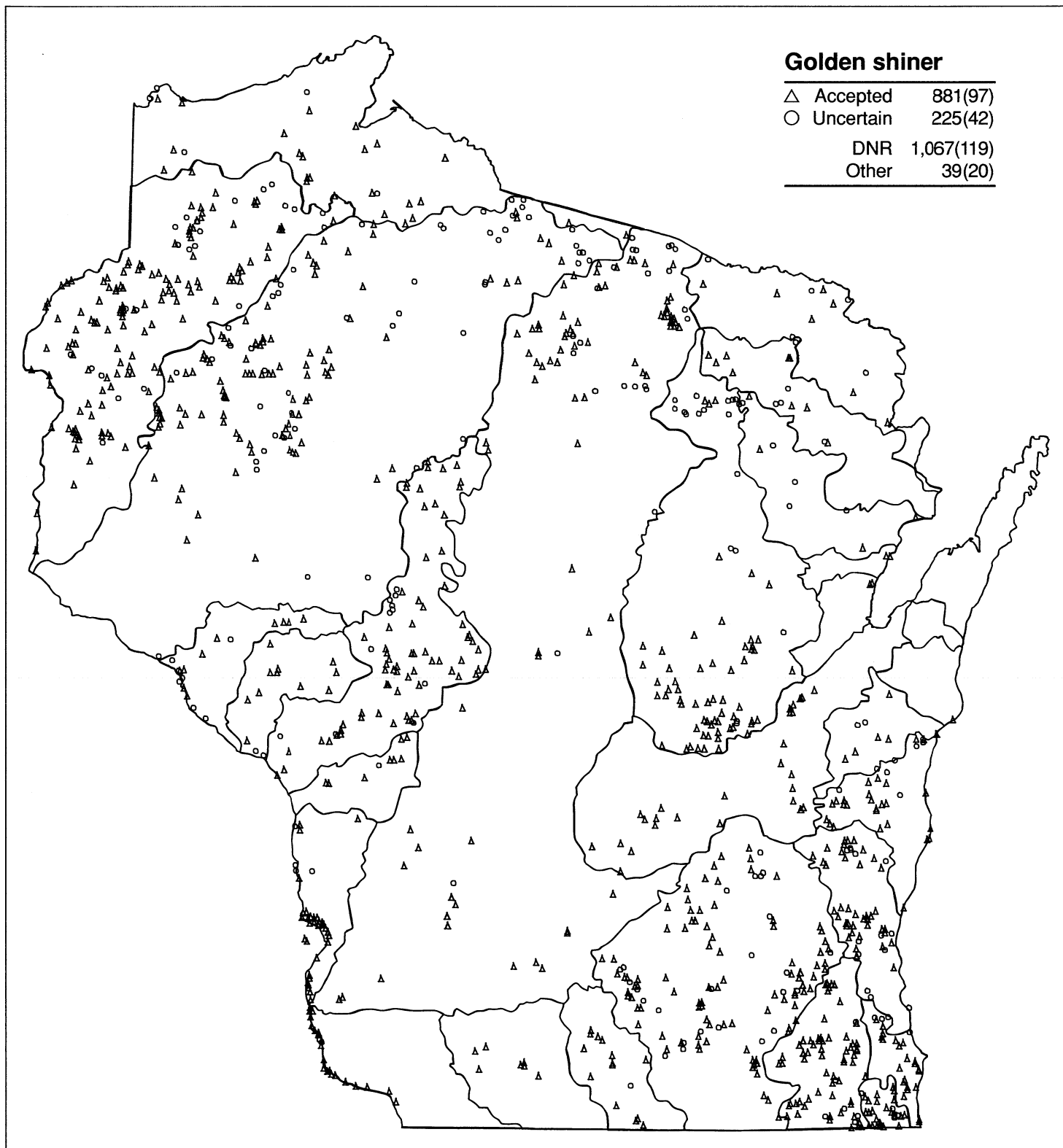
Map 43(E)



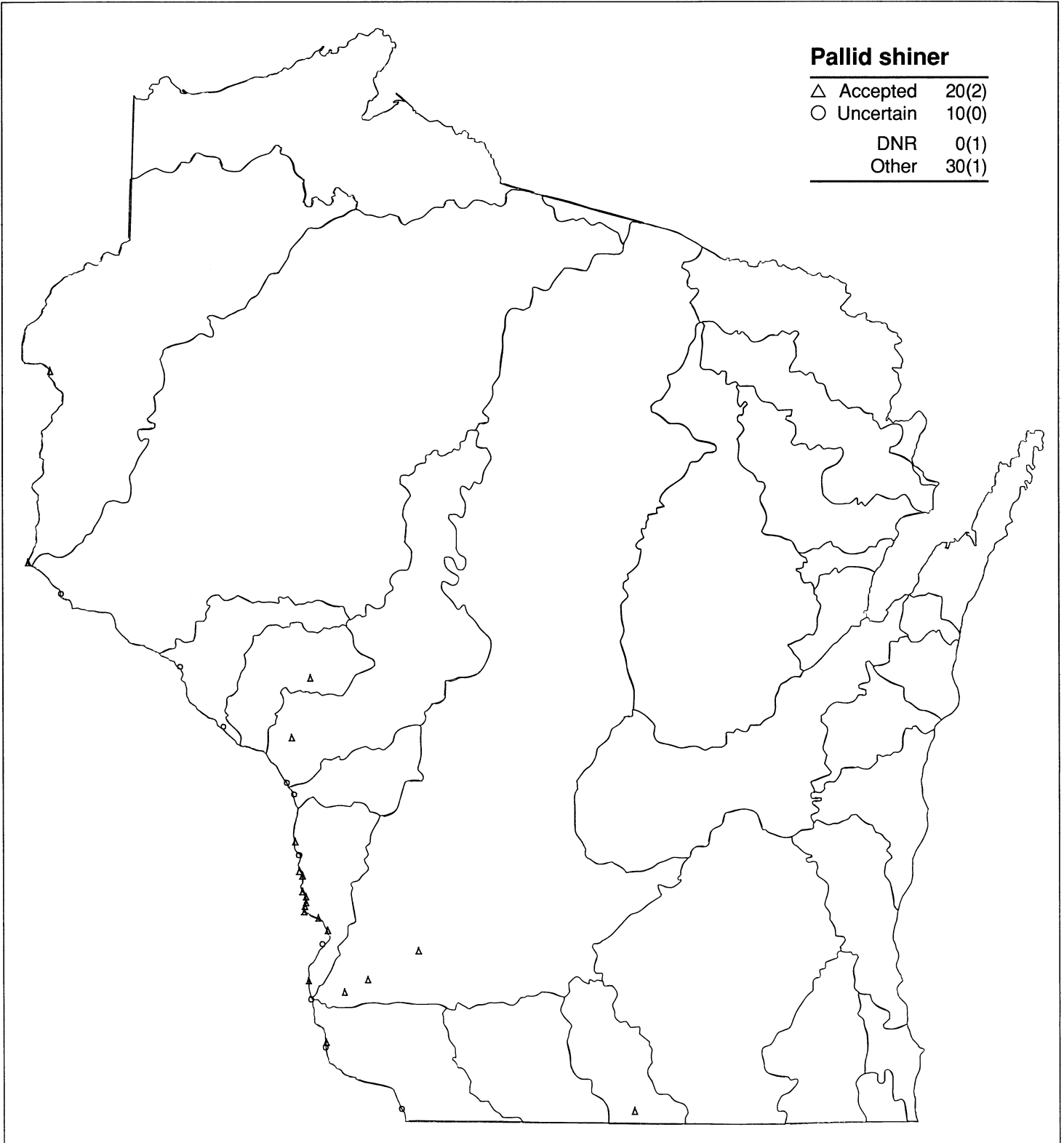


Map 44(E)

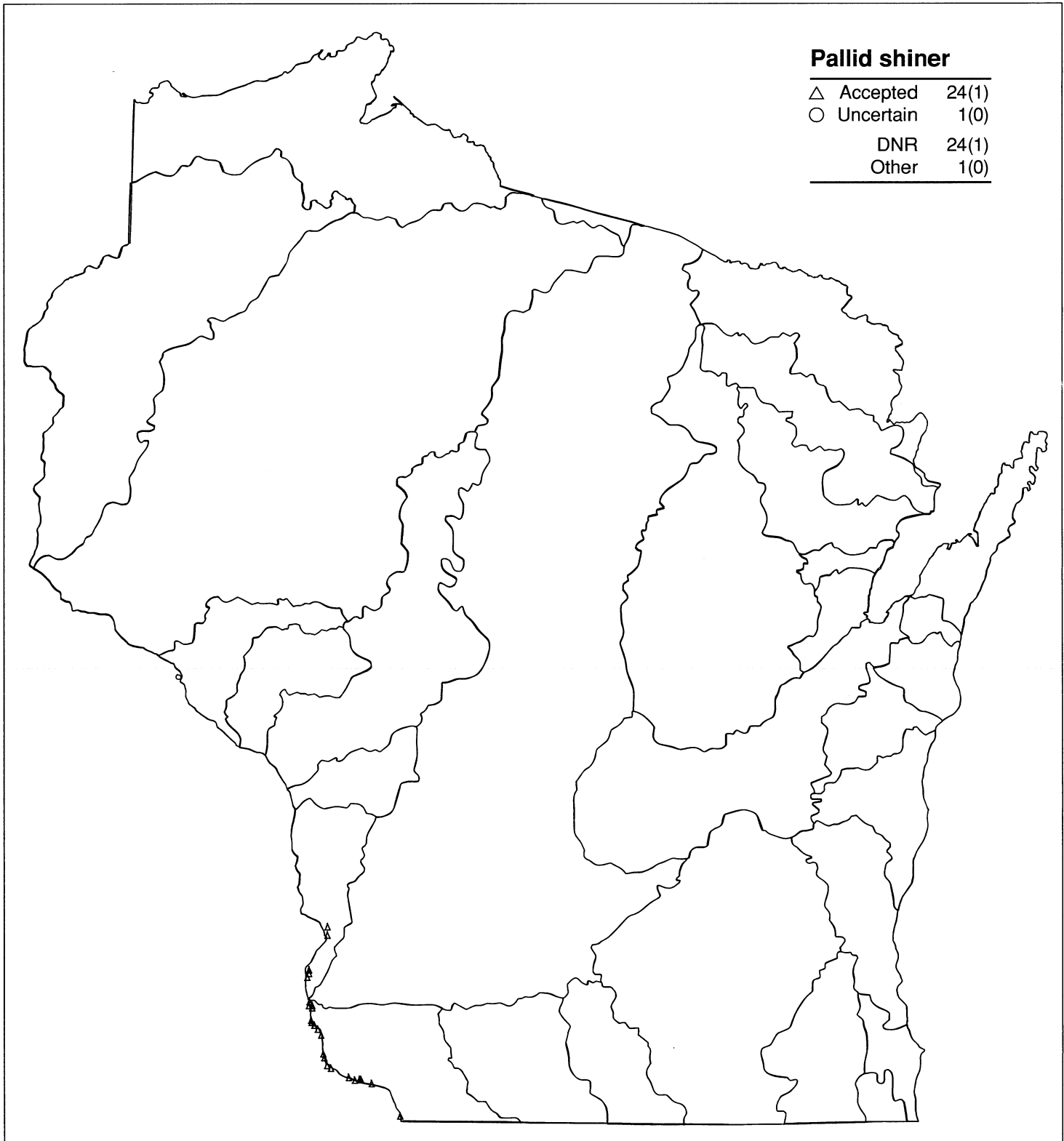




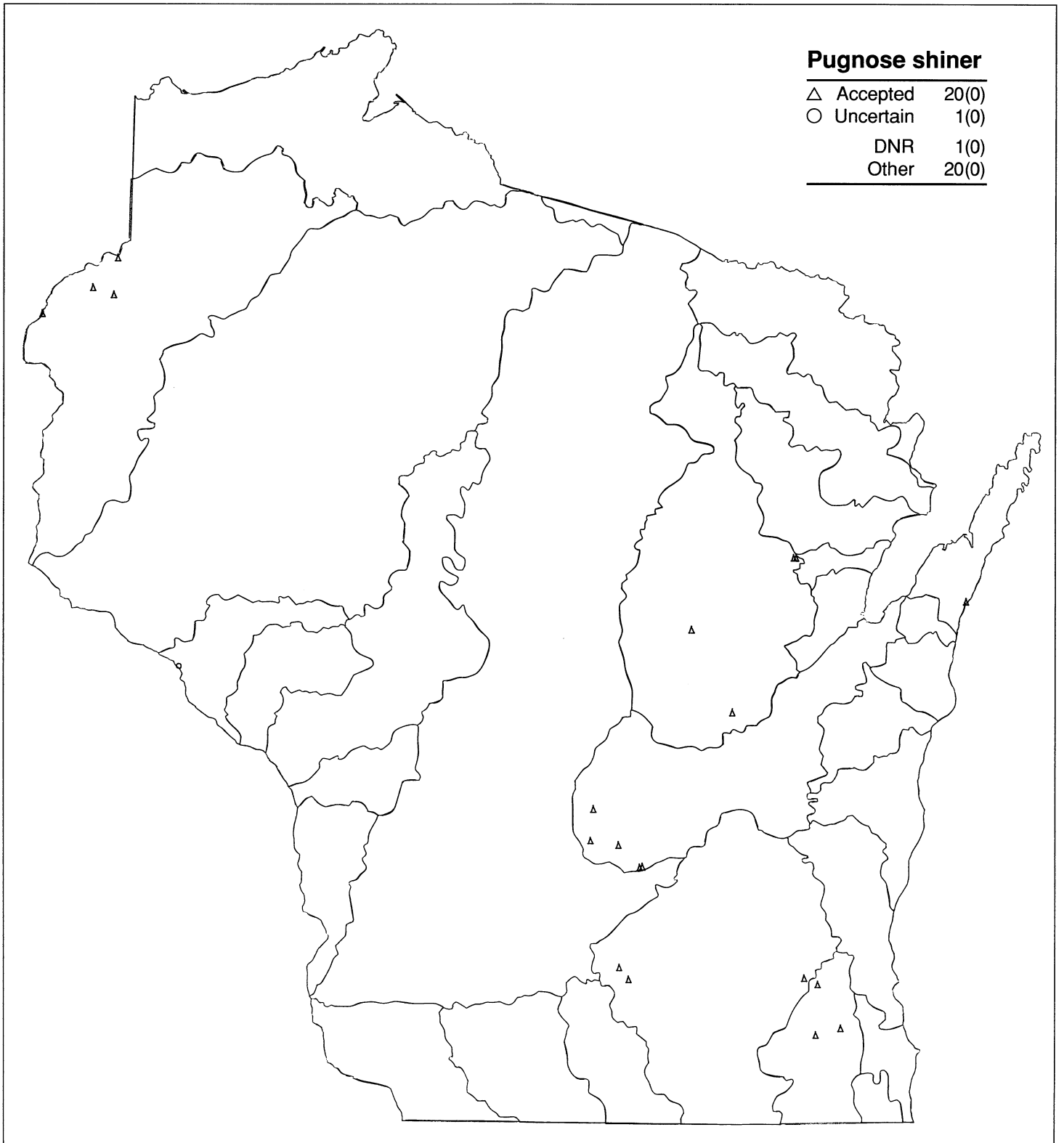
Map 45(E)



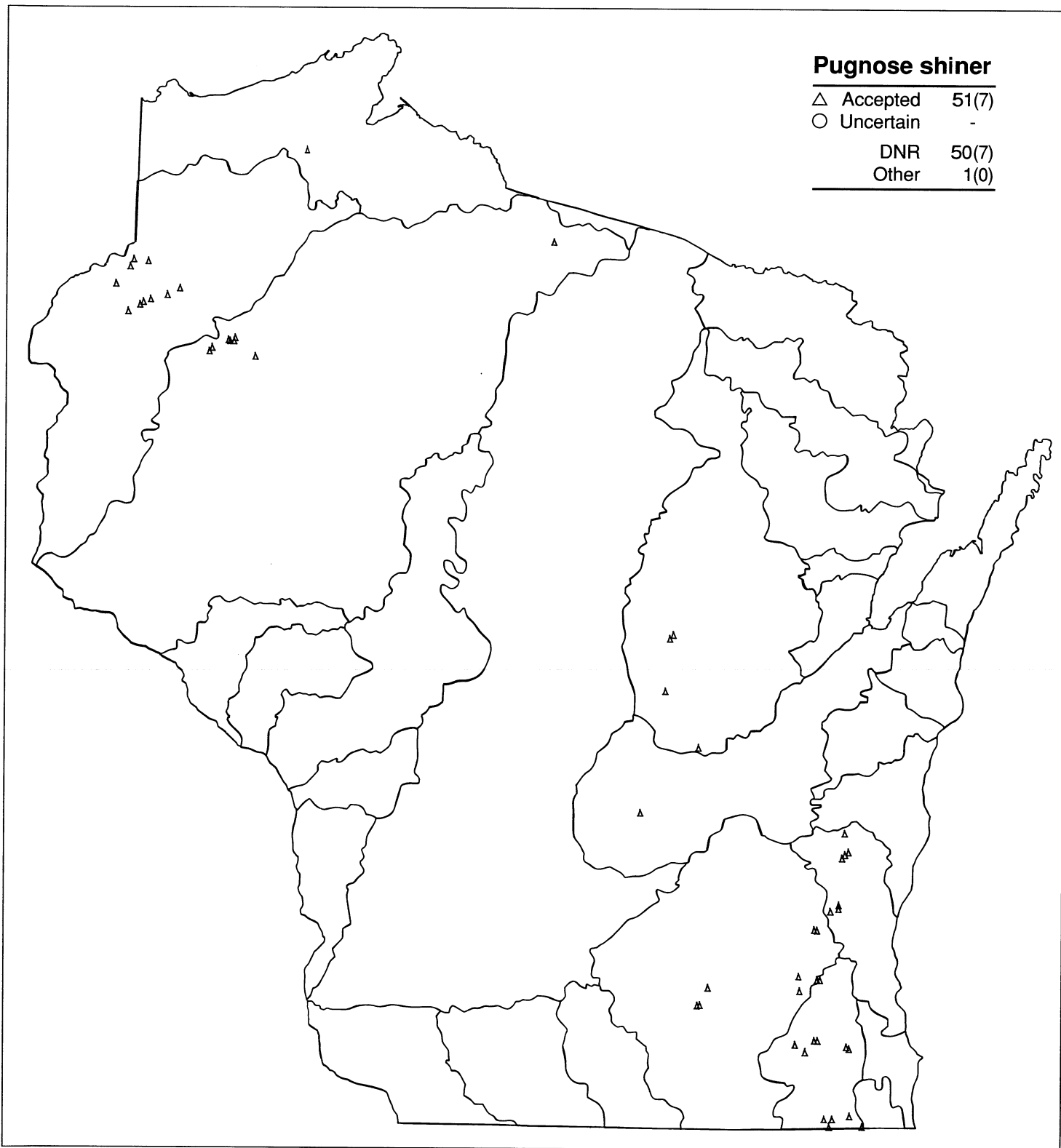
Map 45(L)



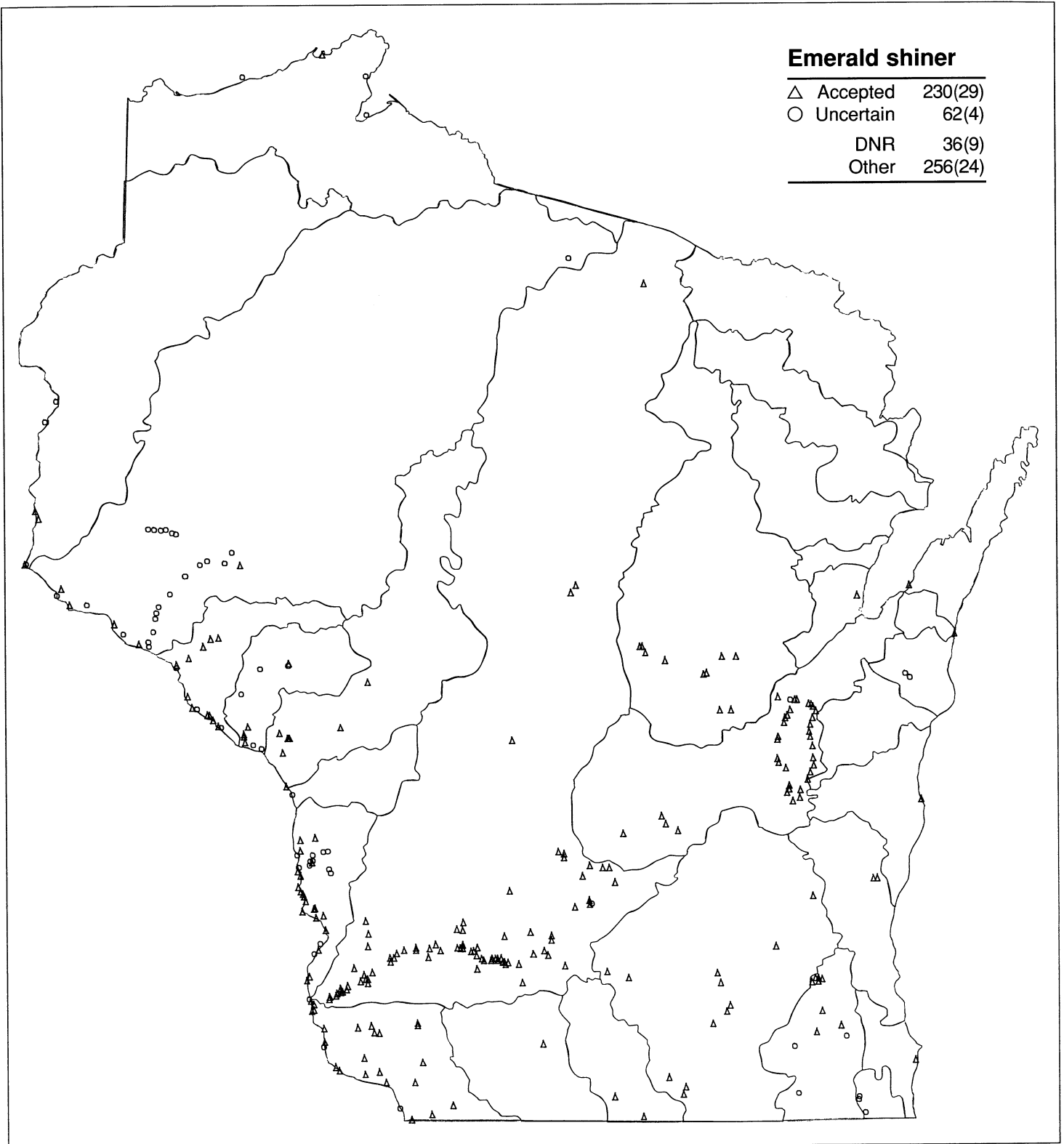
Map 46(E)

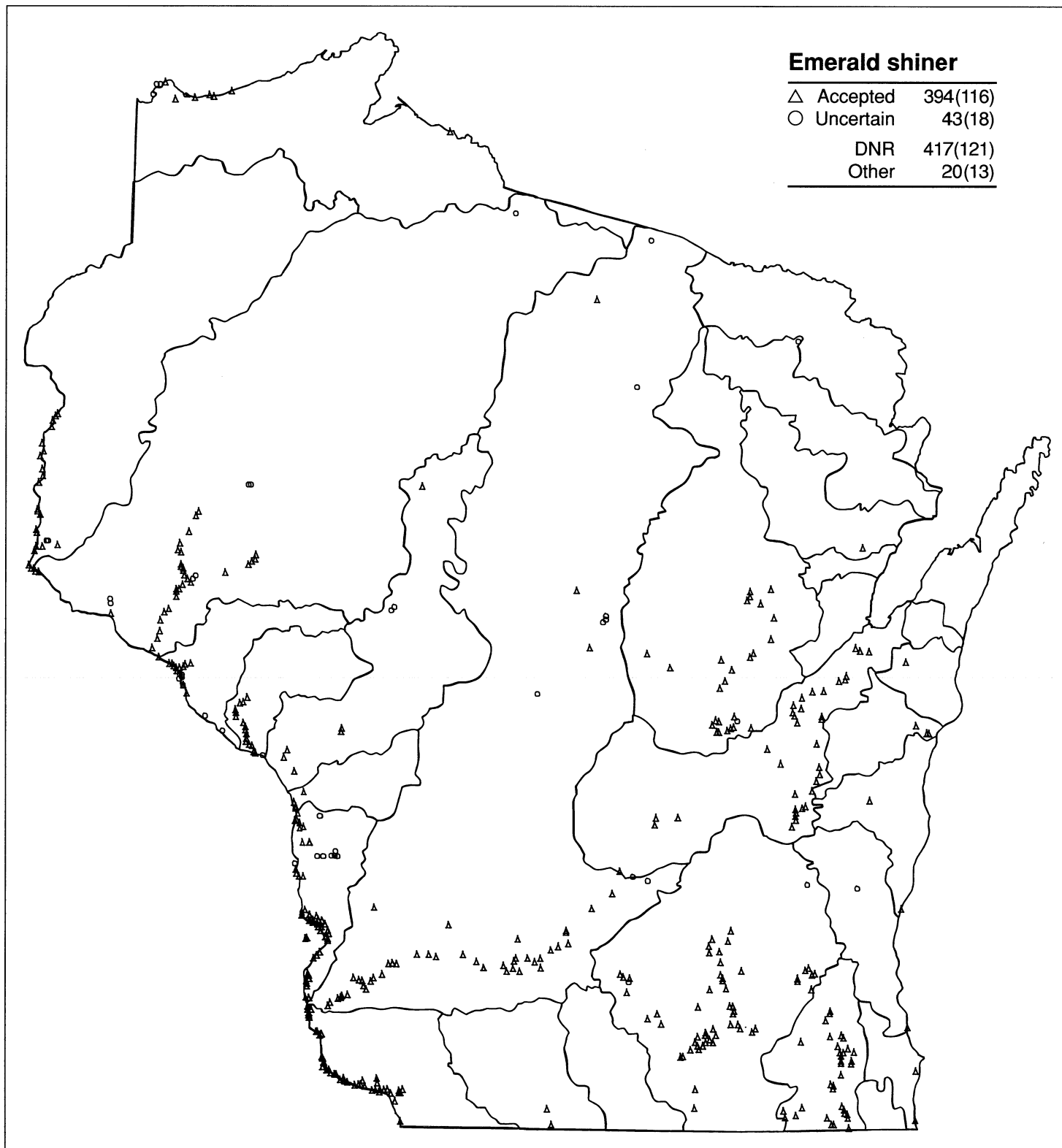


Map 46(L)

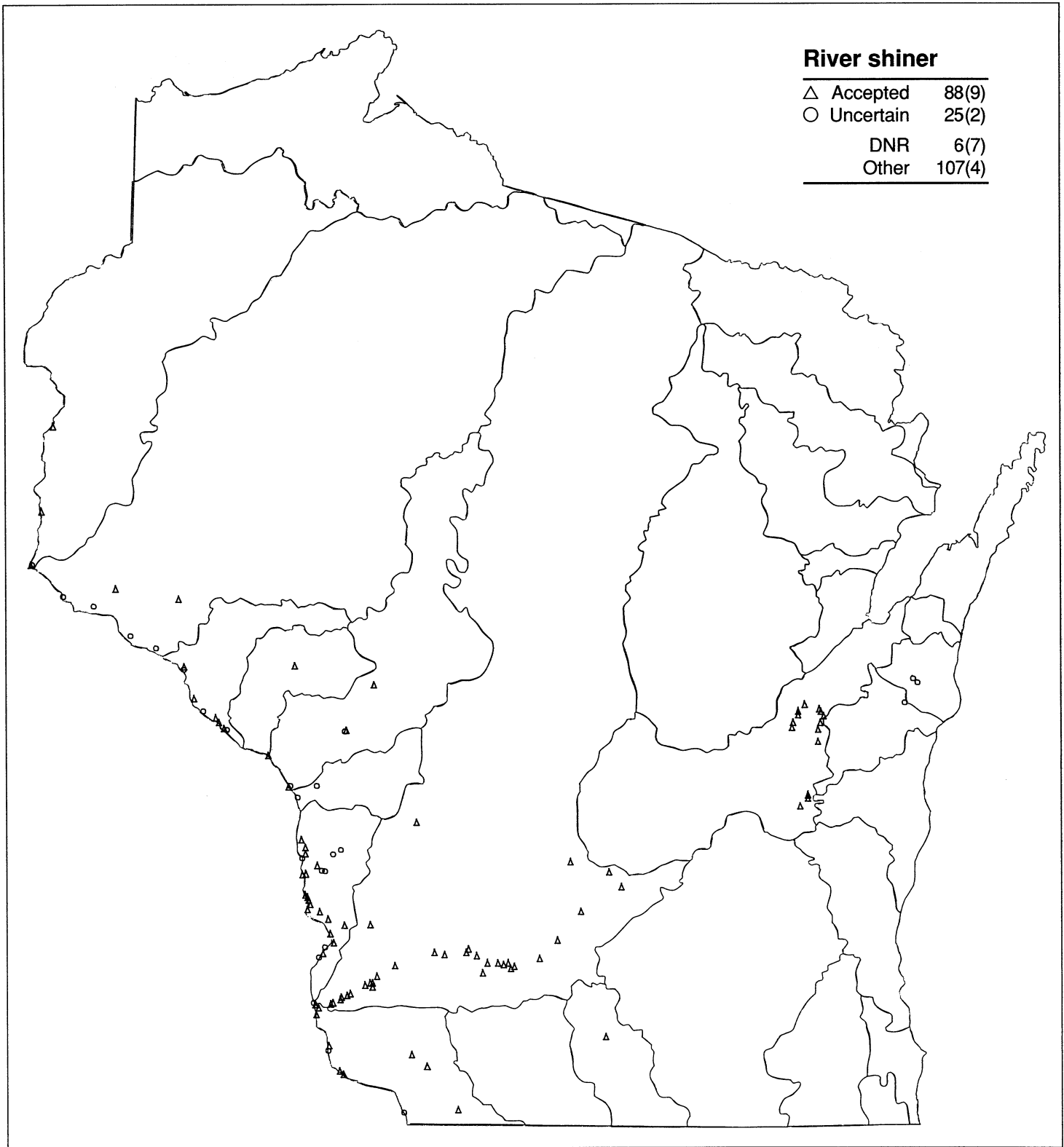


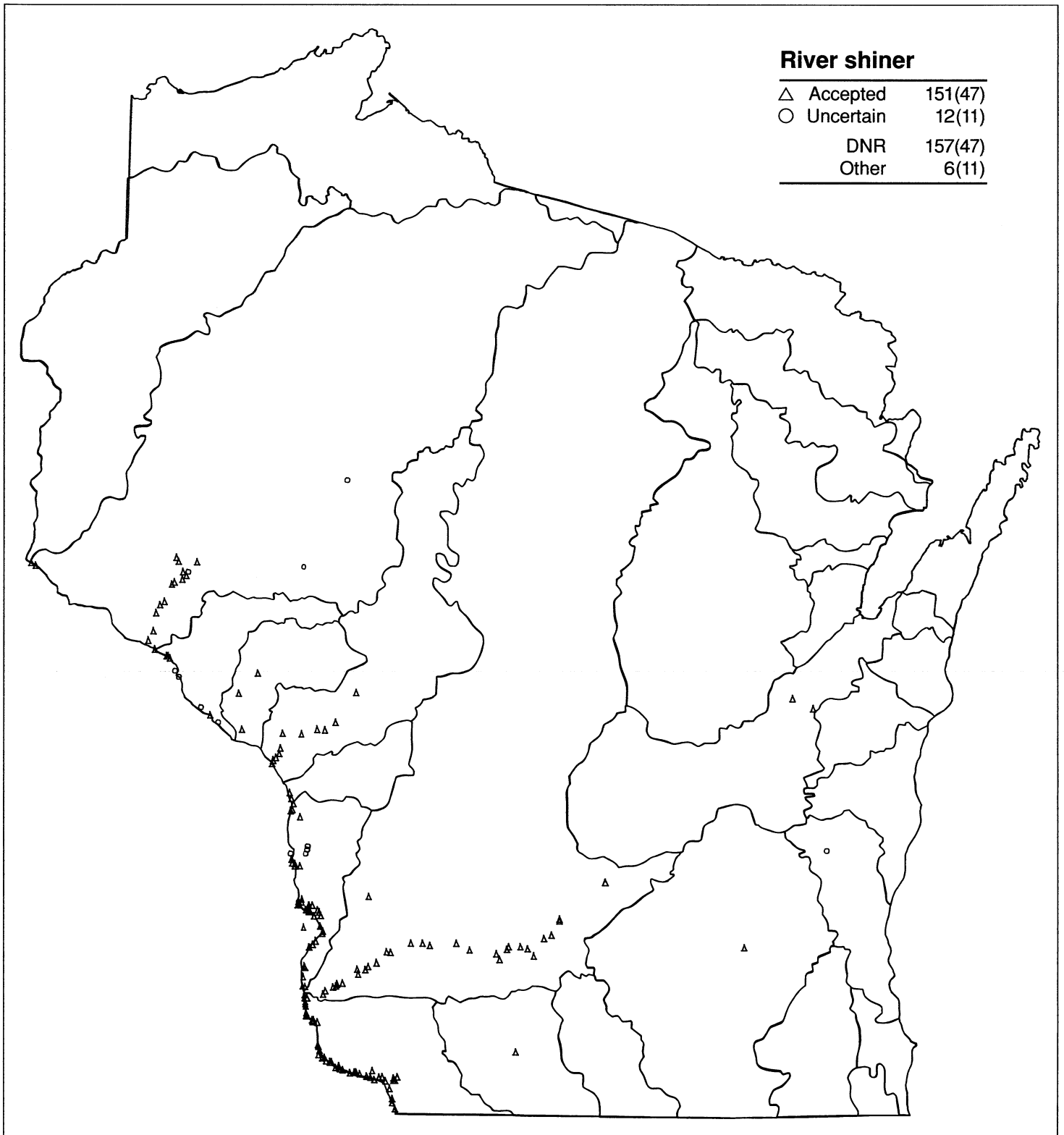
Map 47(E)



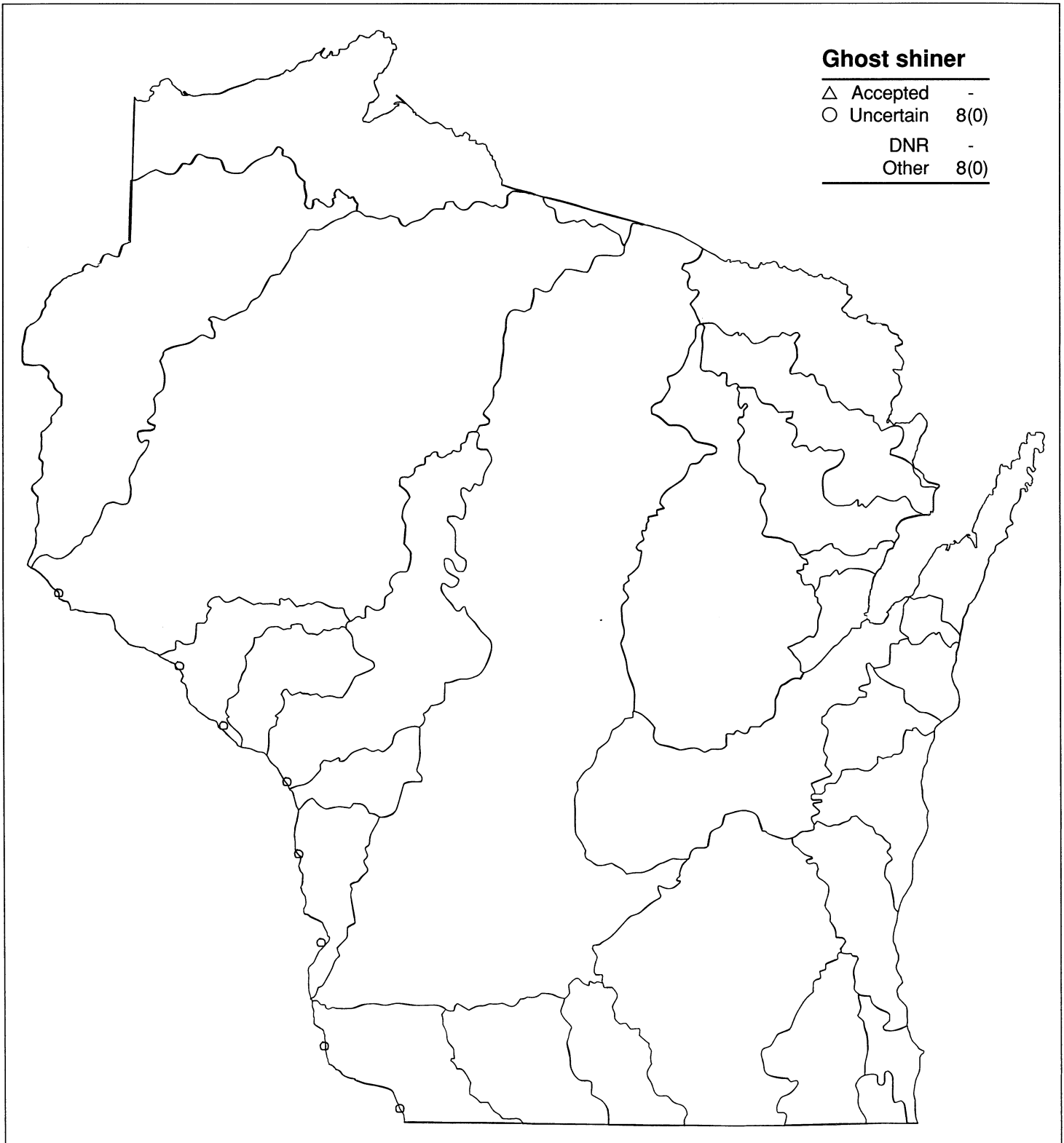


Map 48(E)



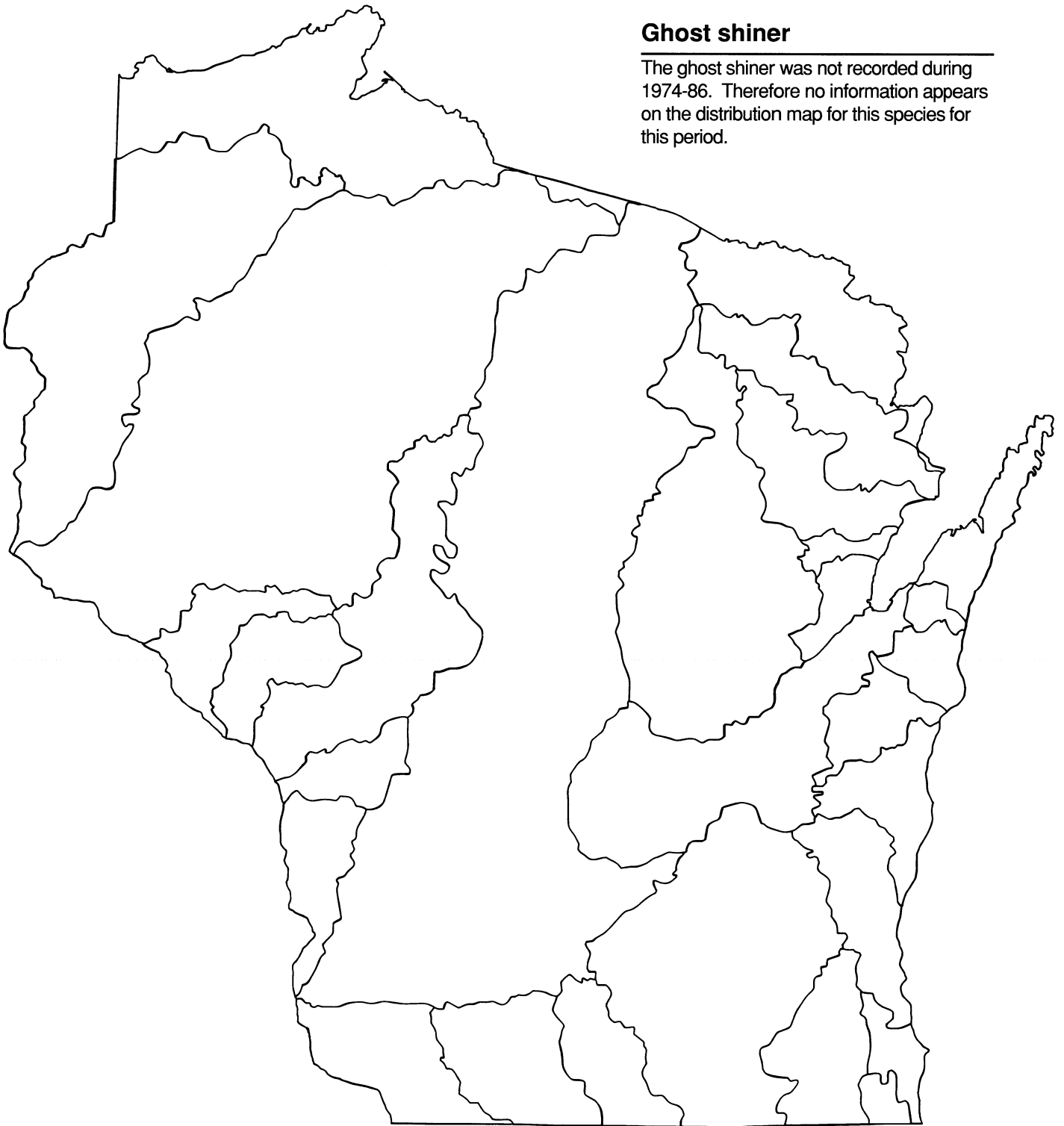


Map 49(E)

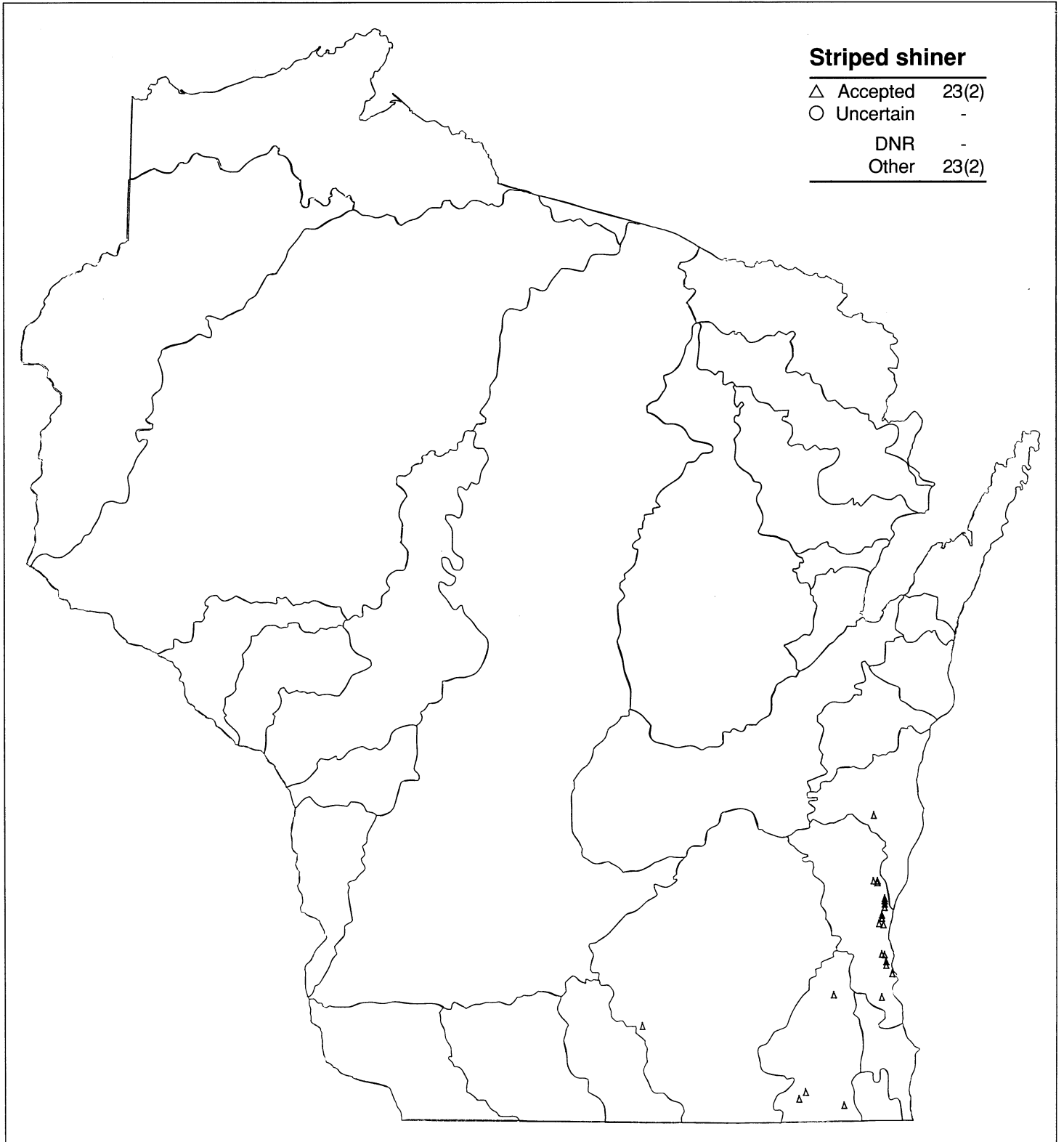


Ghost shiner

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)



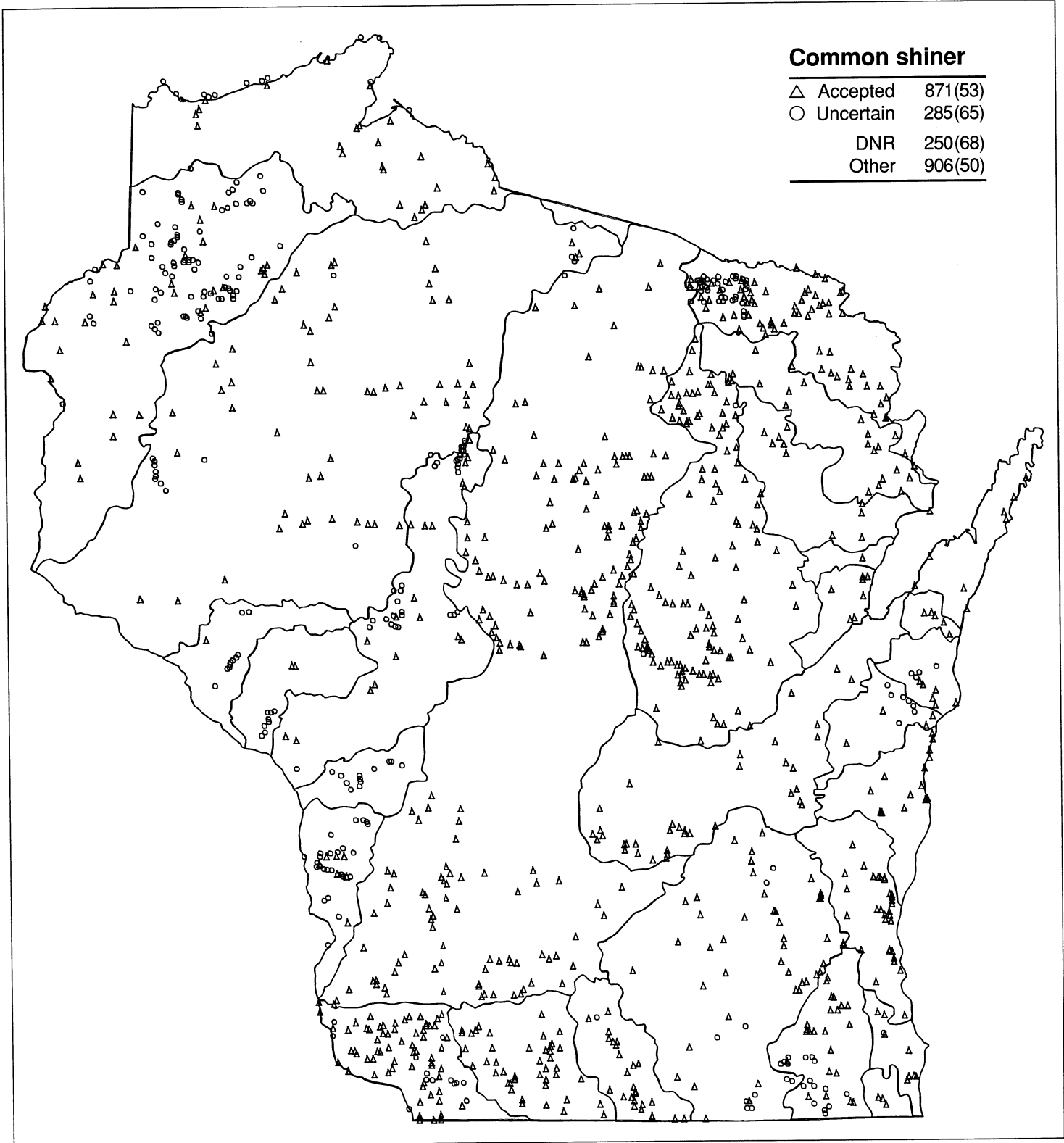
Map 50(L)

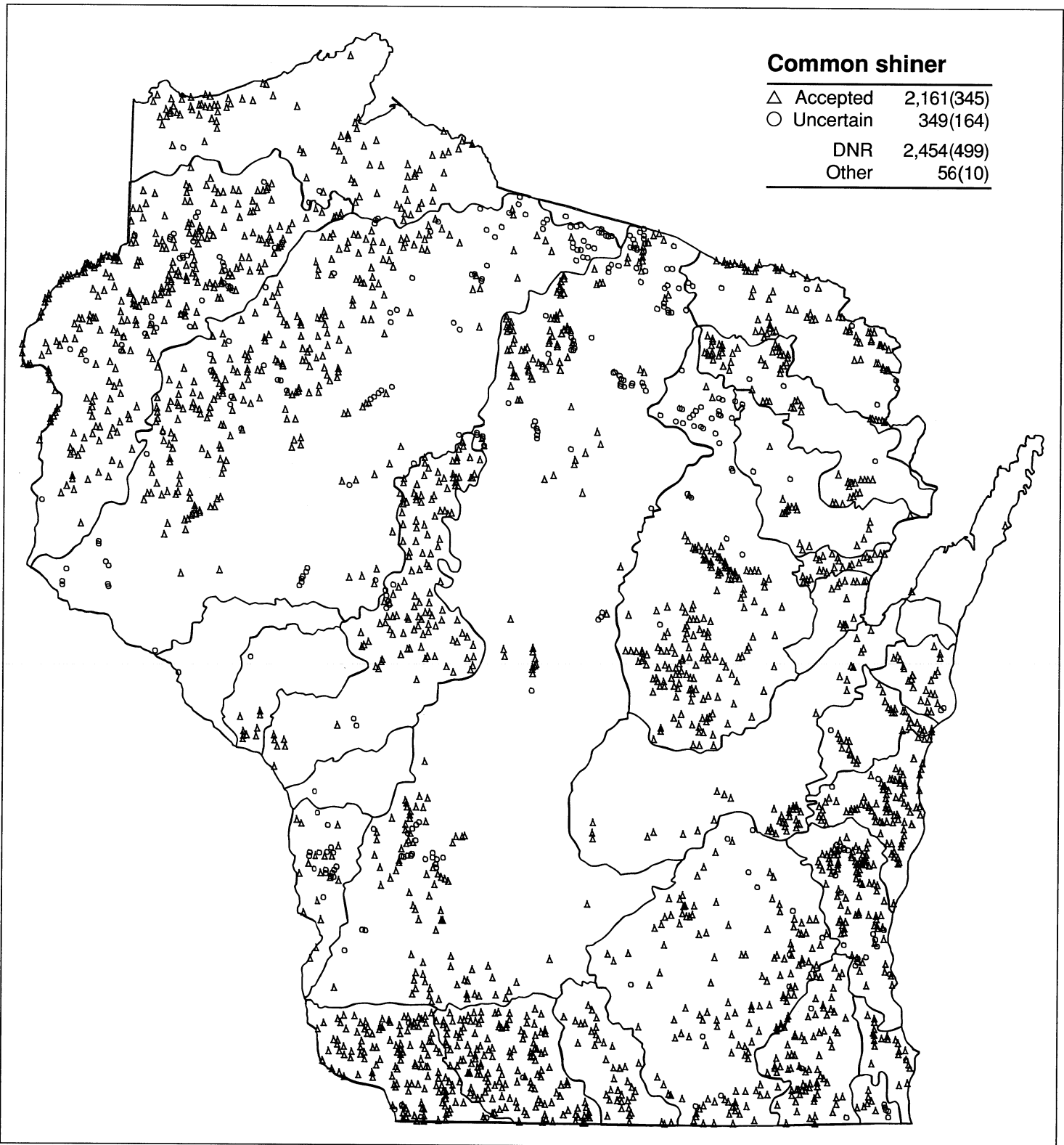
Striped shiner

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

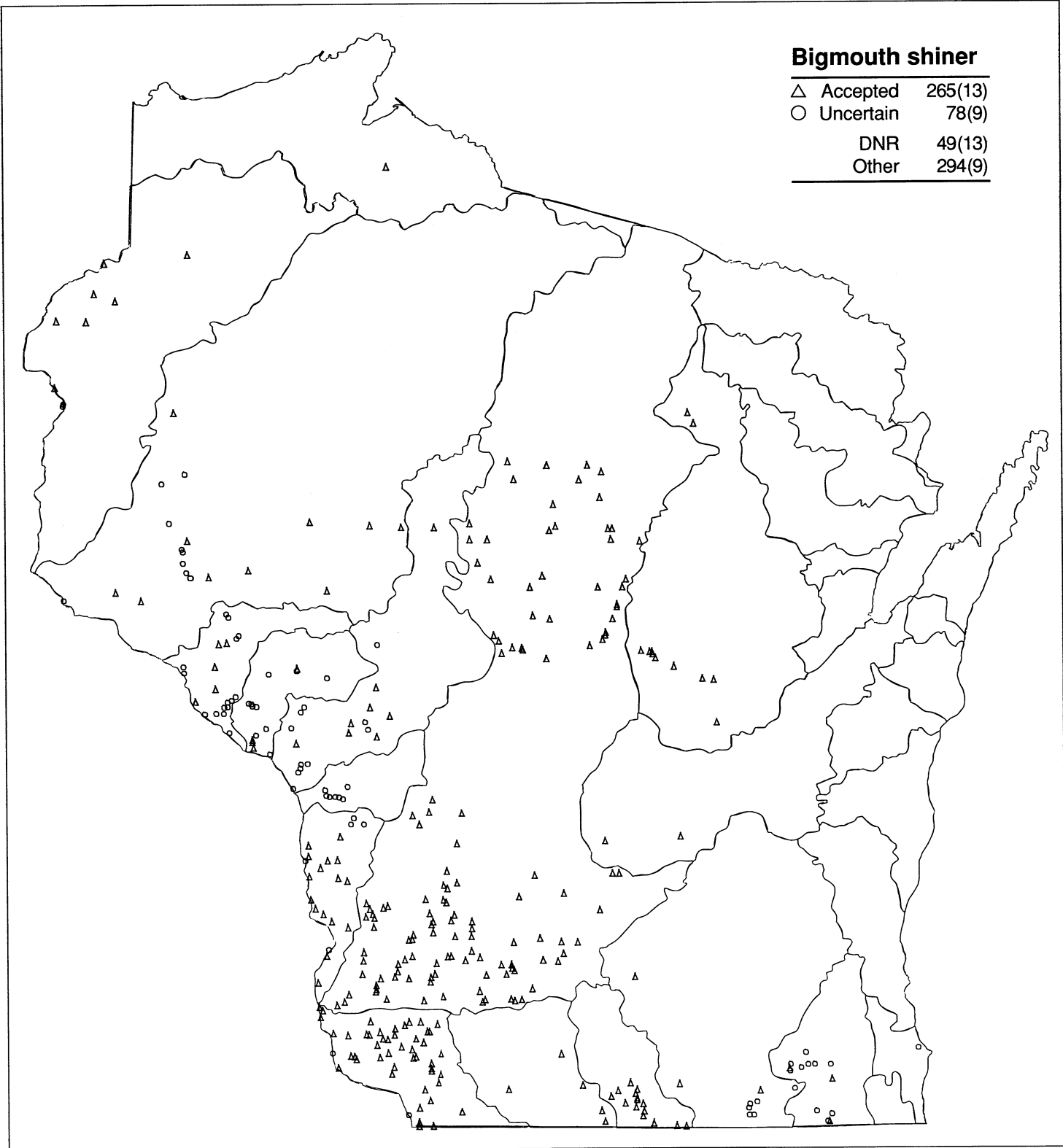


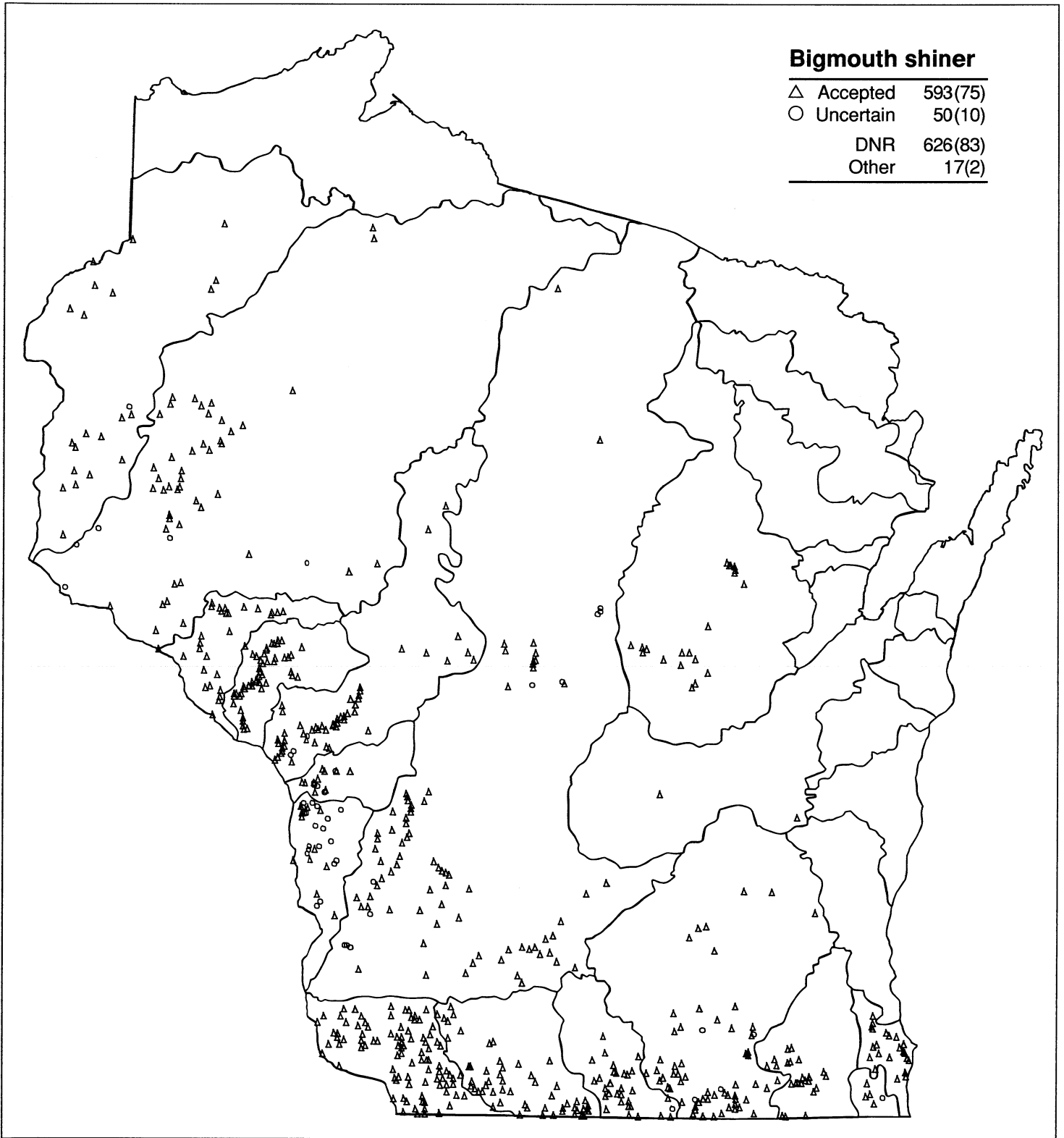
Map 51(E)



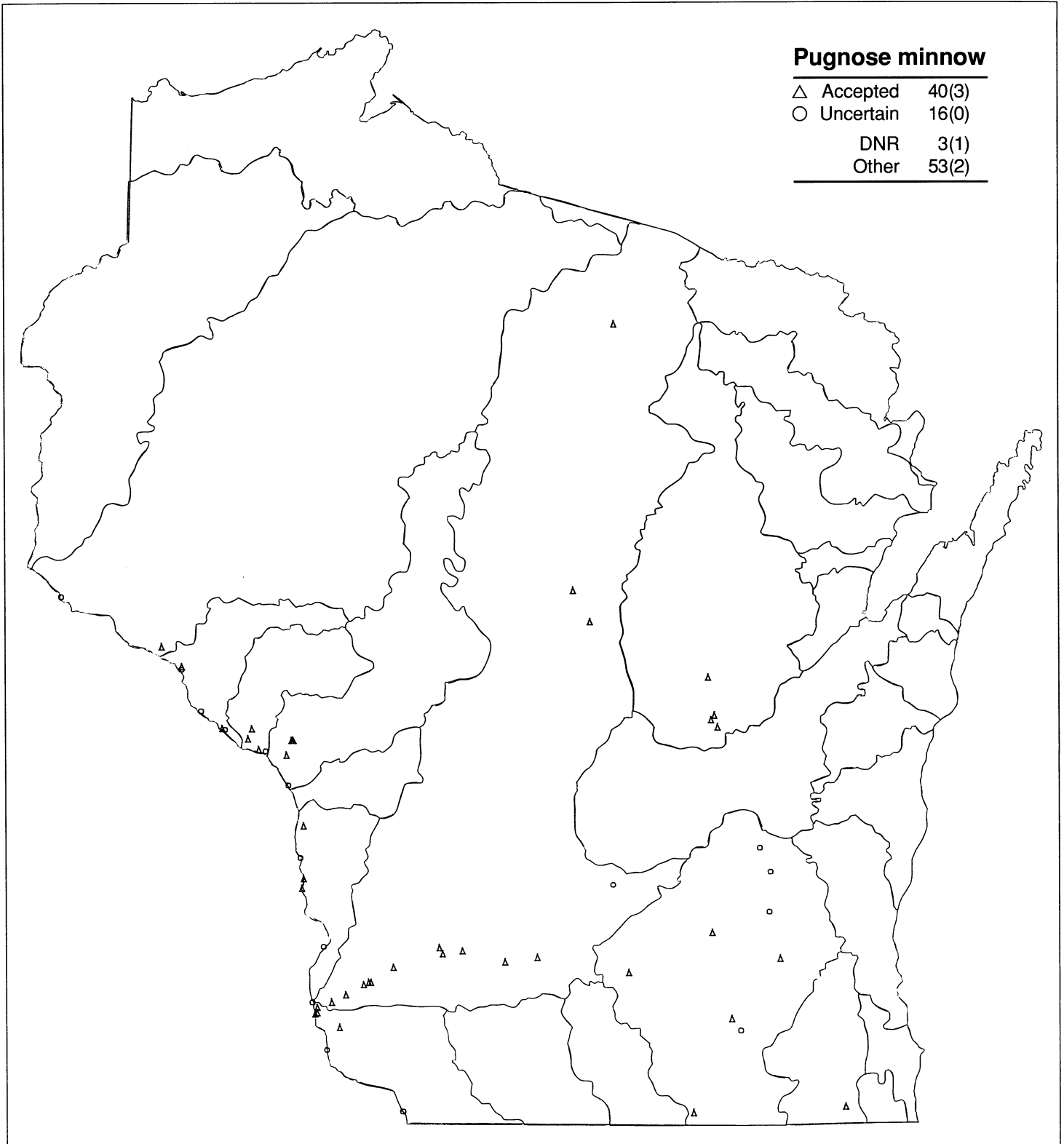


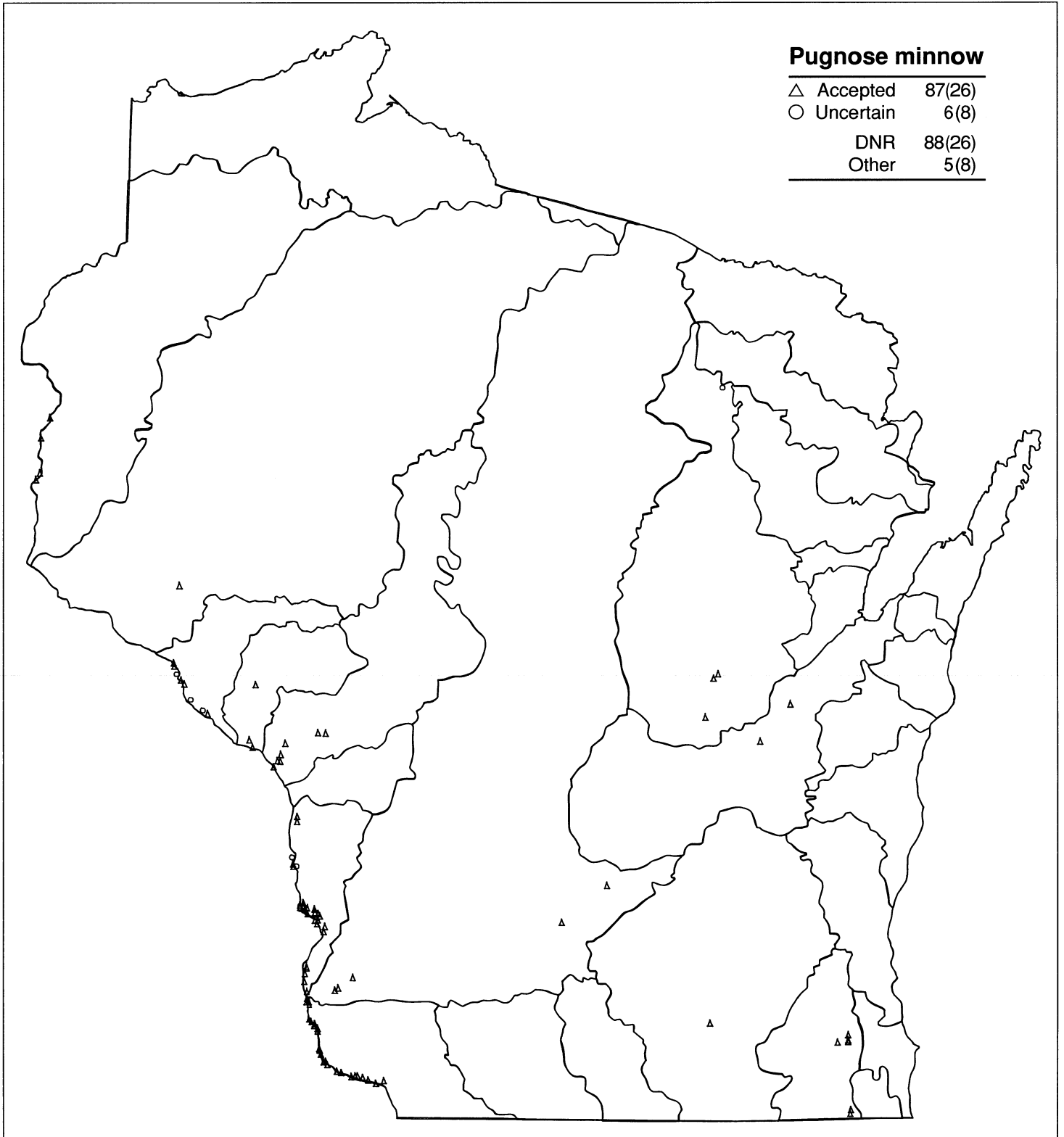
Map 52(E)



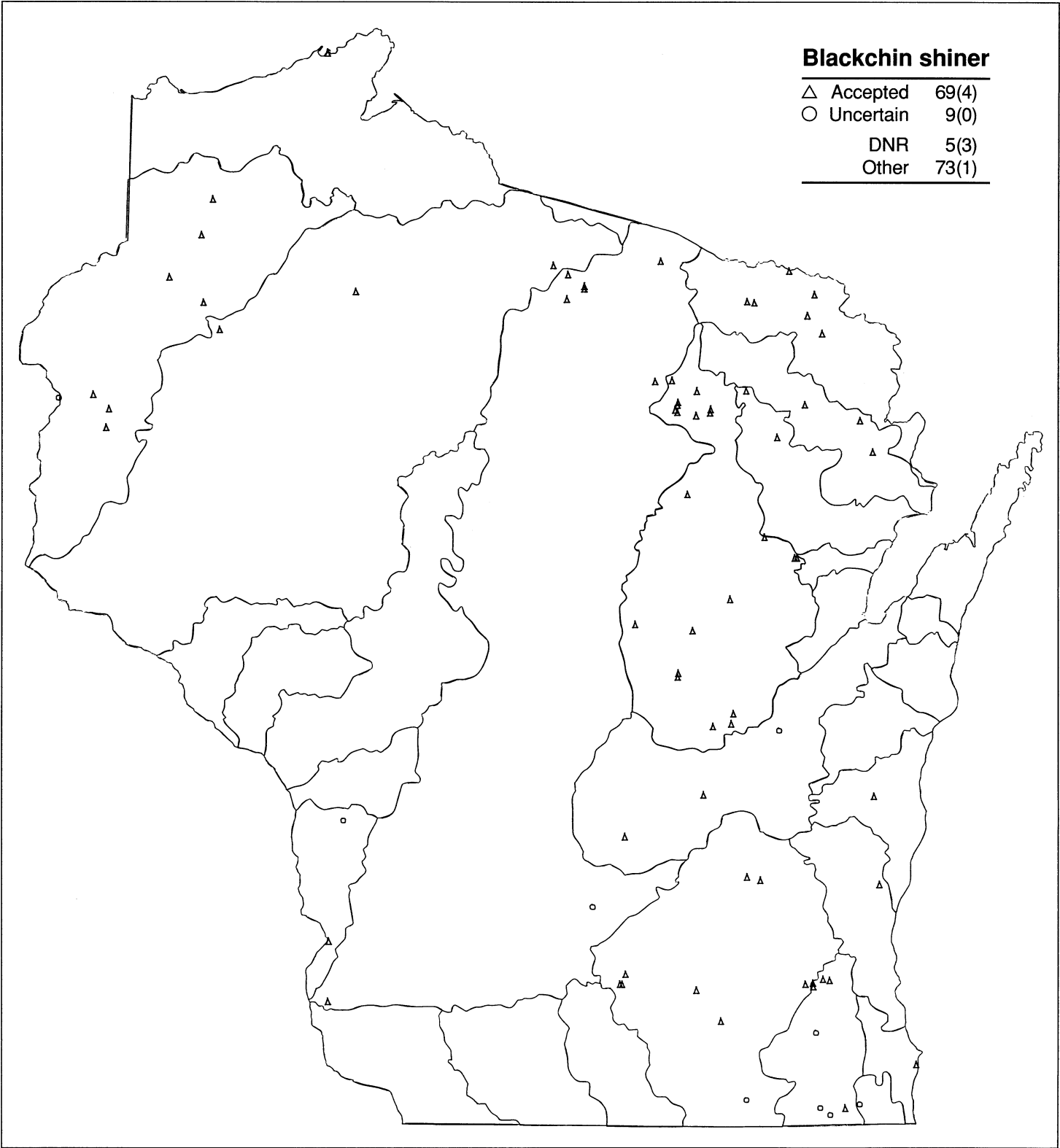


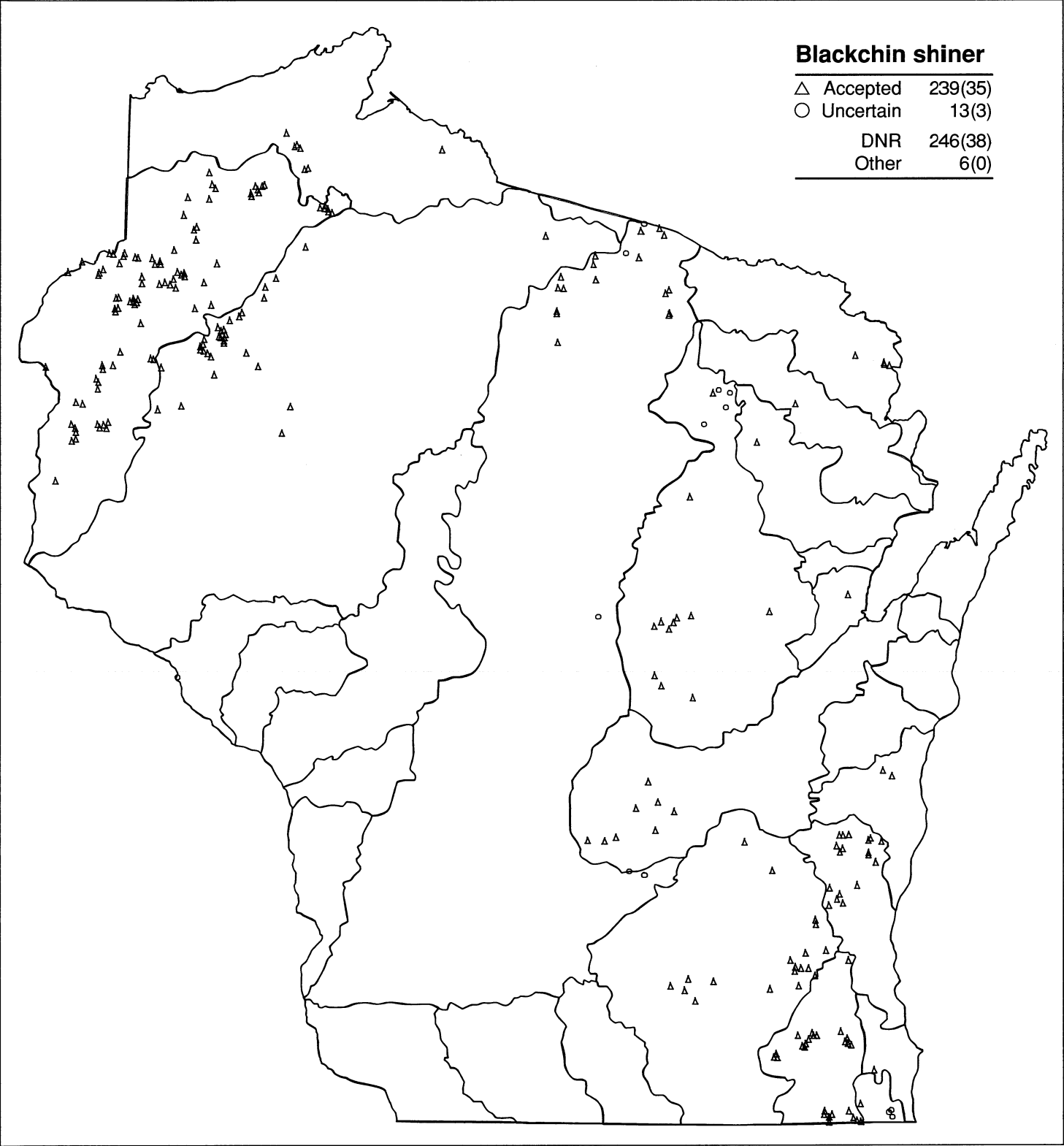
Map 53(E)



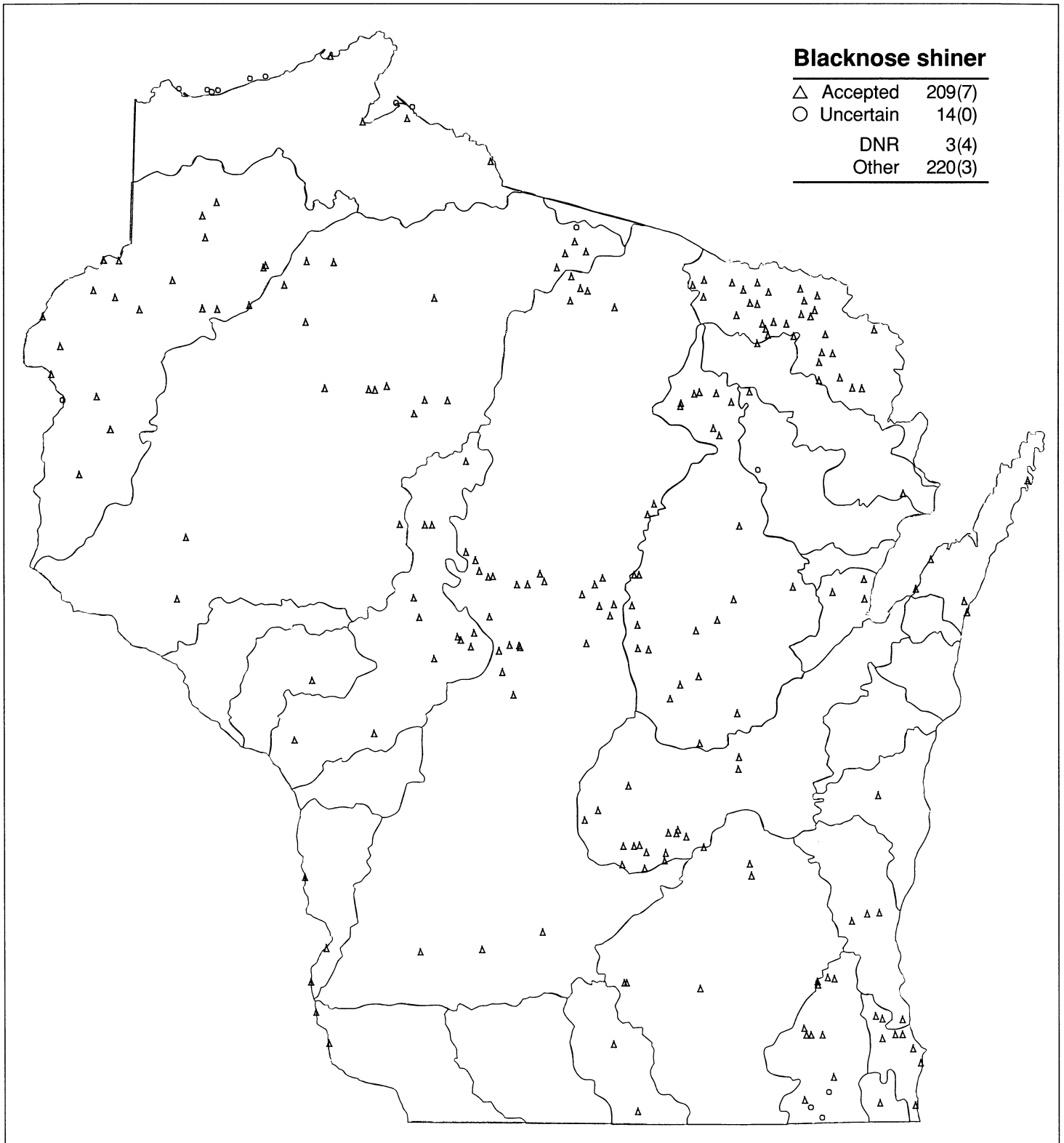


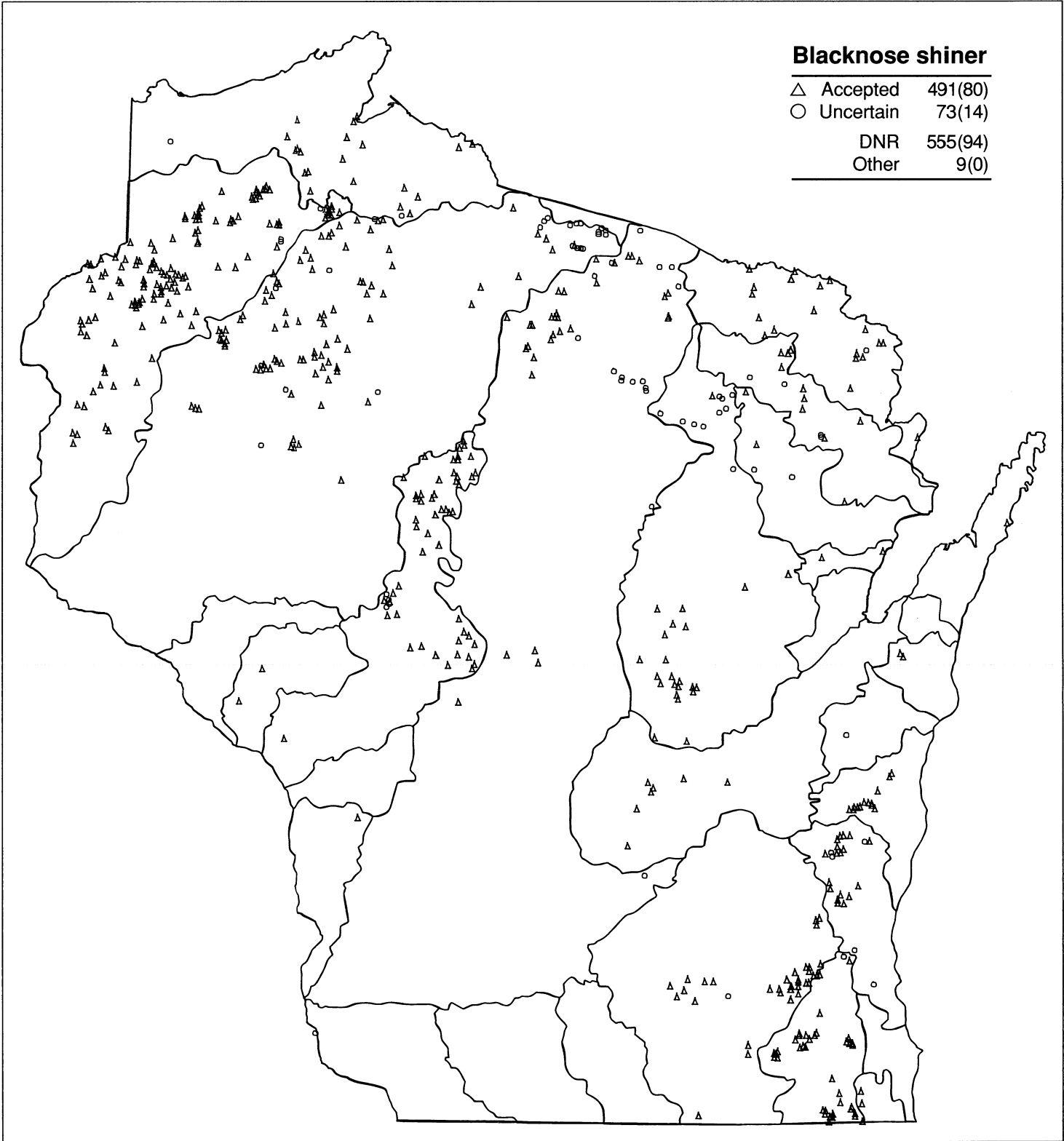
Map 54(E)



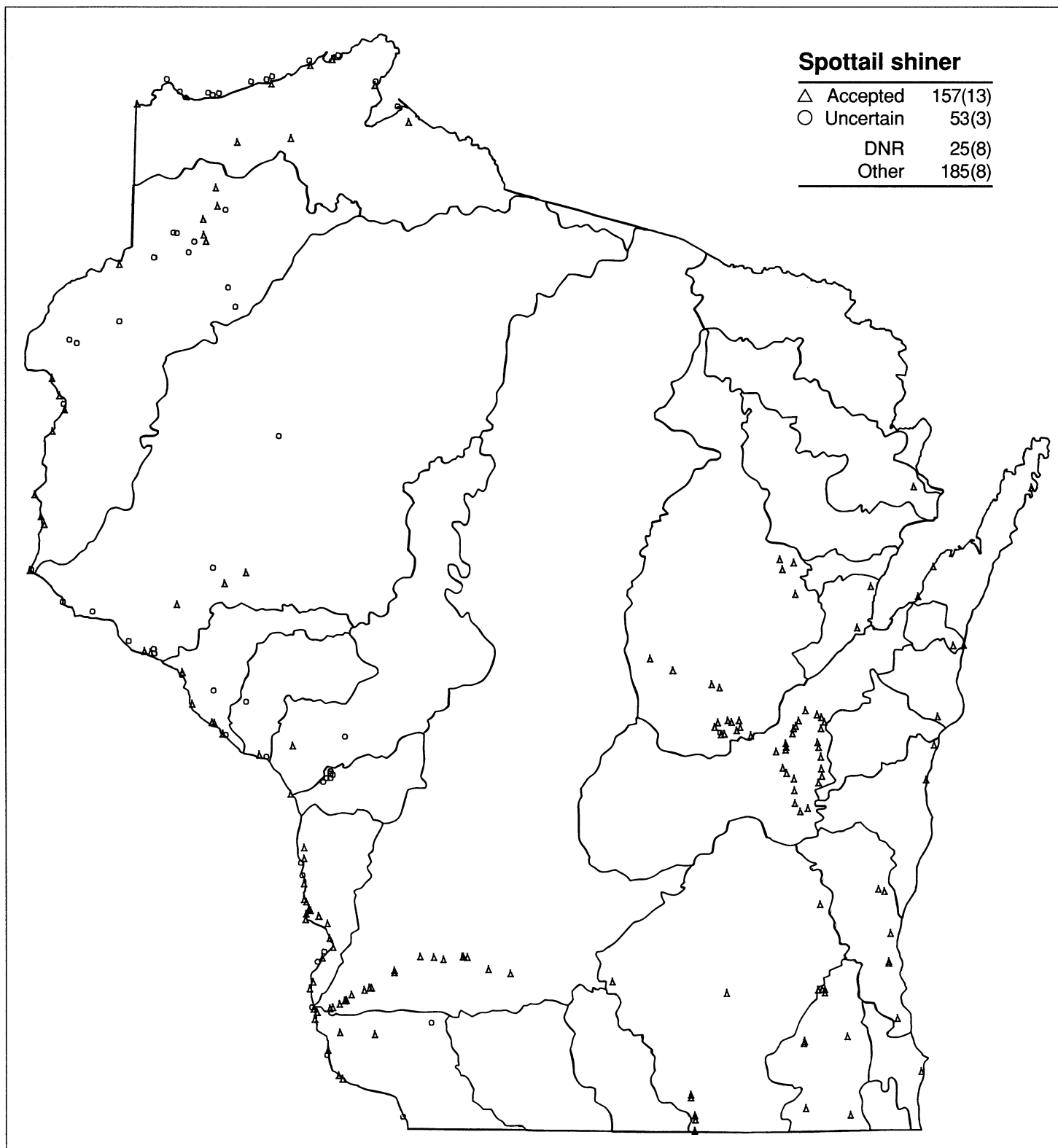


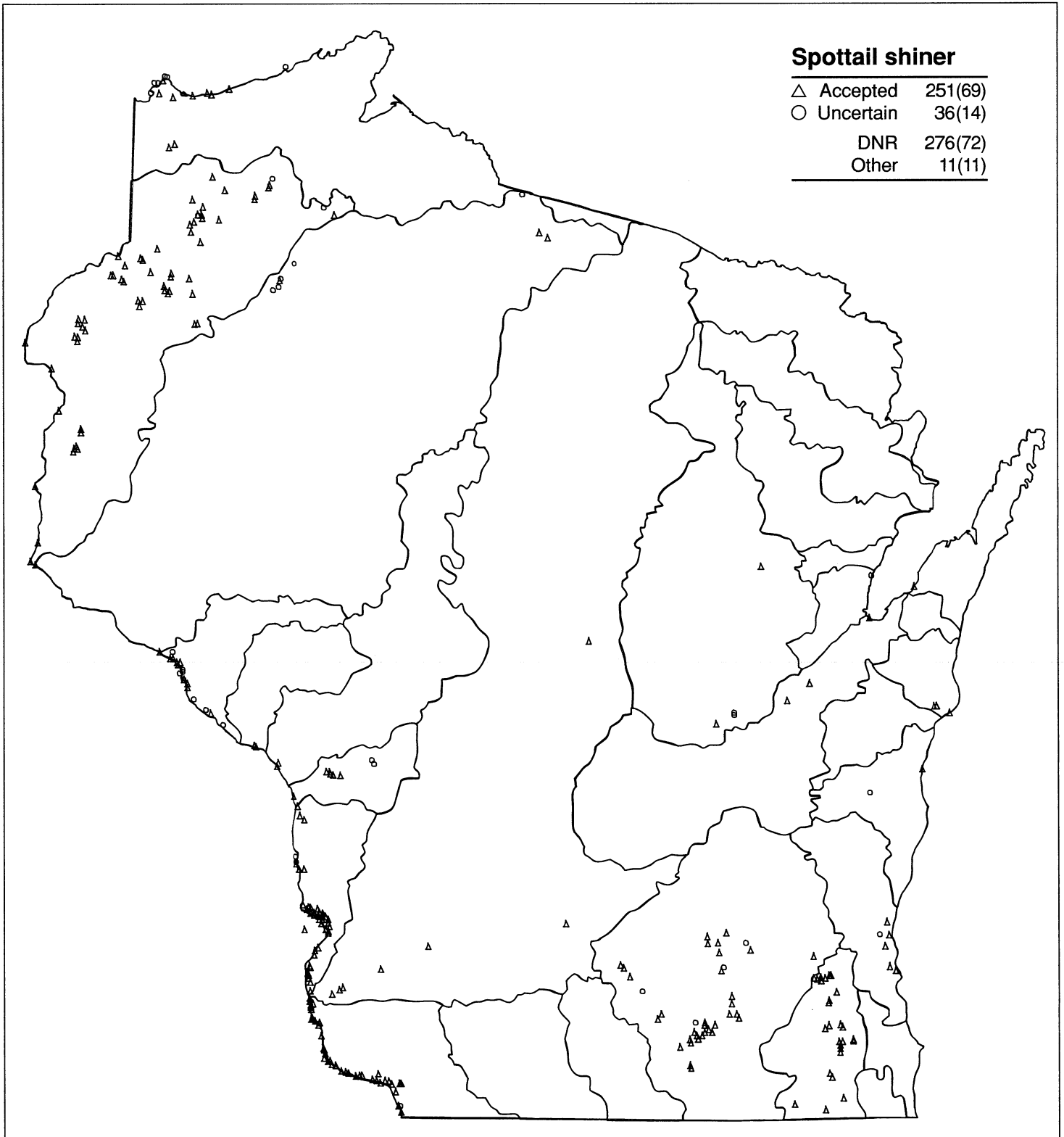
Map 55(E)



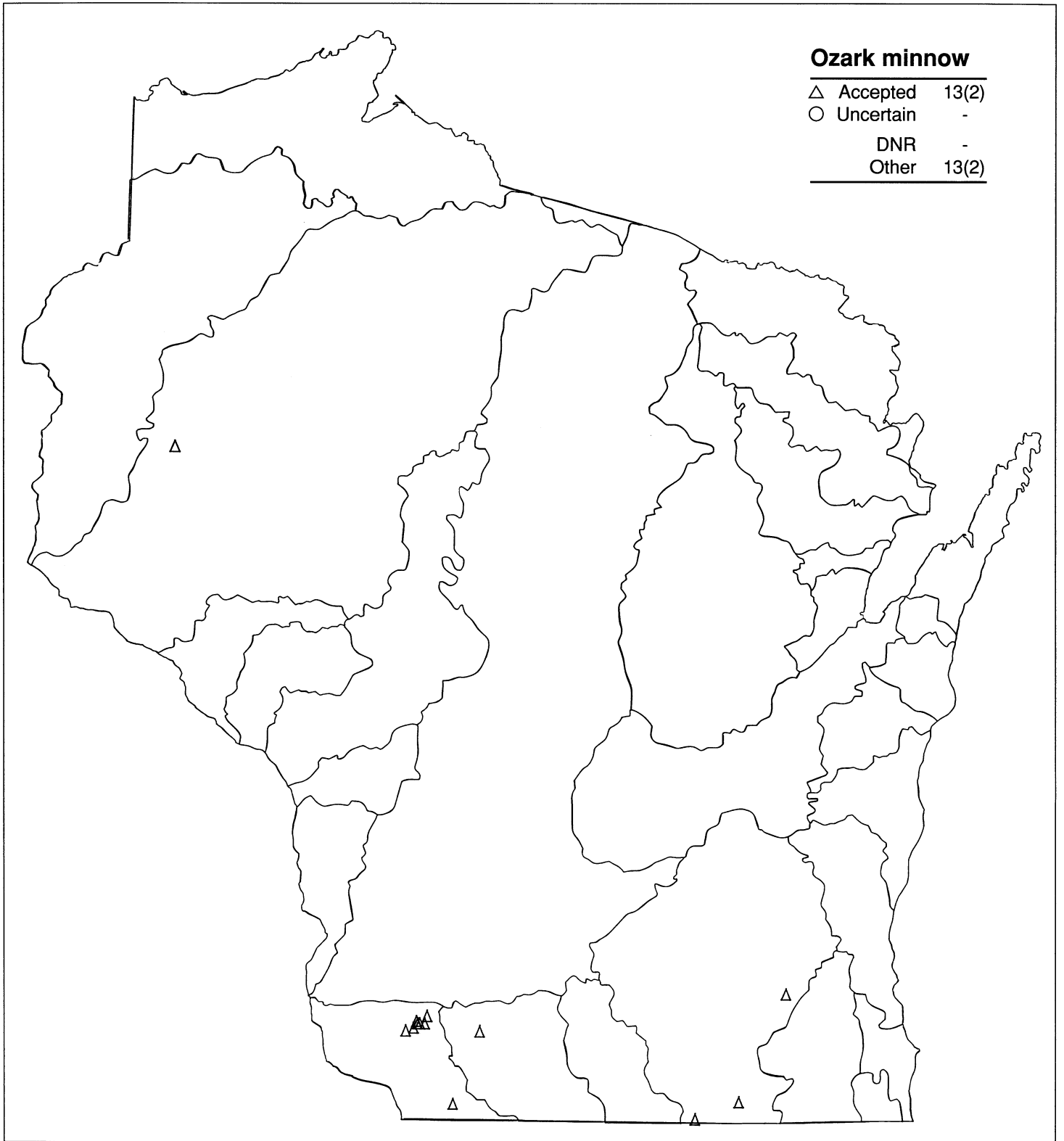


Map 56(E)

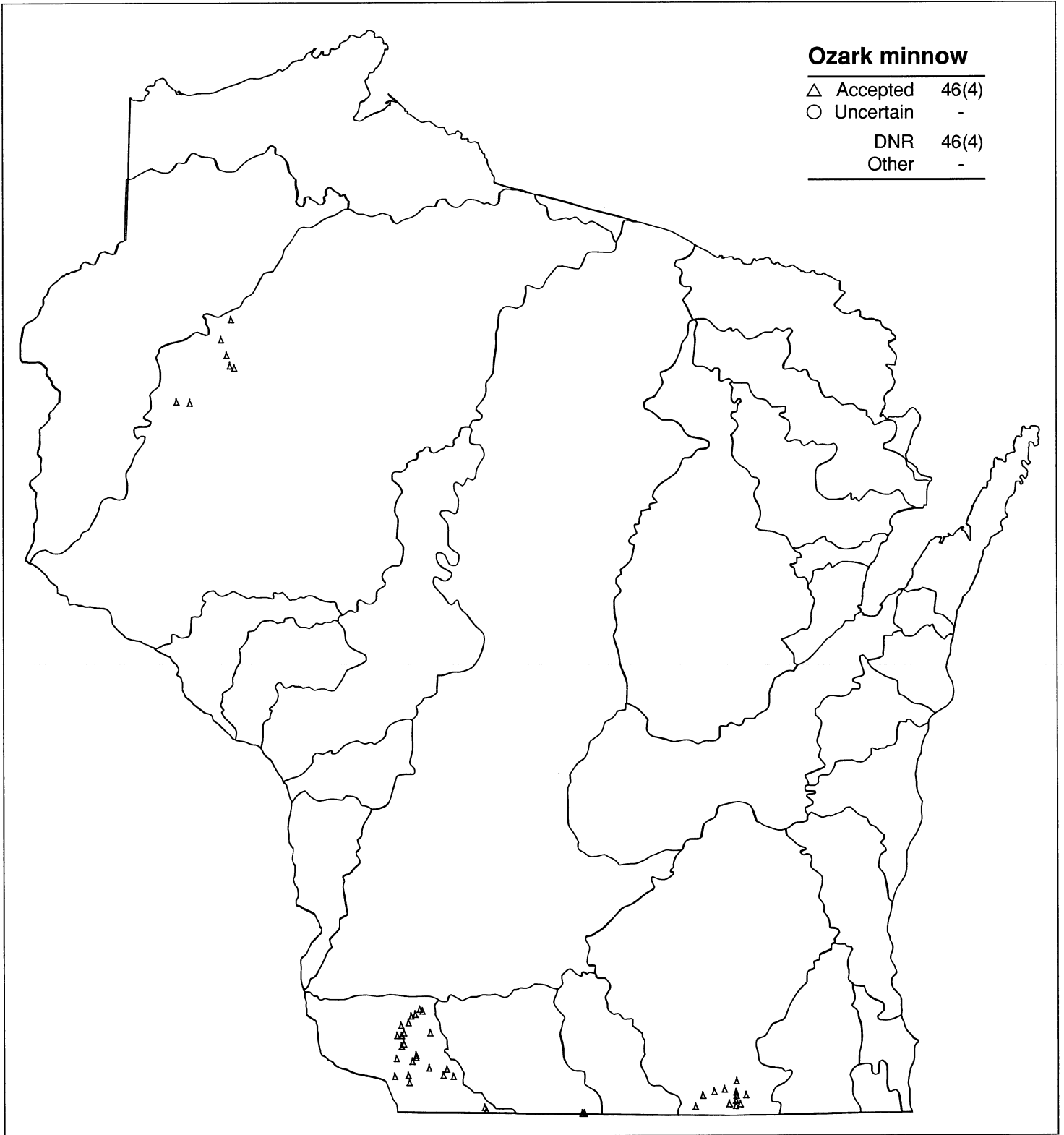




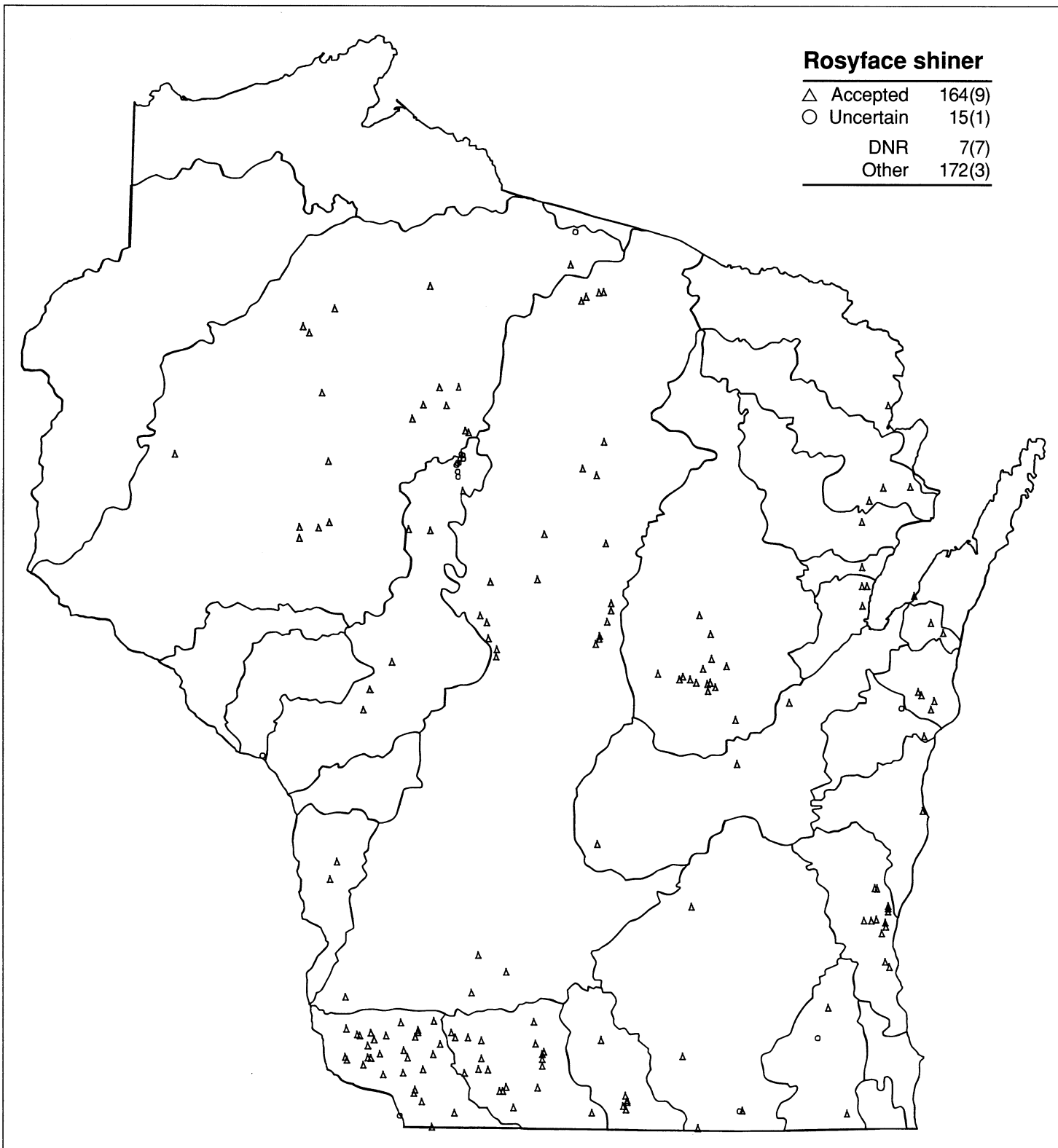
Map 57(E)

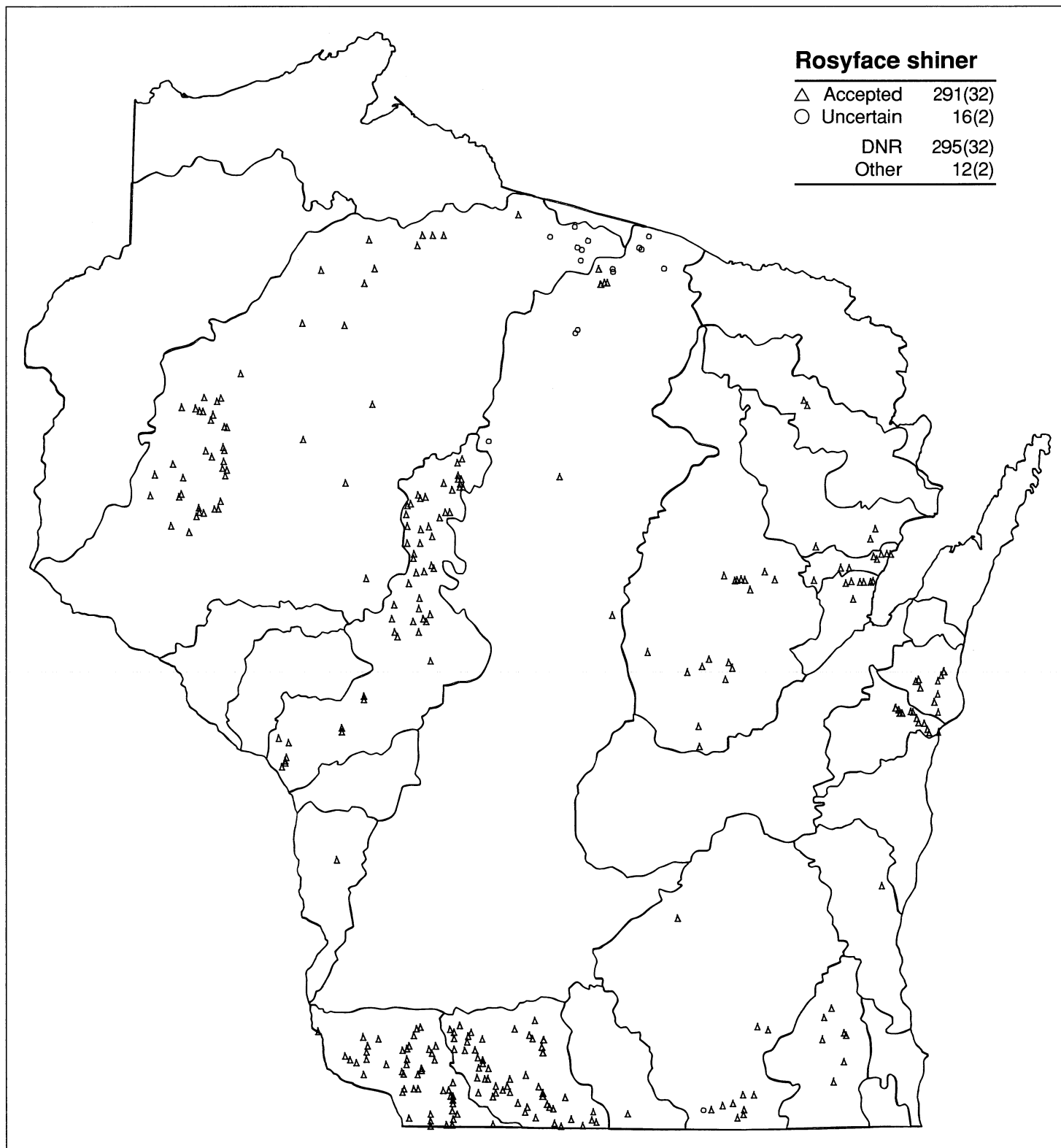


Map 57(L)

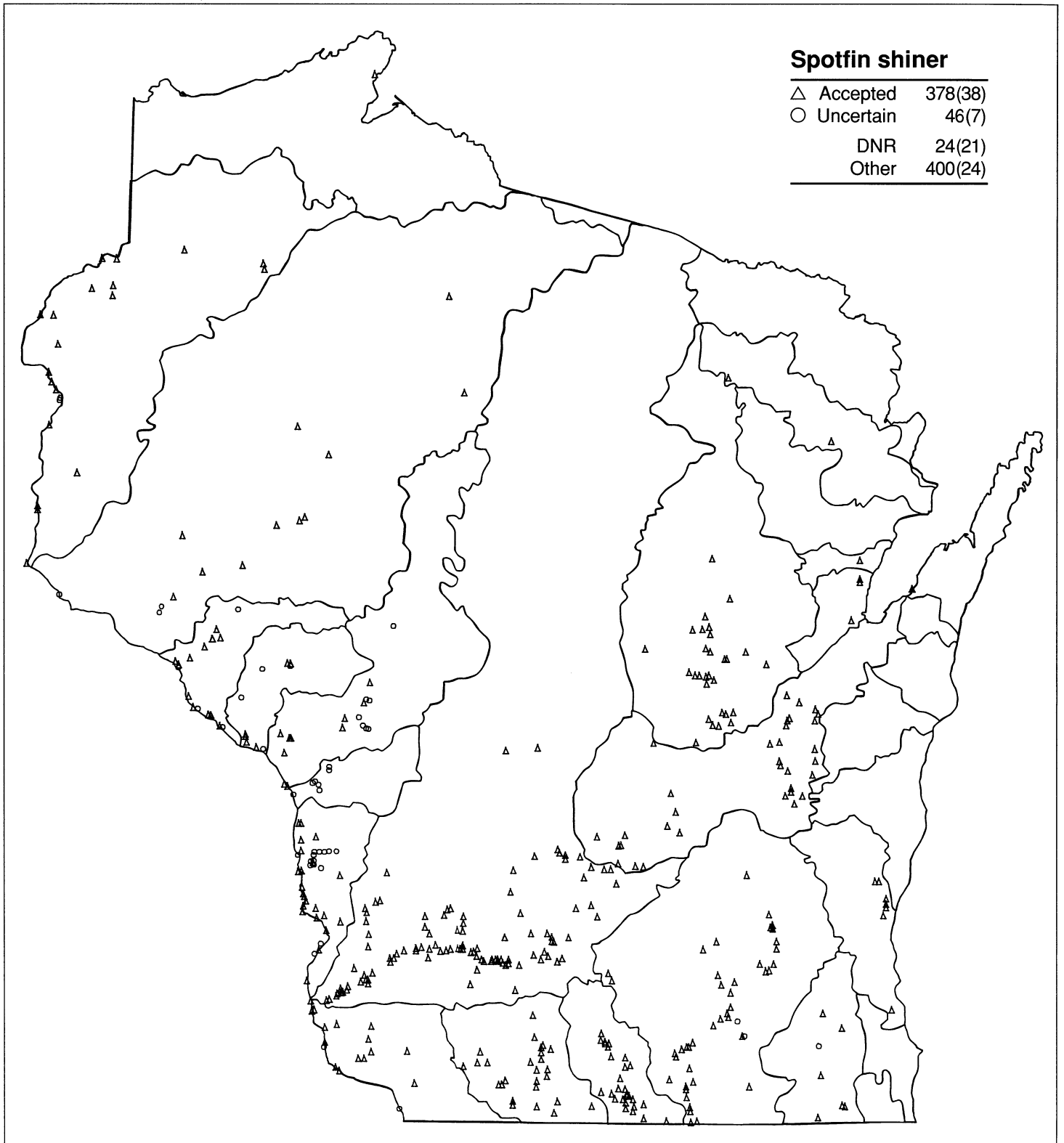


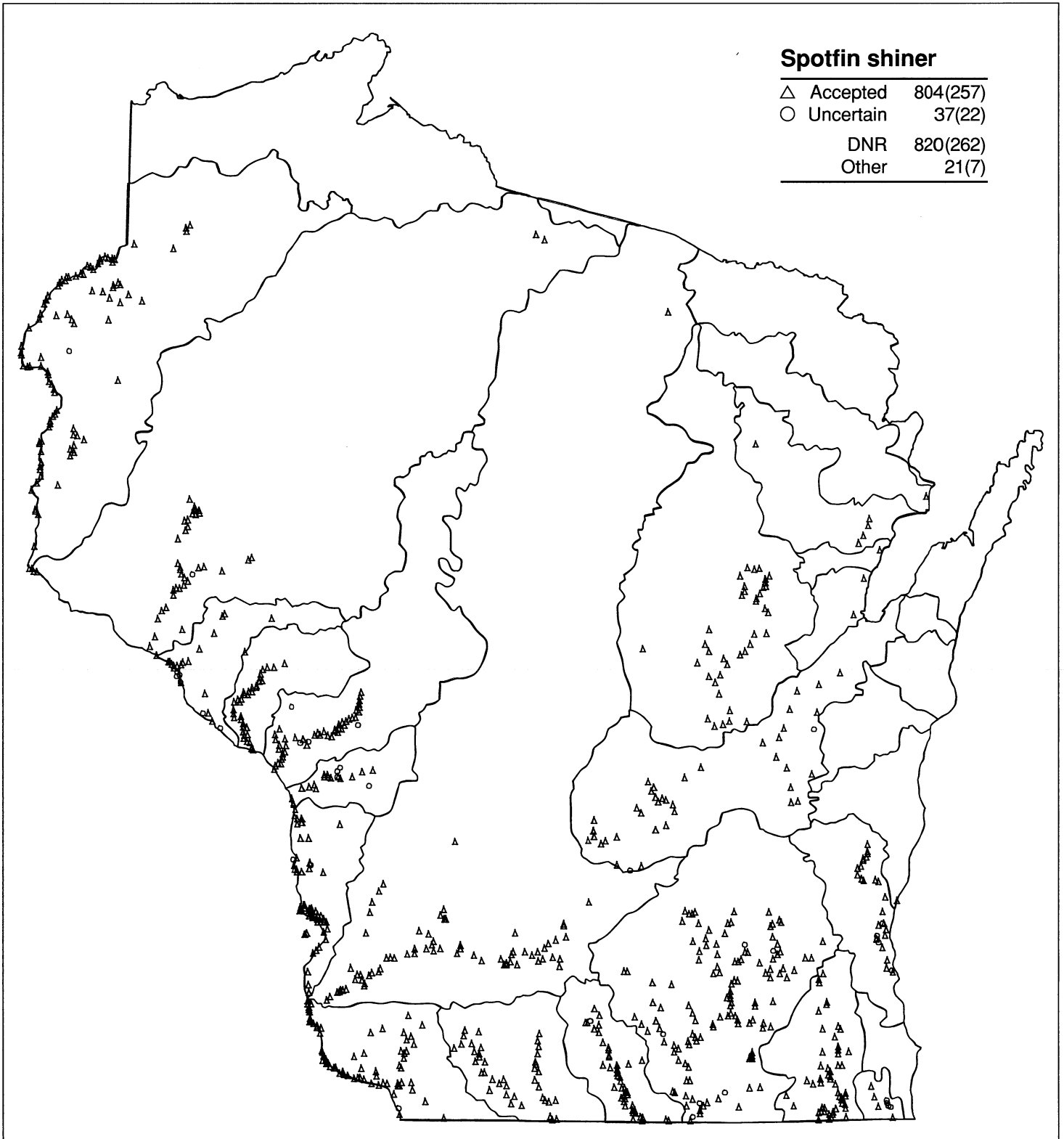
Map 58(E)



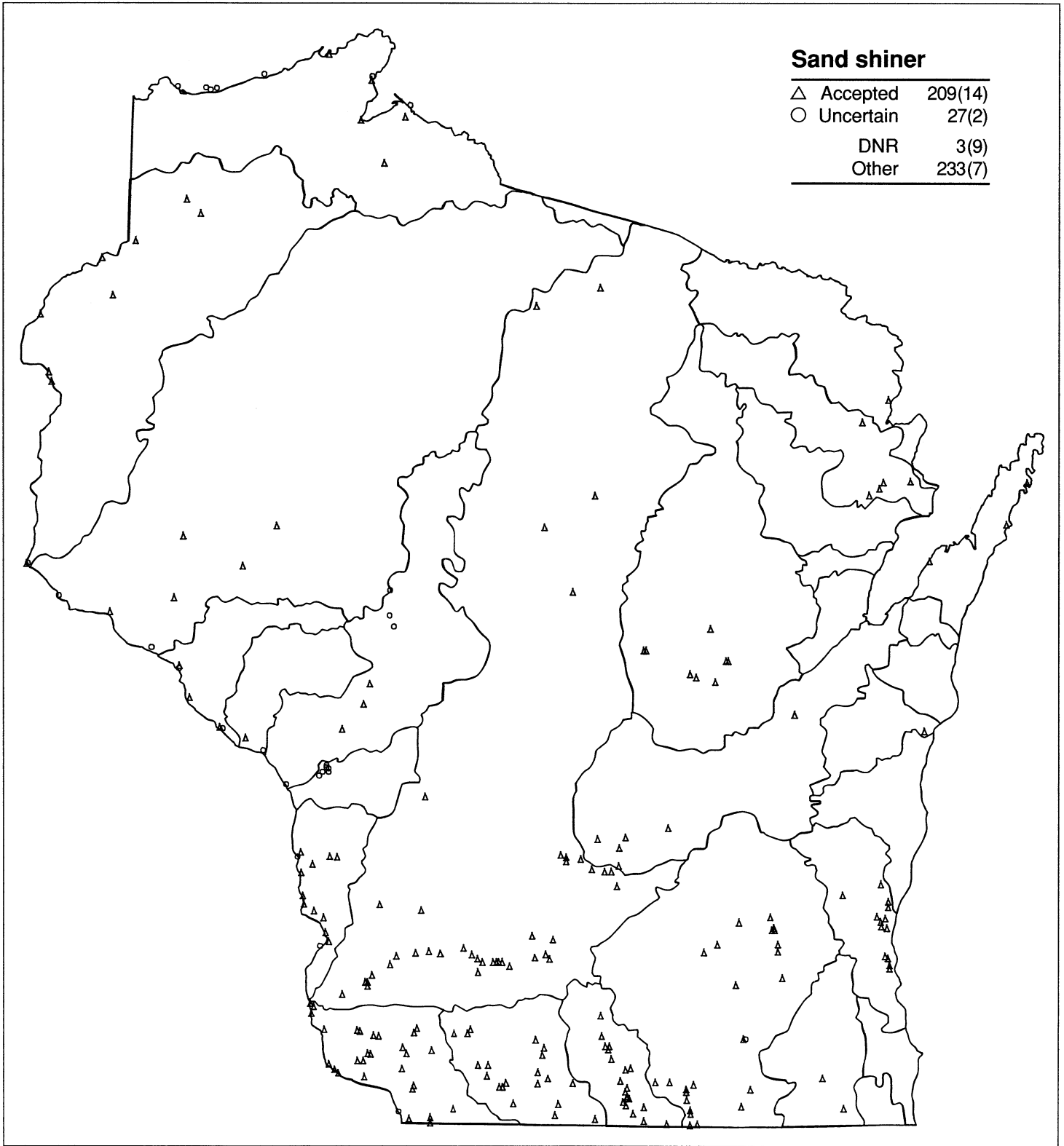


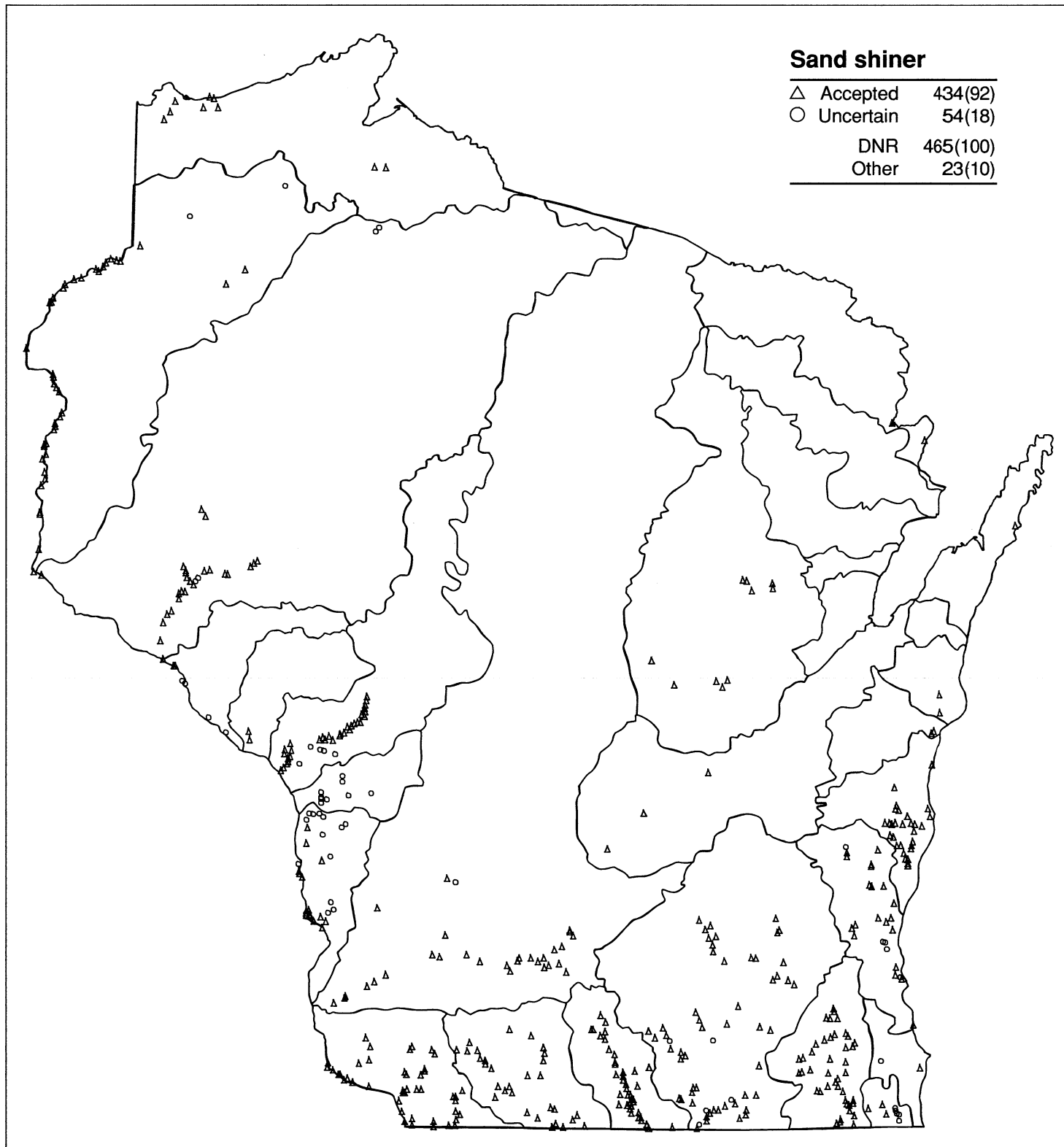
Map 59(E)



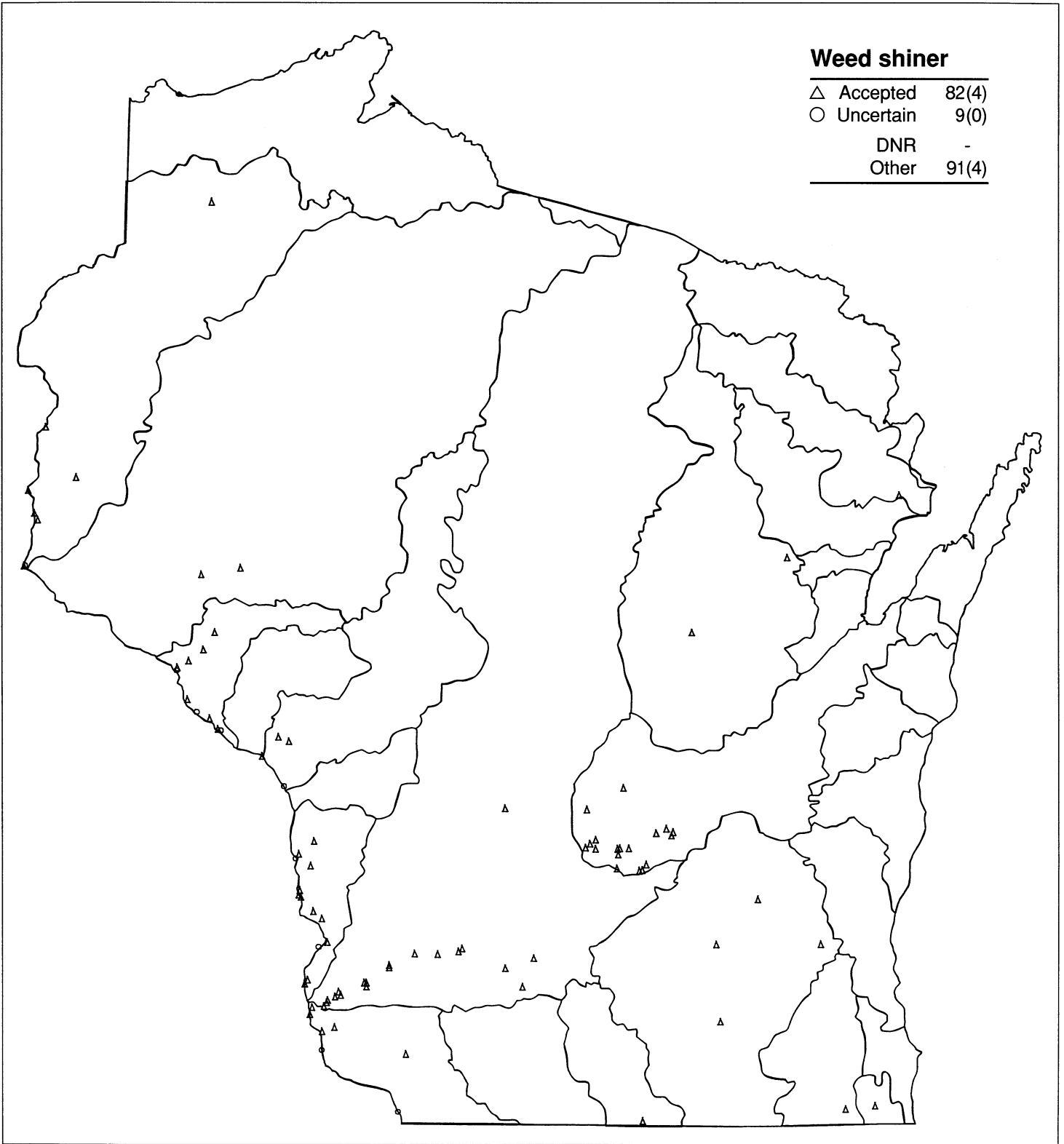


Map 60(E)

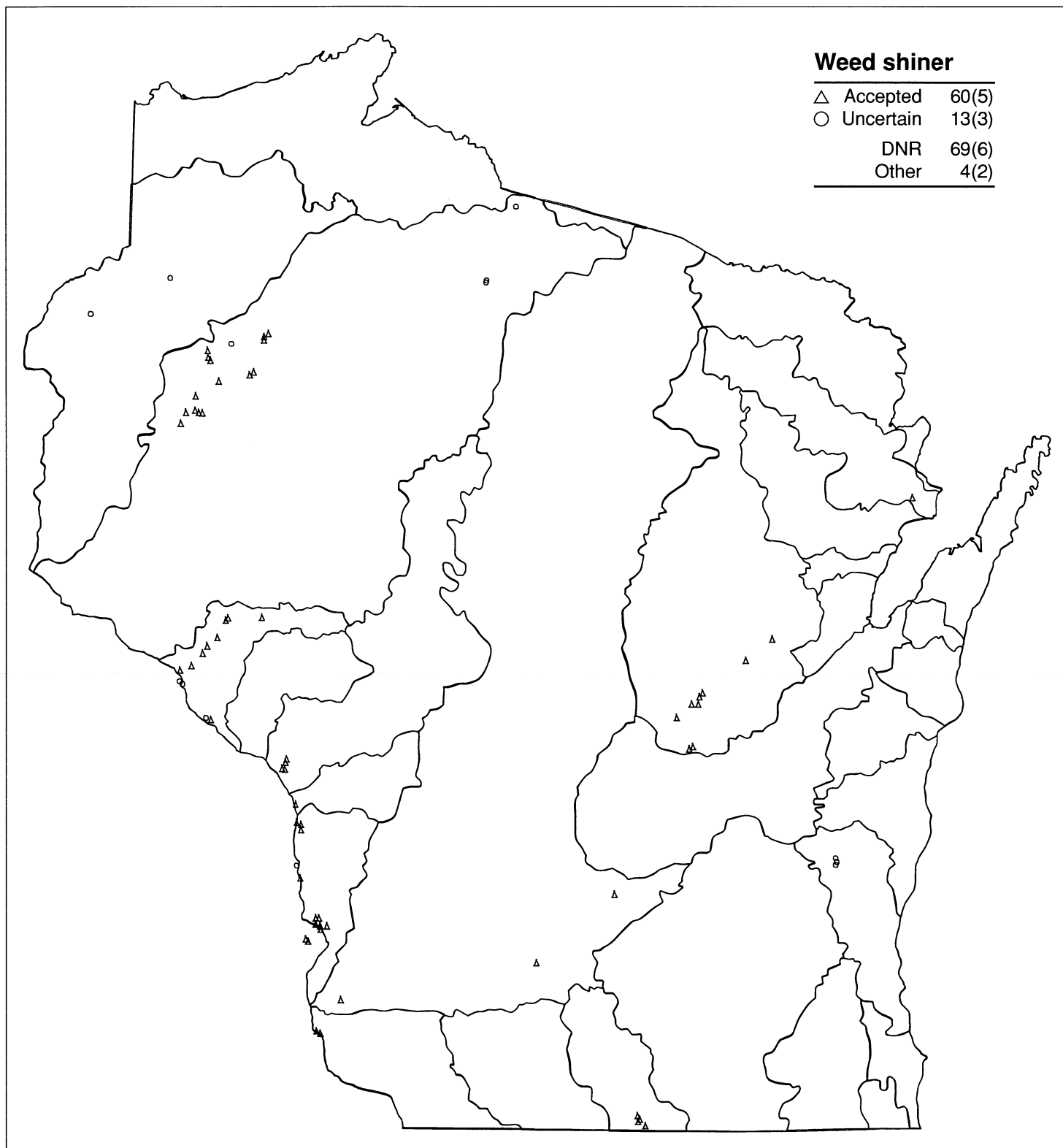




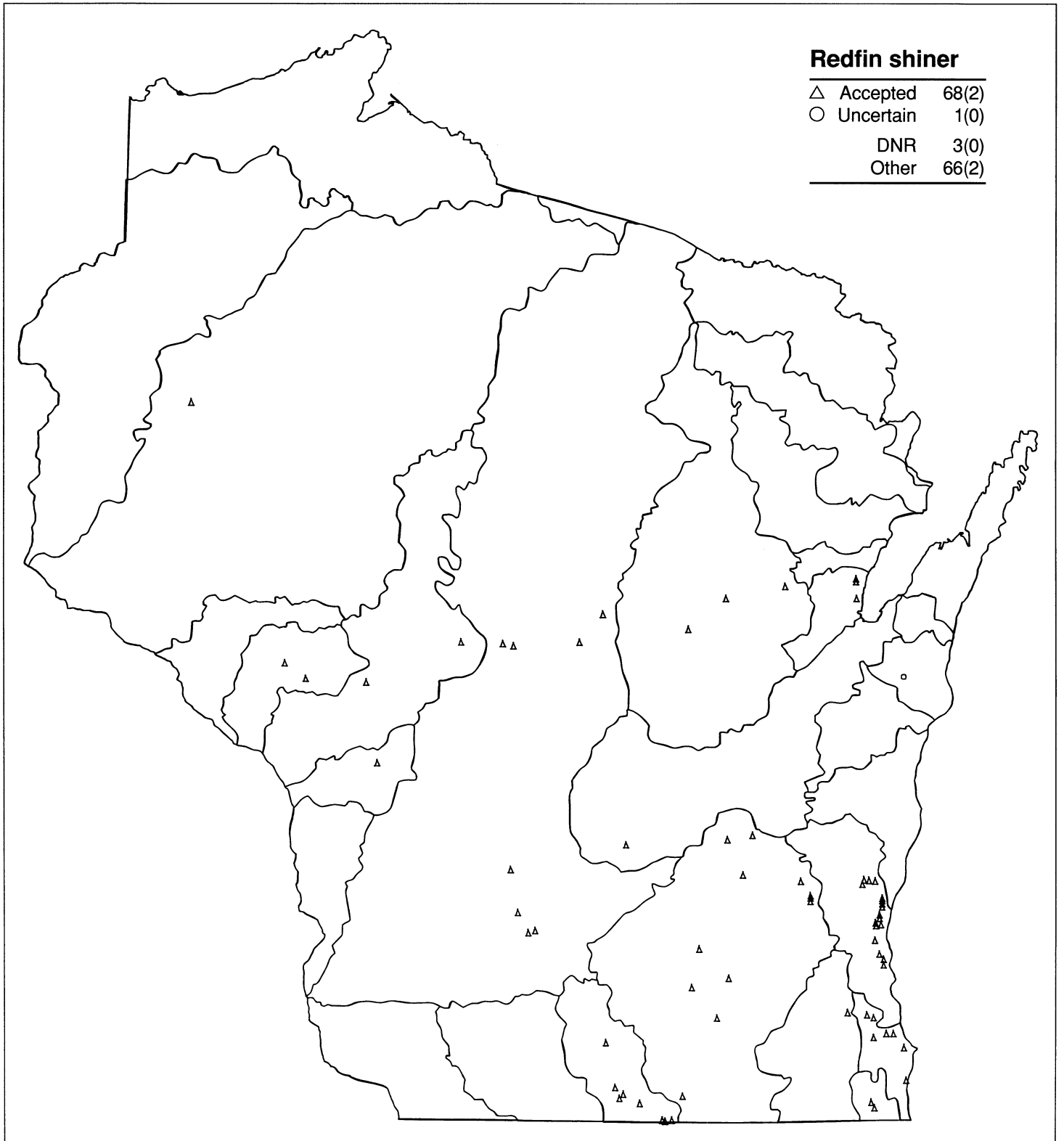
Map 61(E)



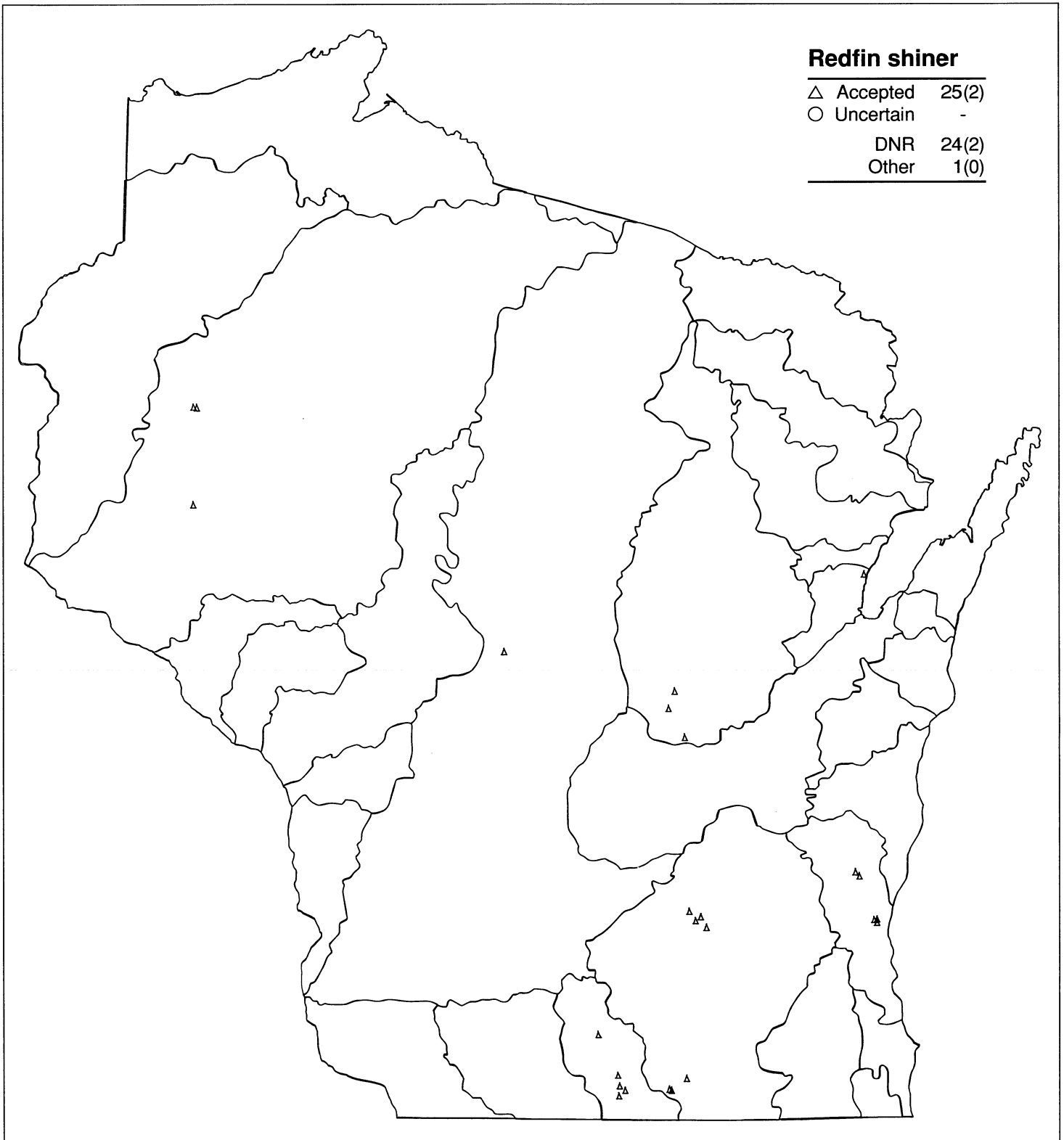
Map 61(L)



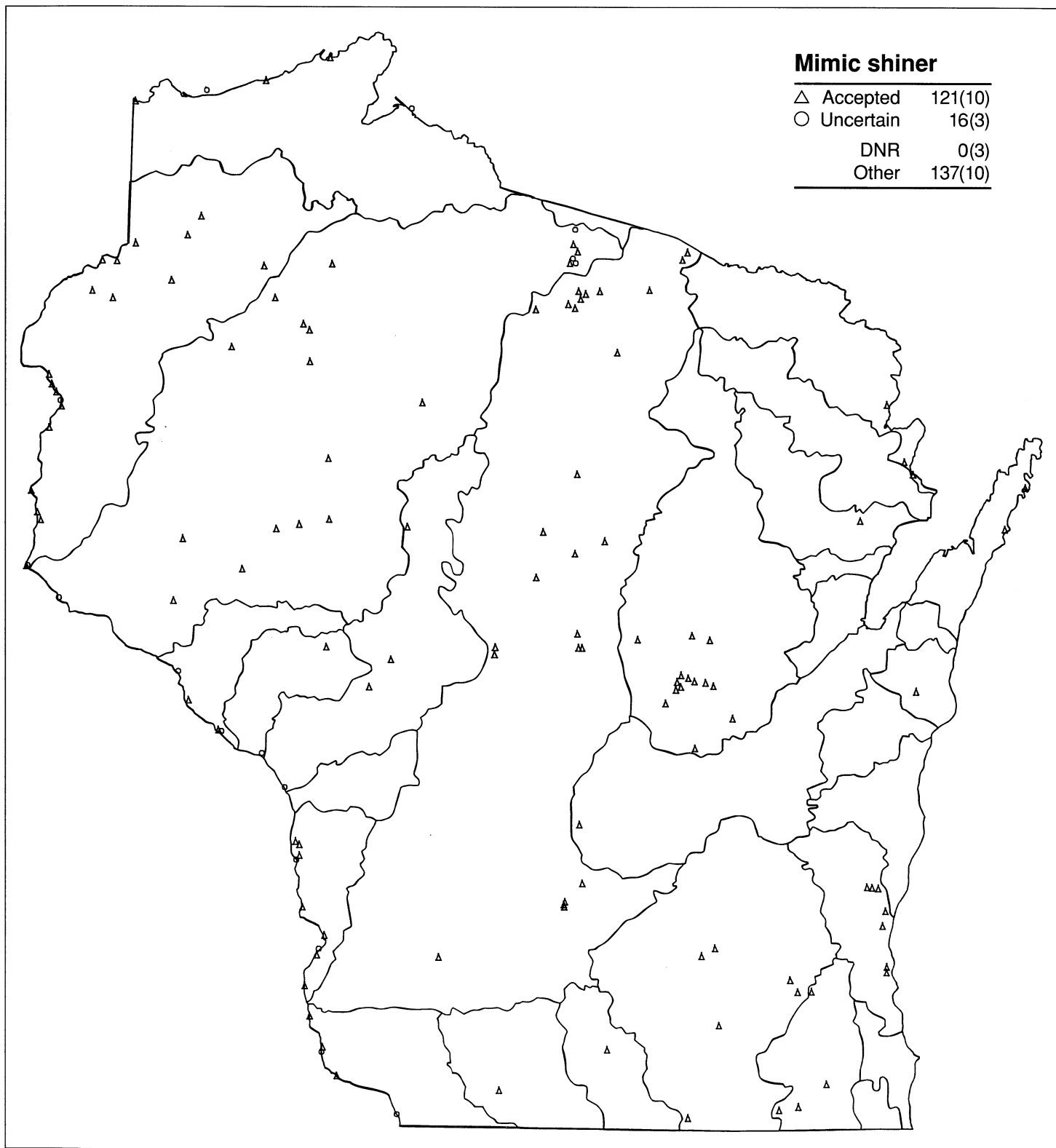
Map 62(E)

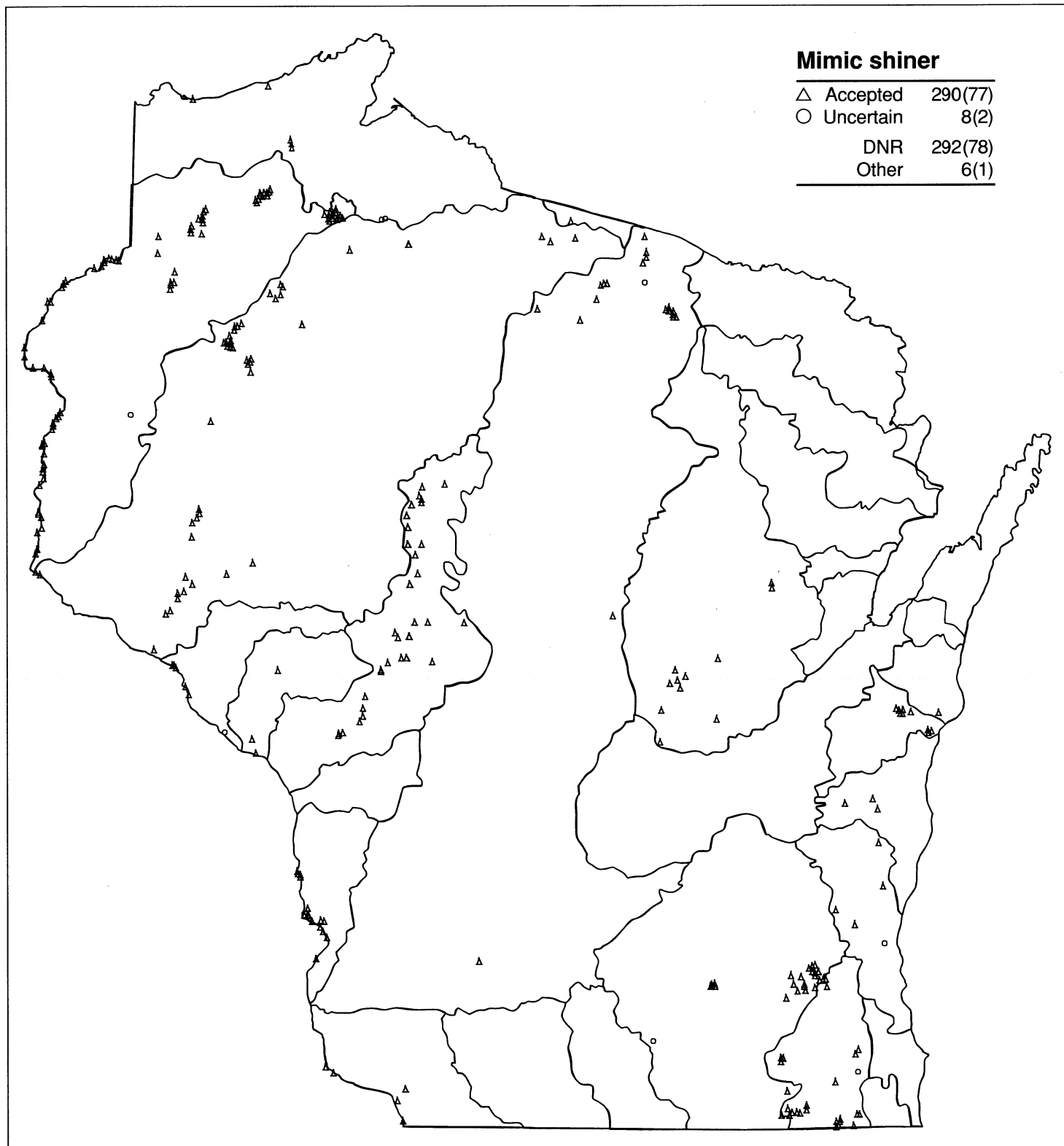


Map 62(L)

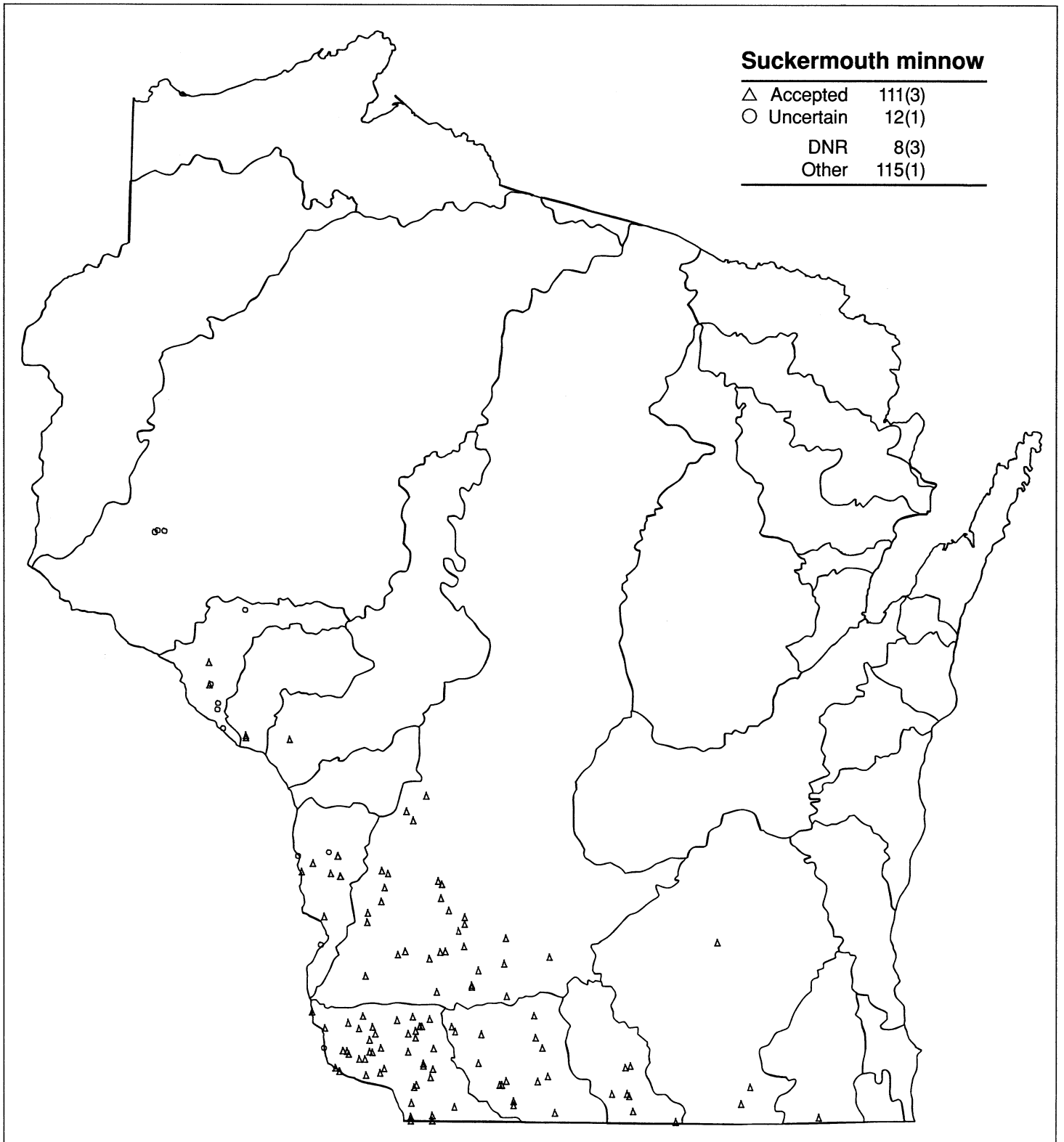


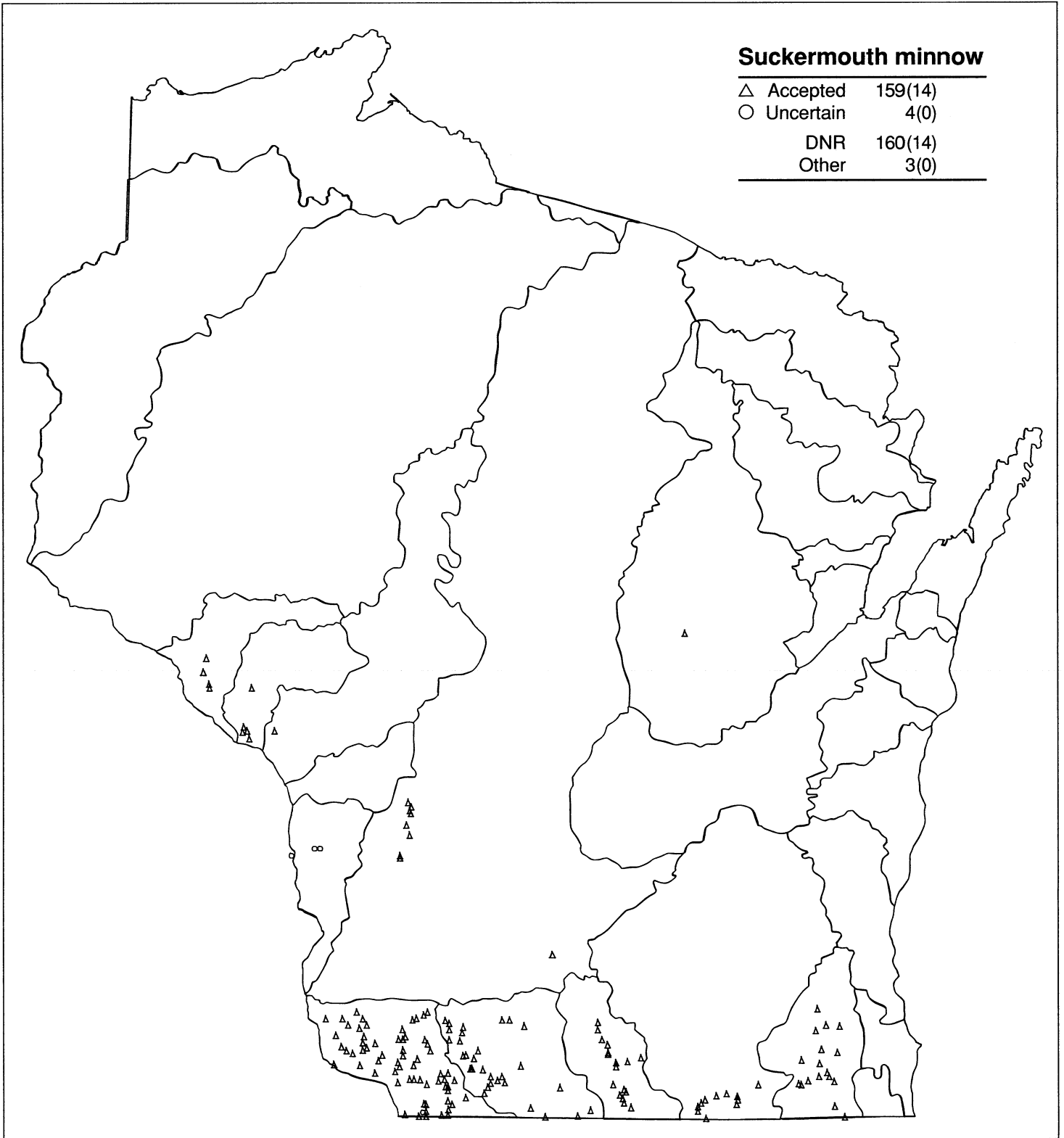
Map 63(E)



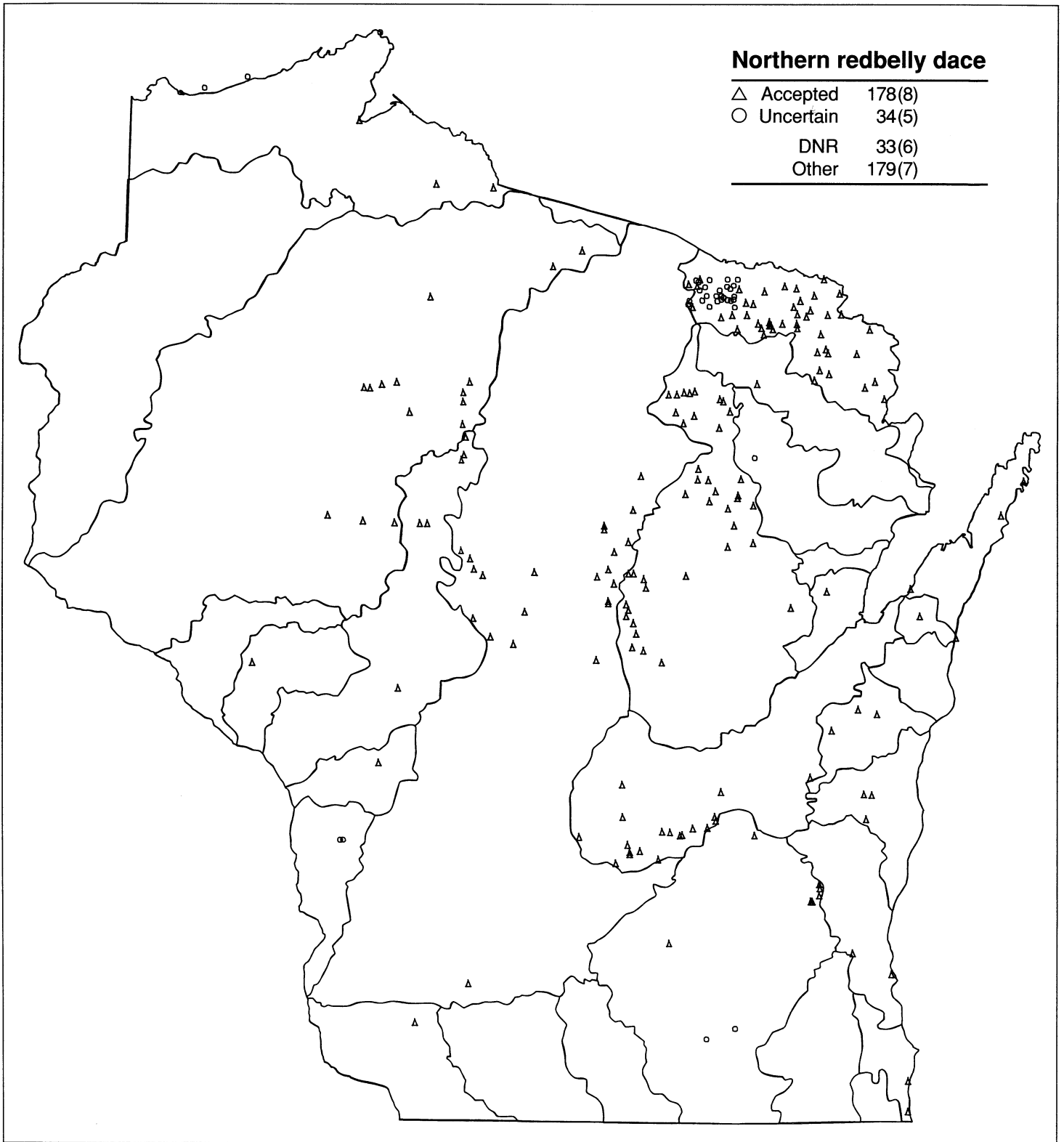


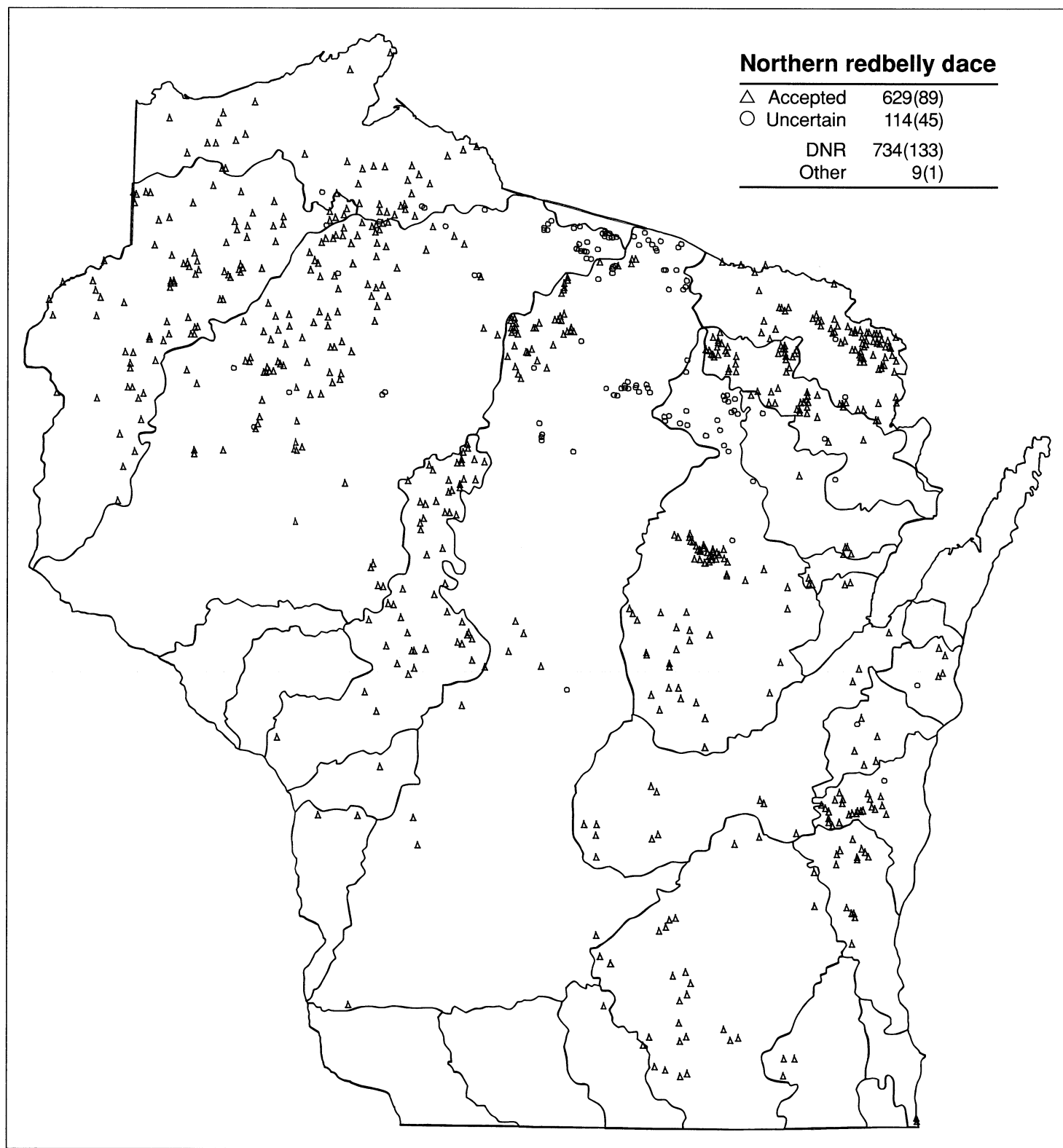
Map 64(E)



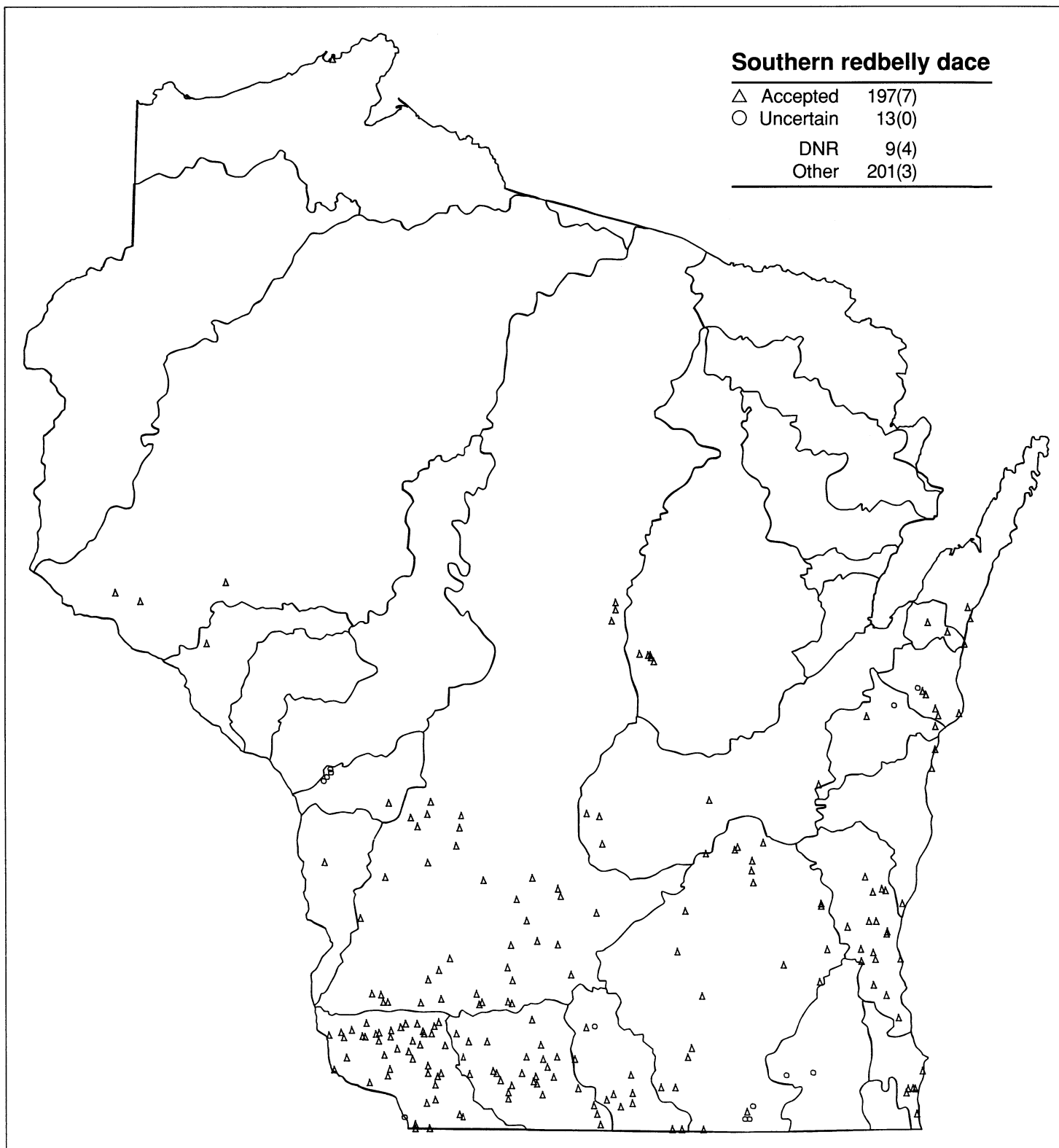


Map 65(E)

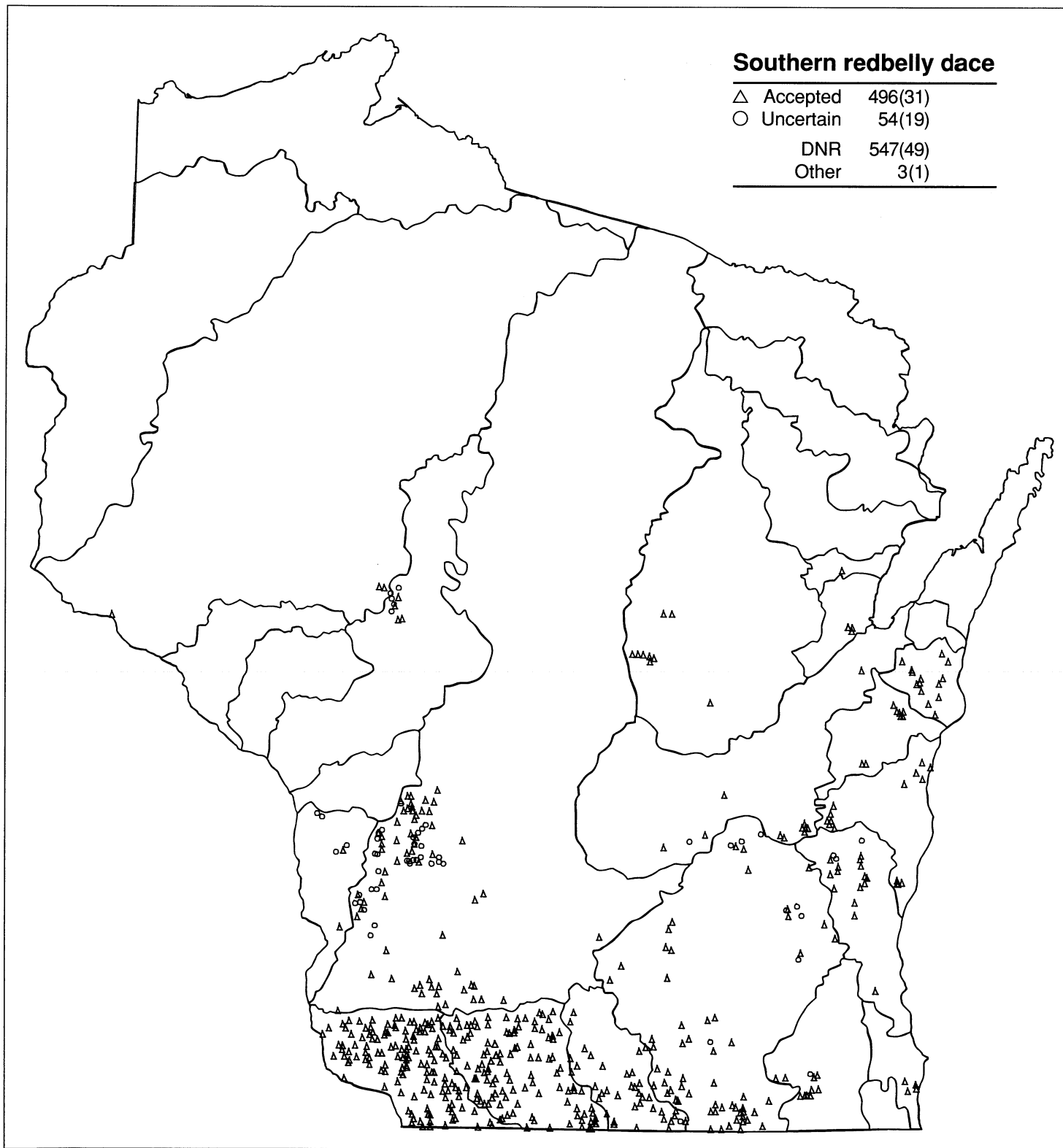




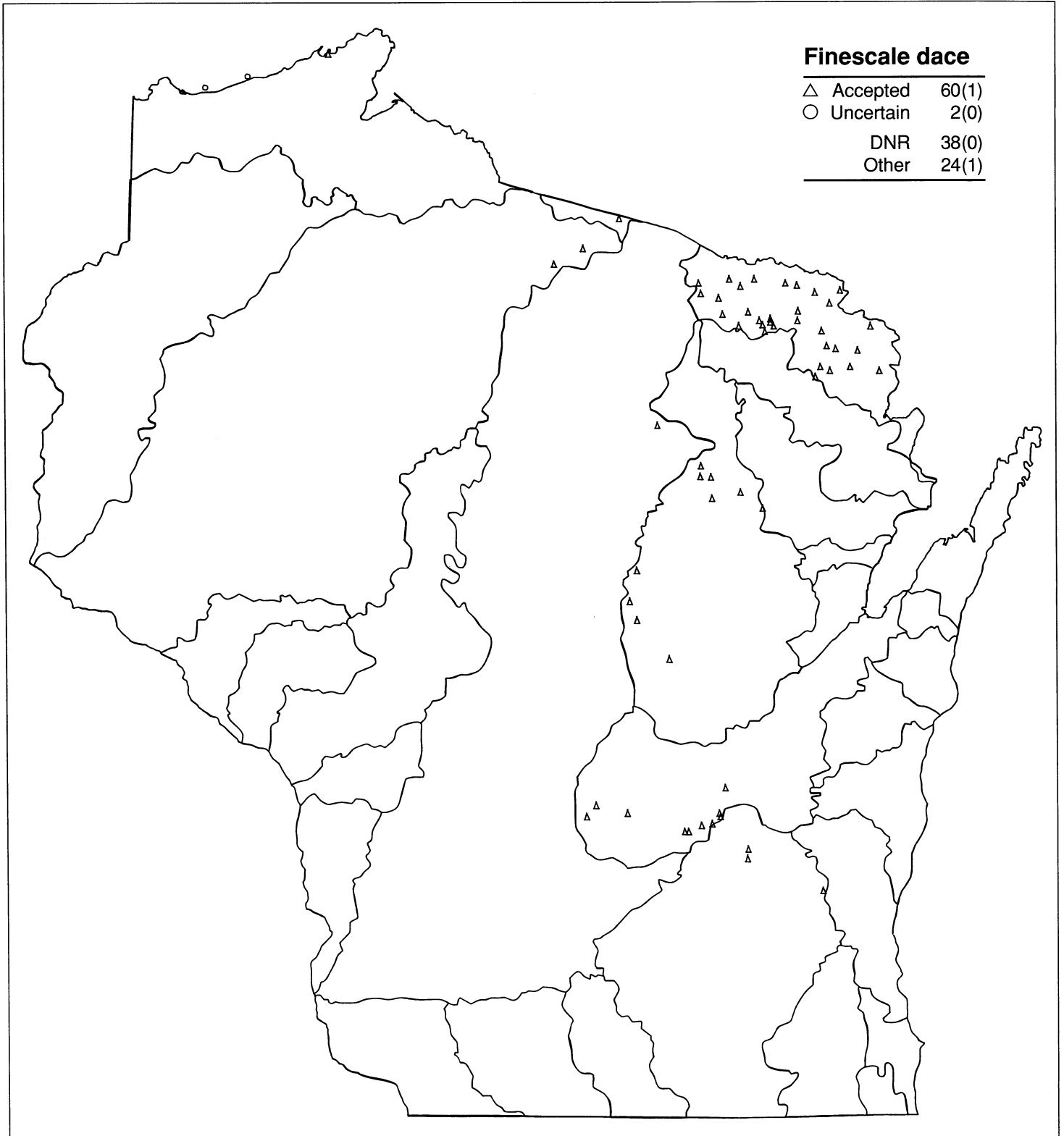
Map 66(E)



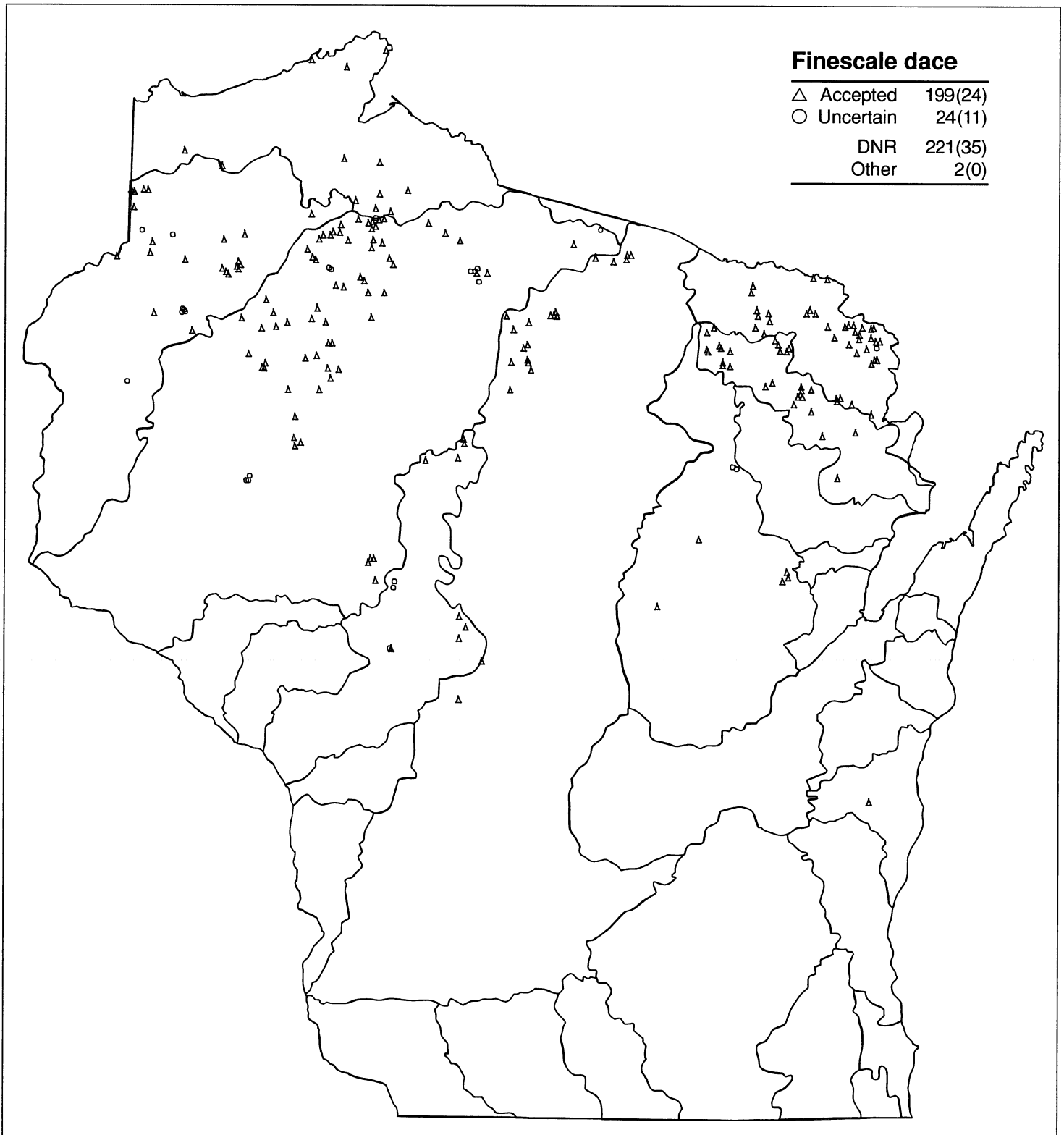
Map 66(L)



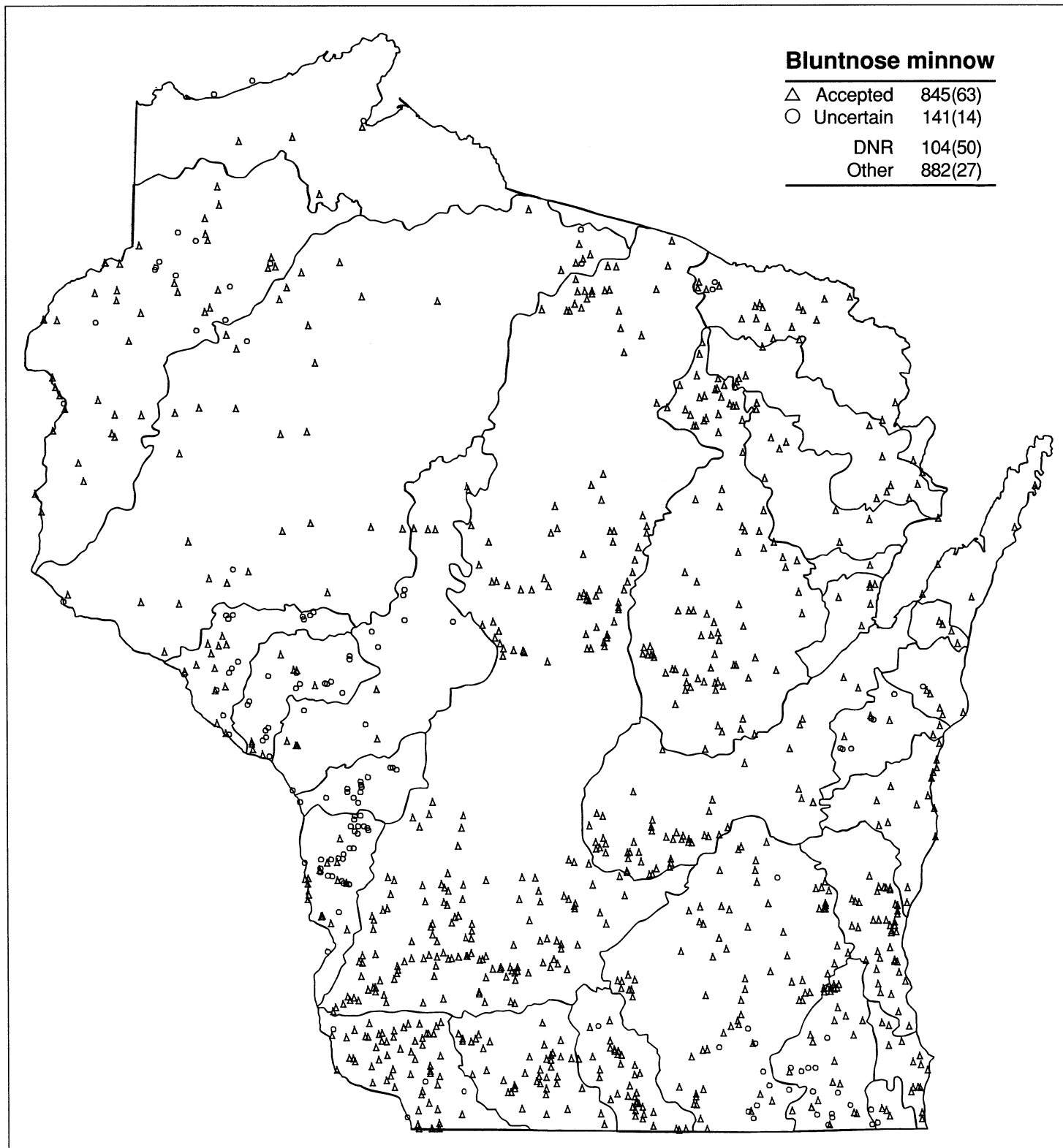
Map 67(E)

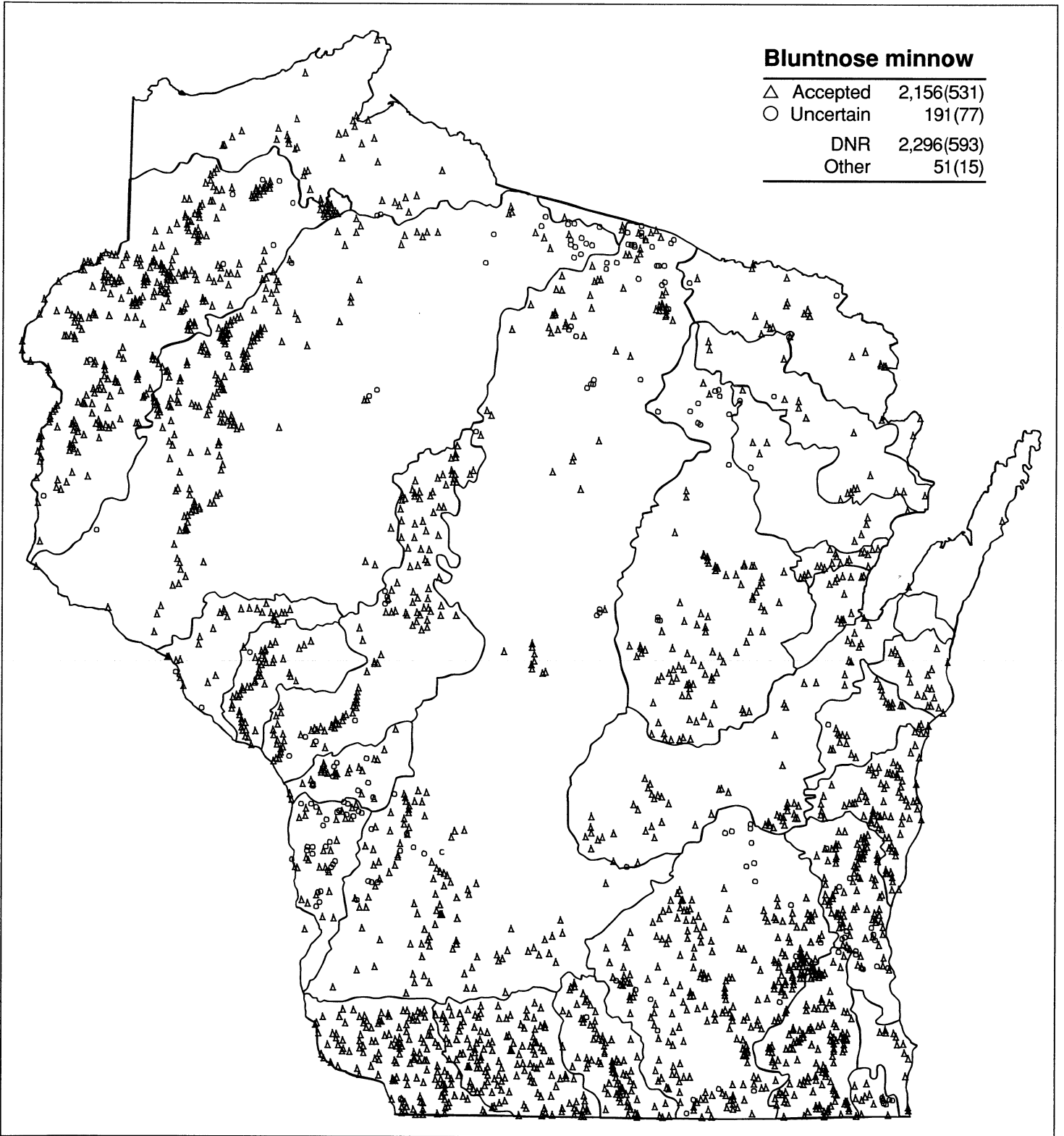


Map 67(L)

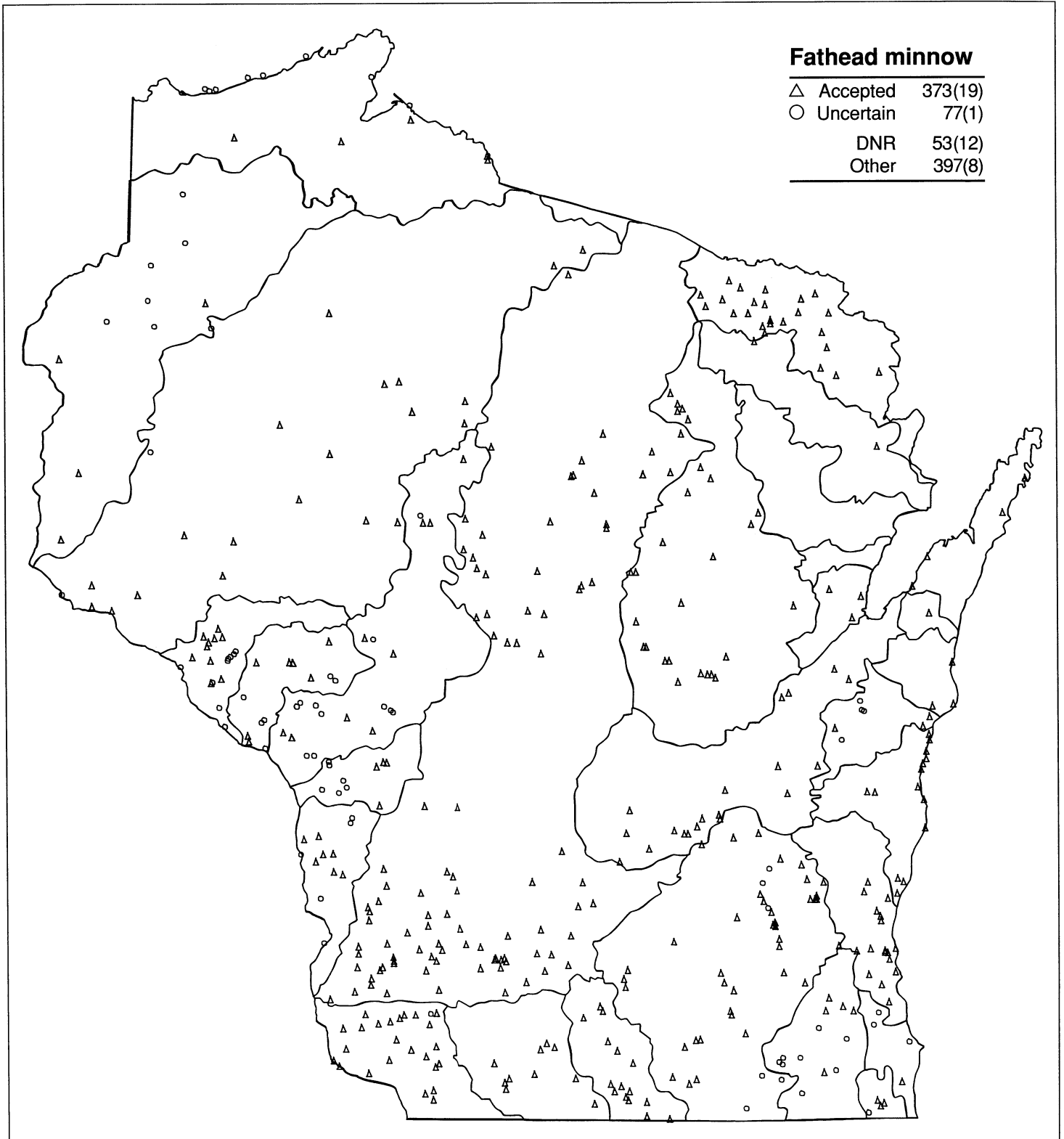


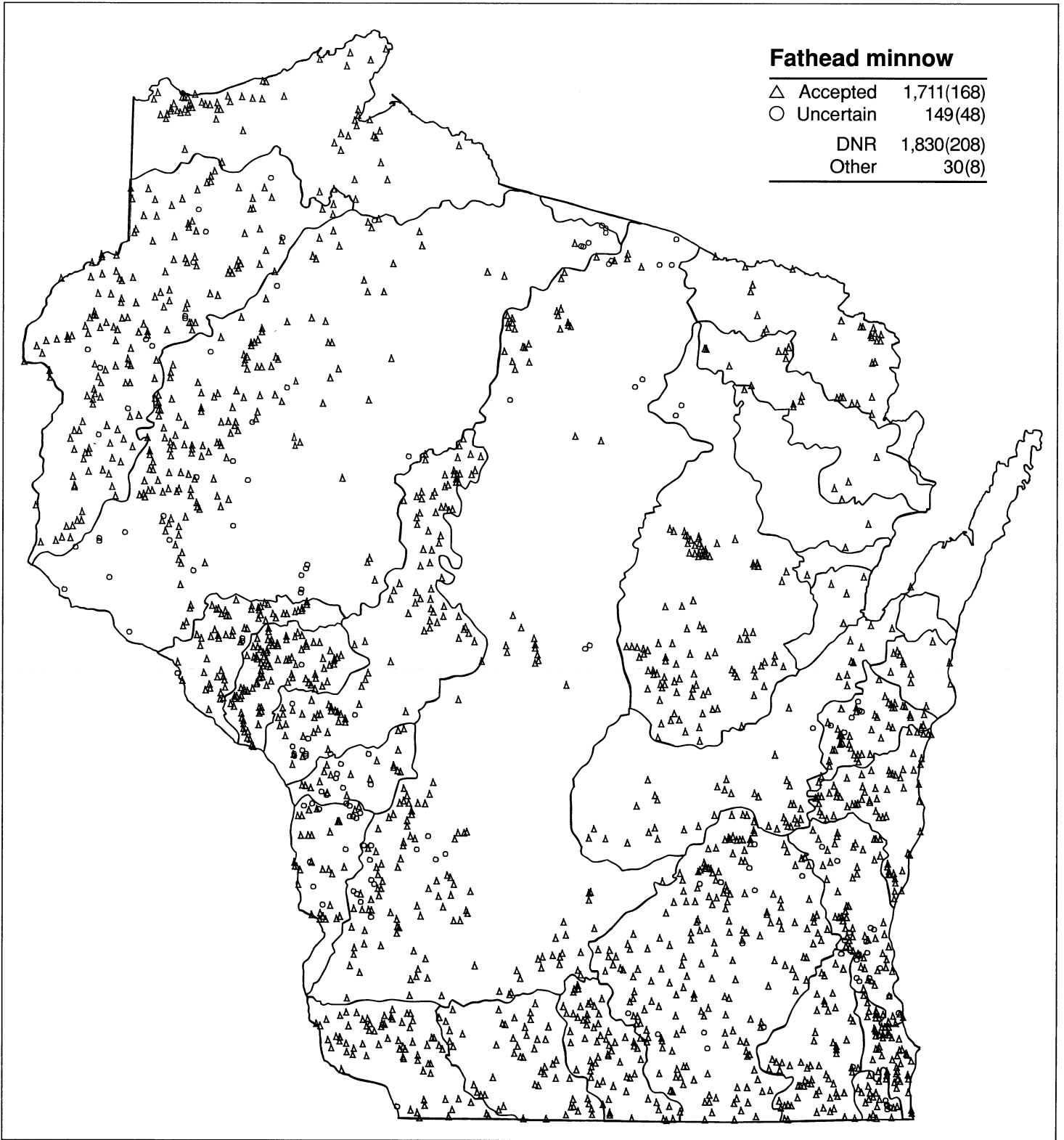
Map 68(E)



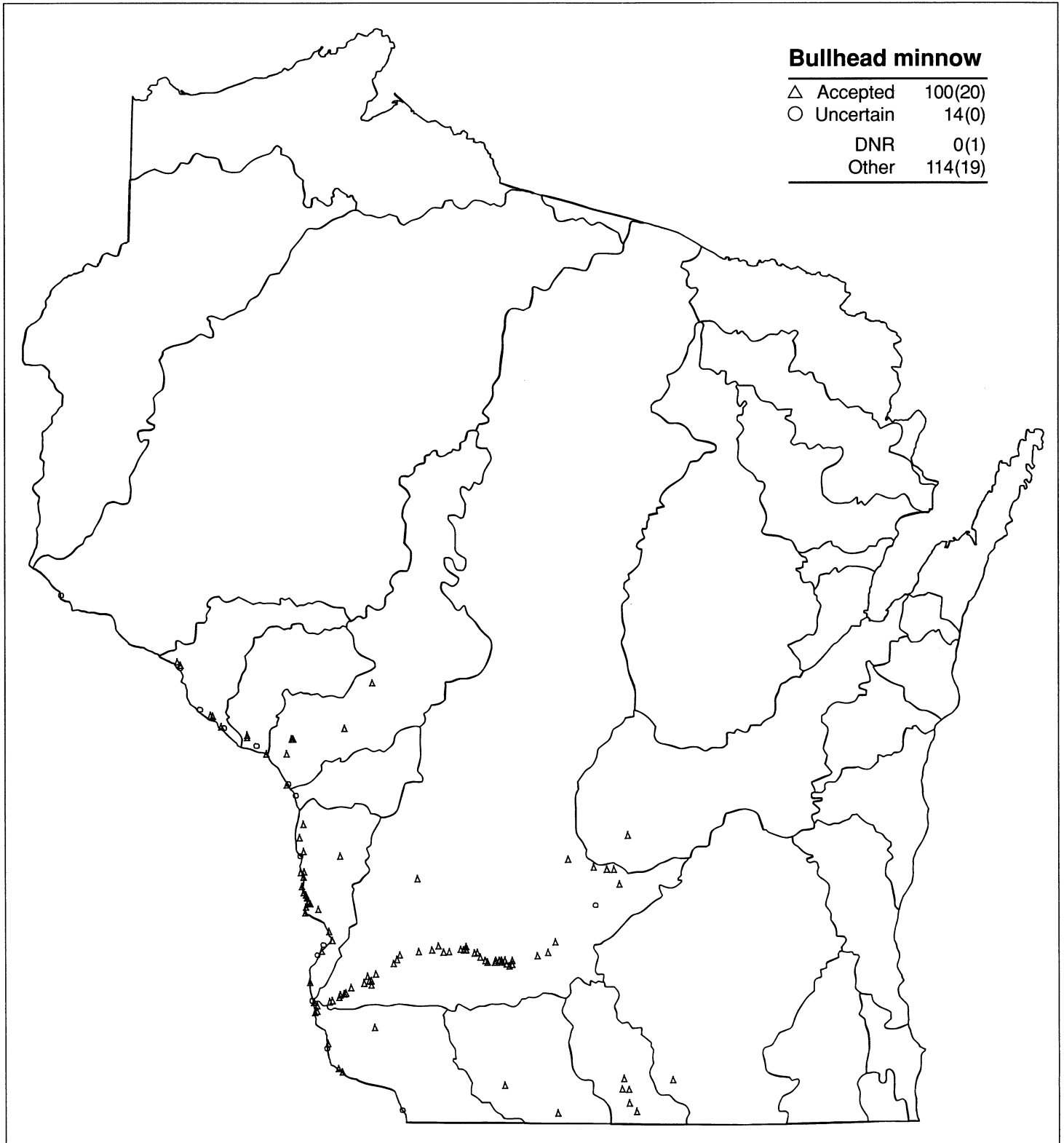


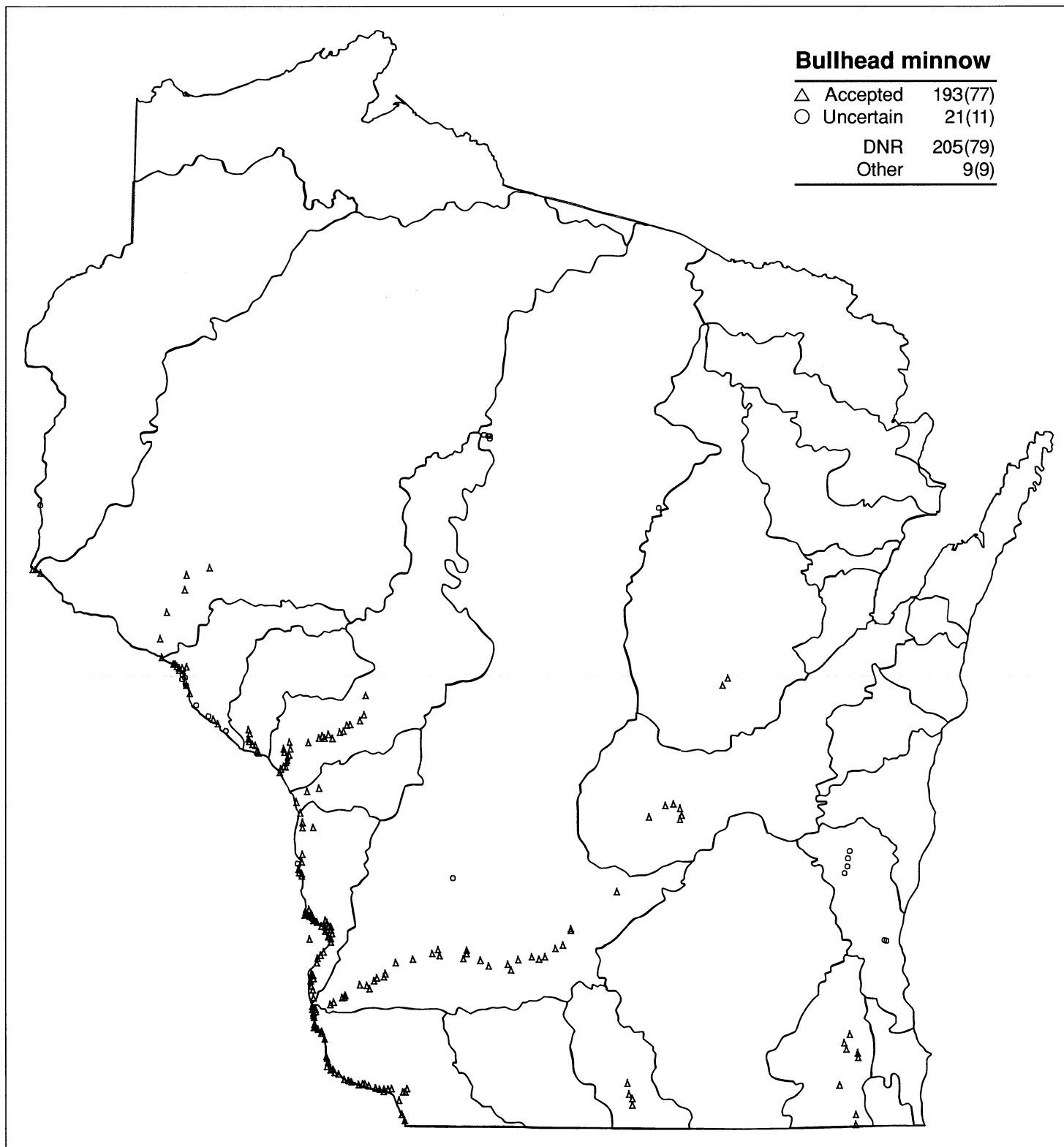
Map 69(E)



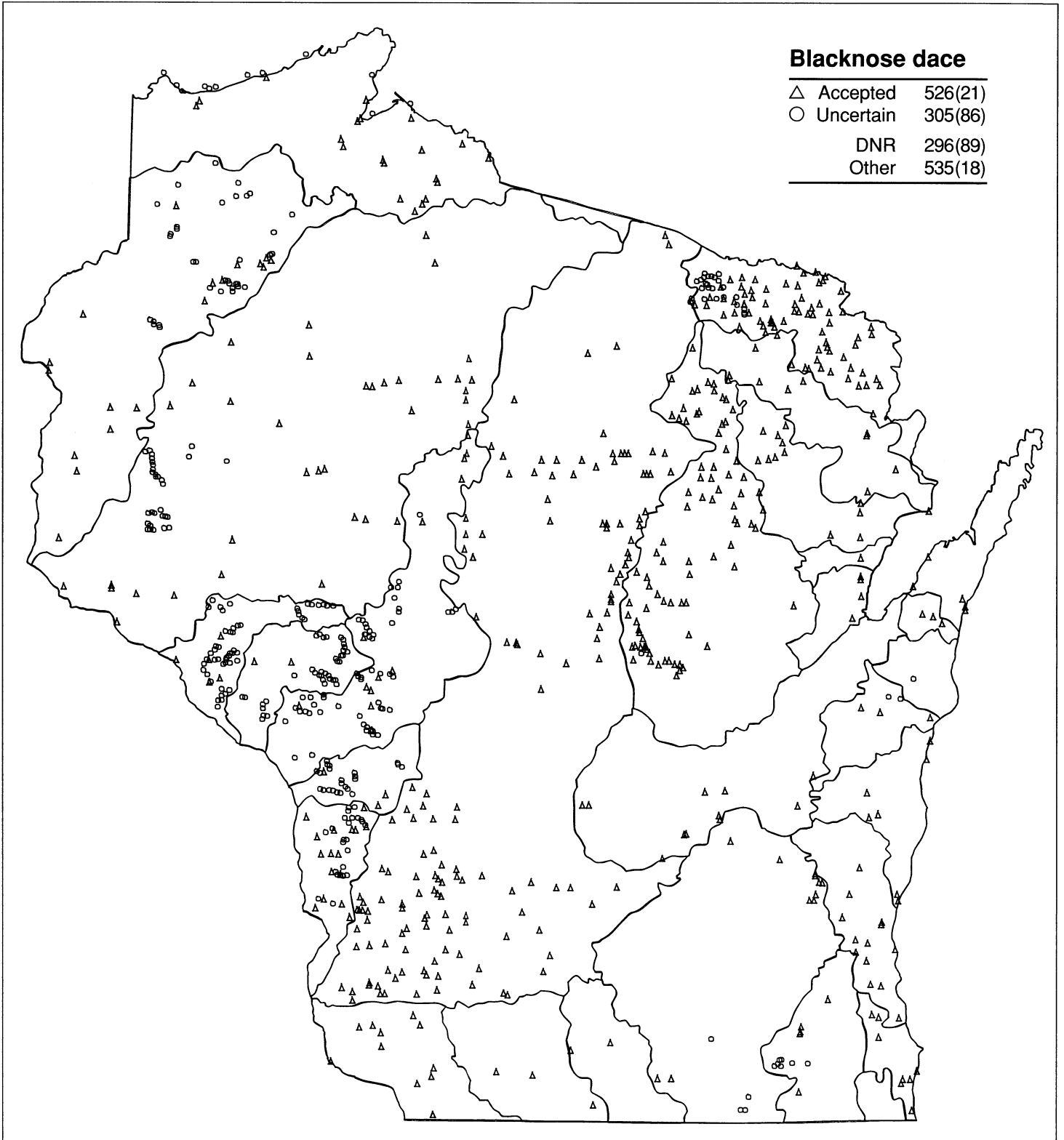


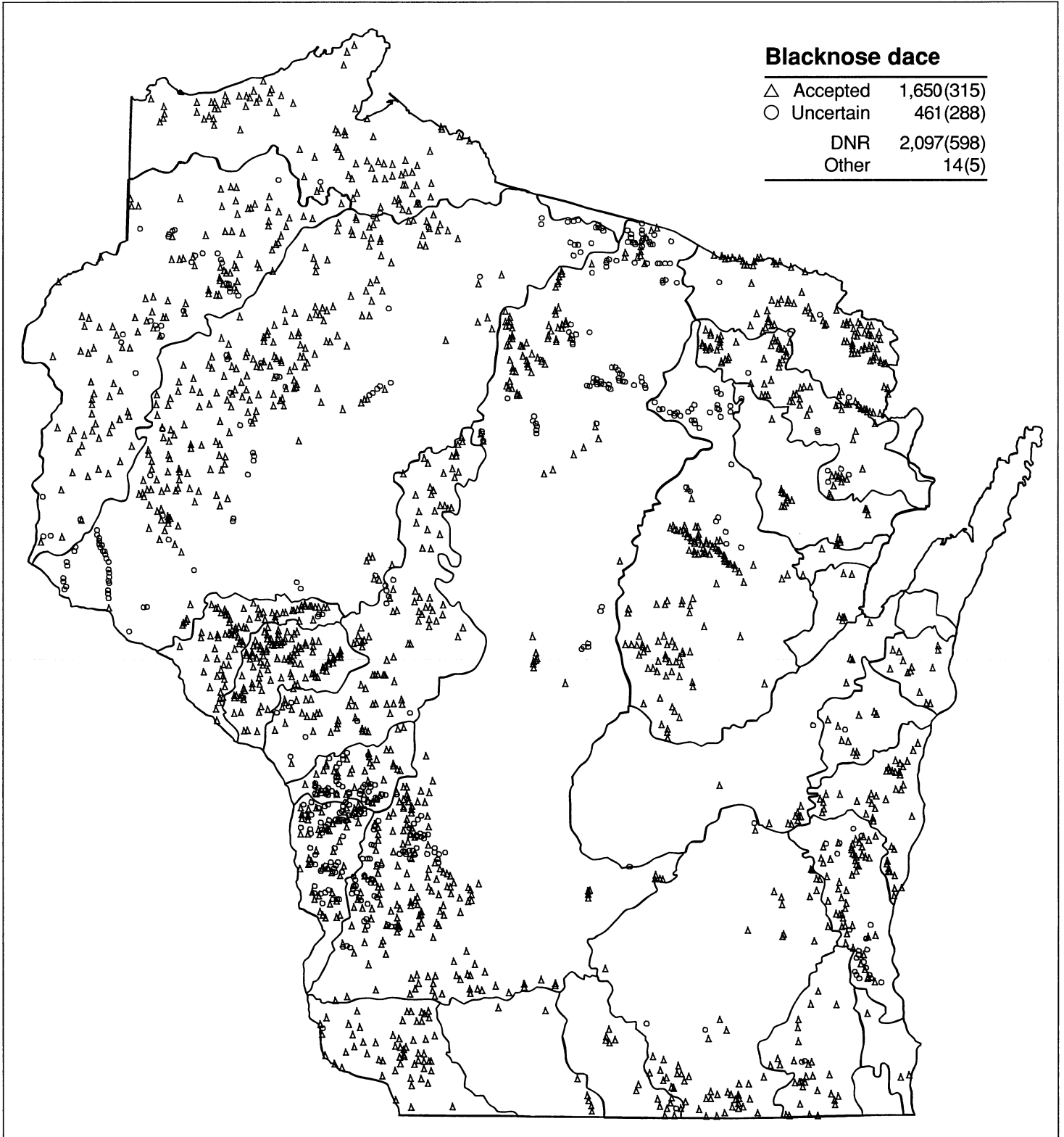
Map 70(E)



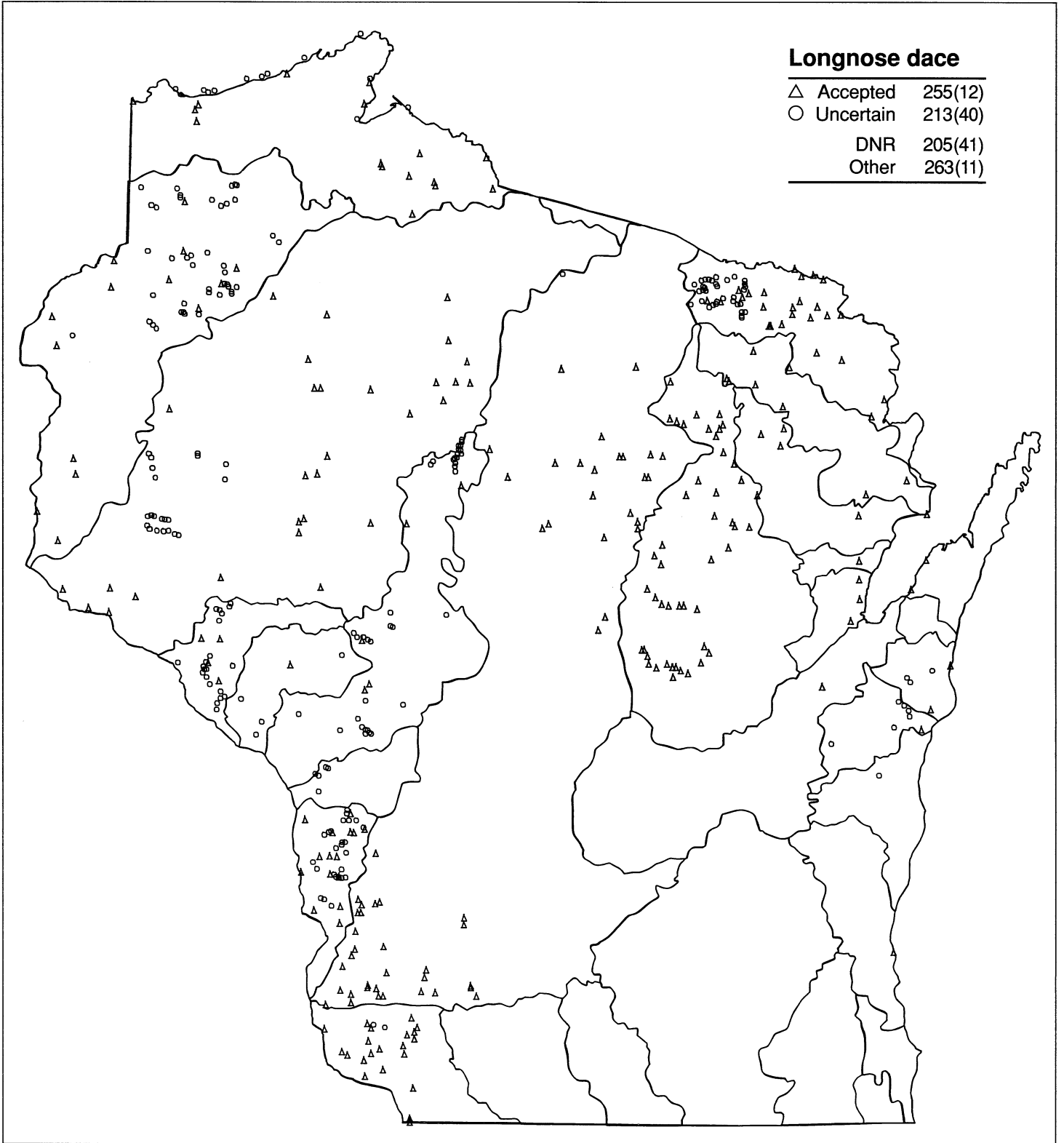


Map 71(E)

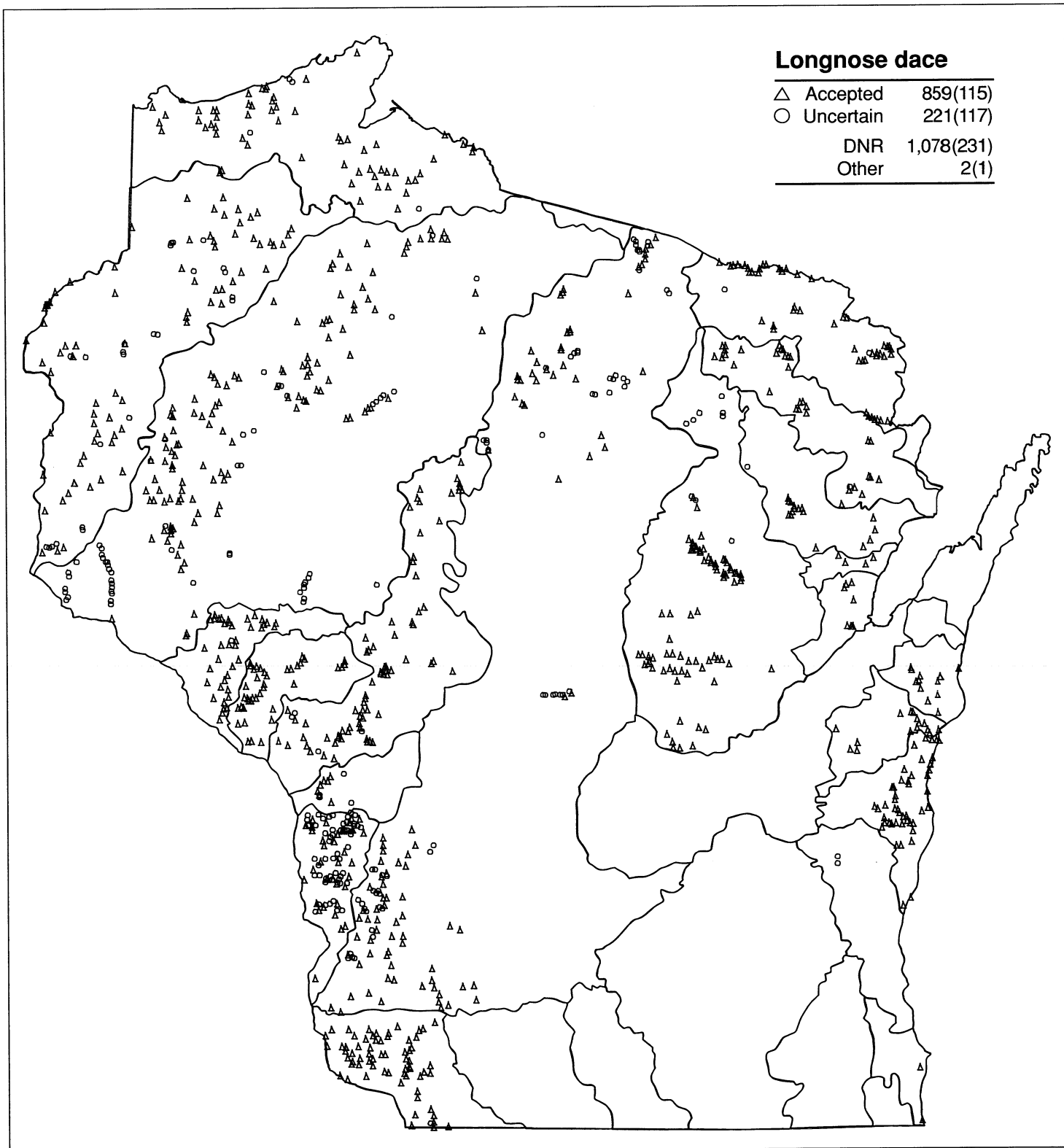




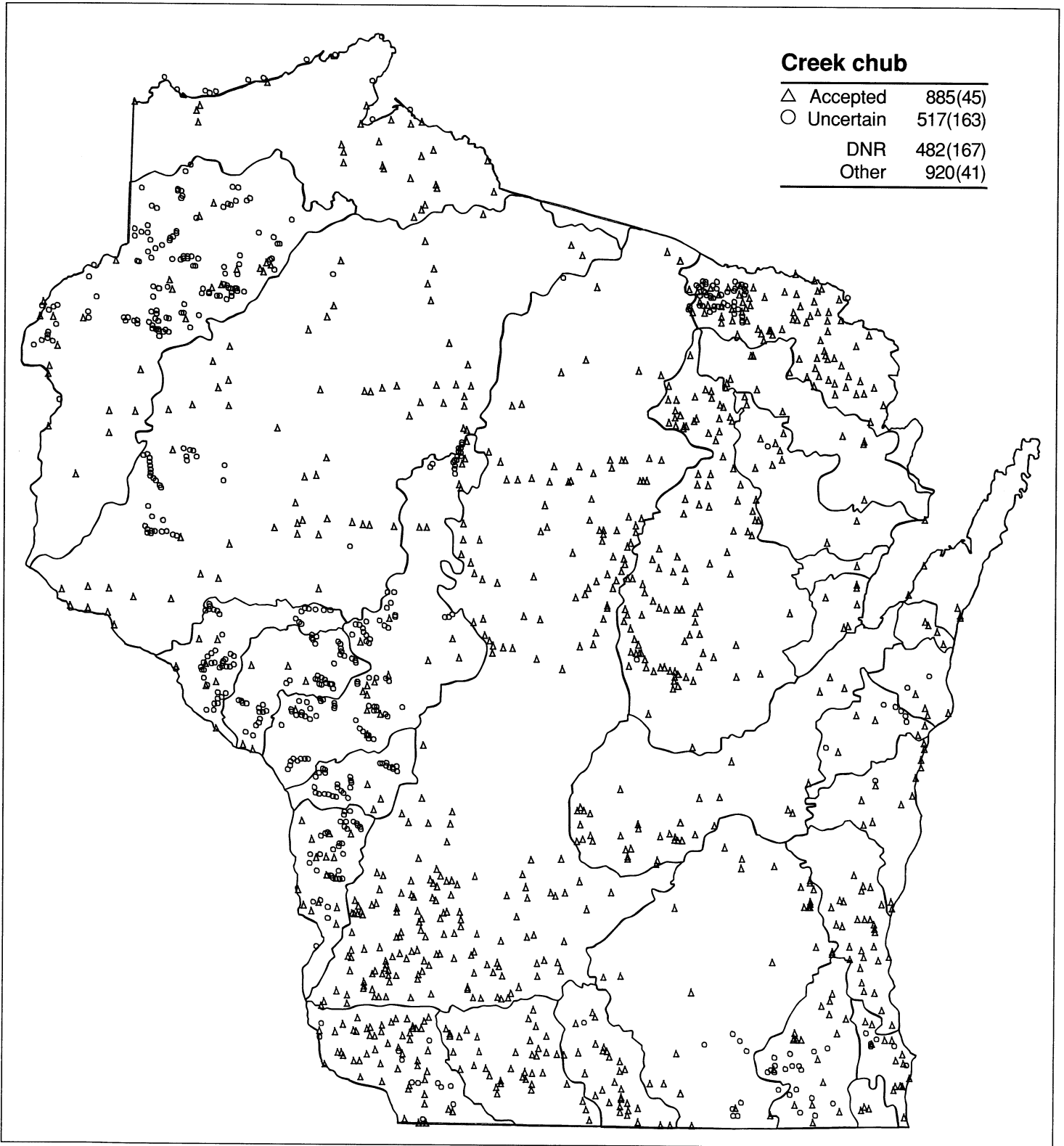
Map 72(E)

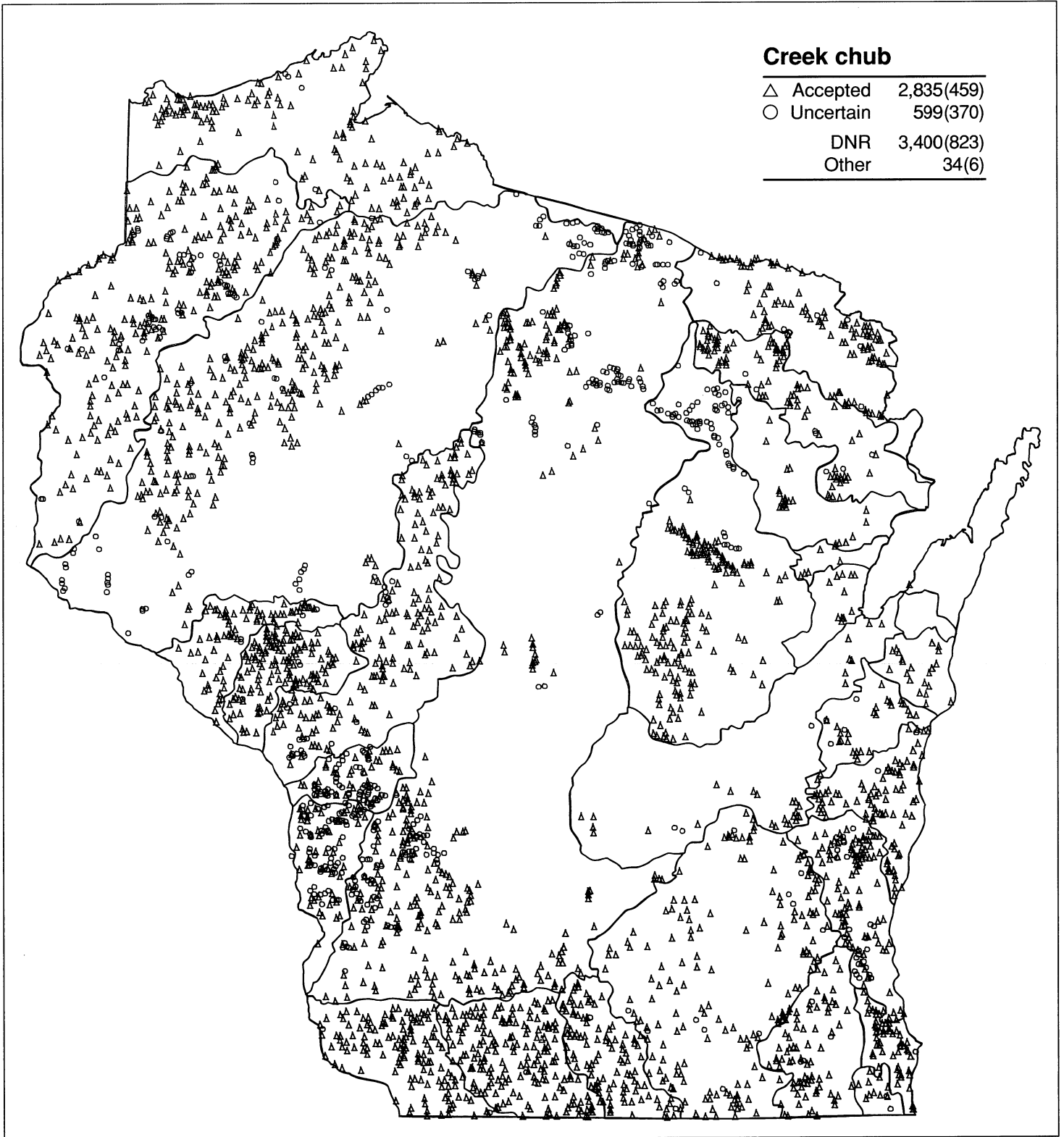


Map 72(L)

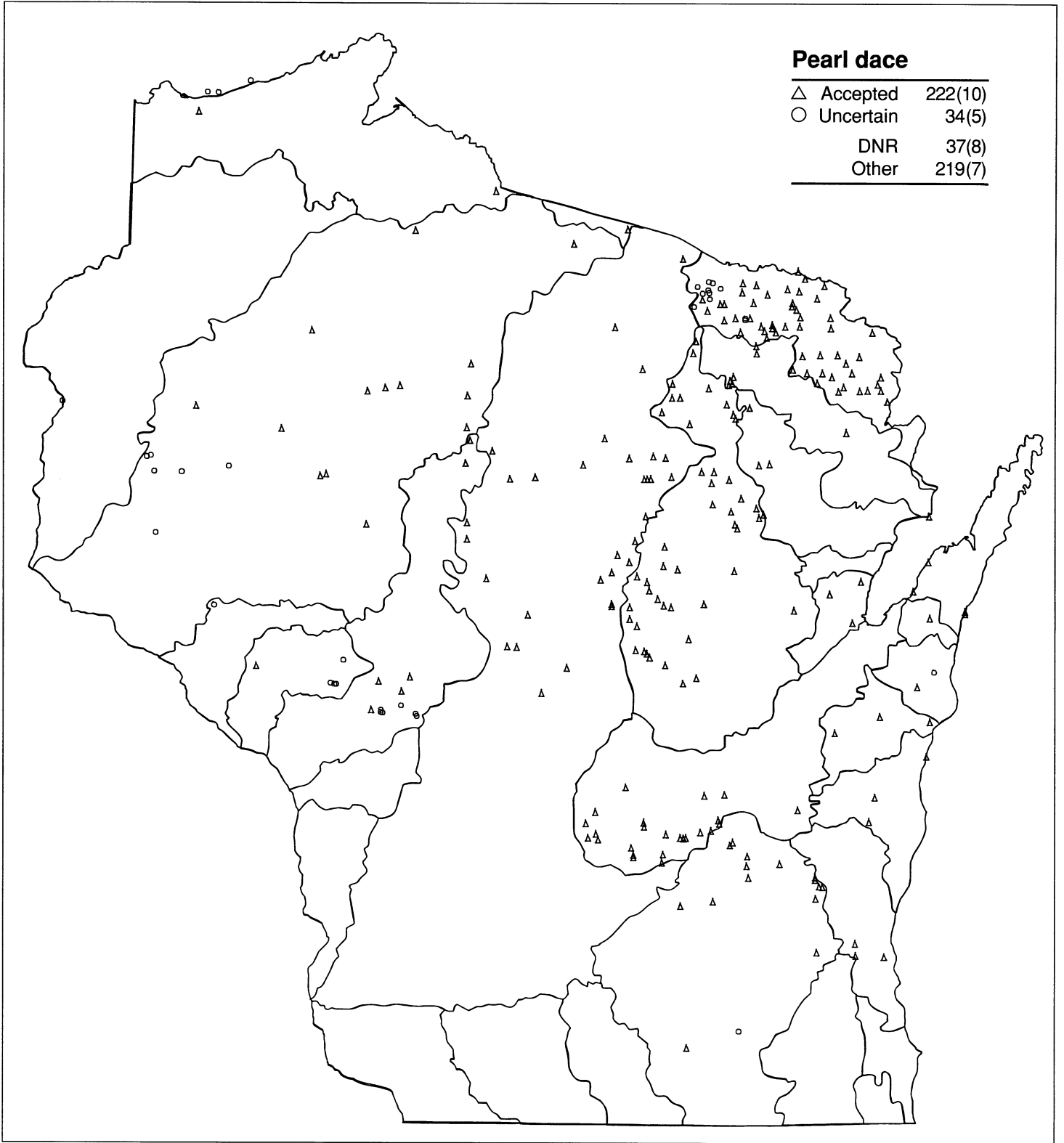


Map 73(E)

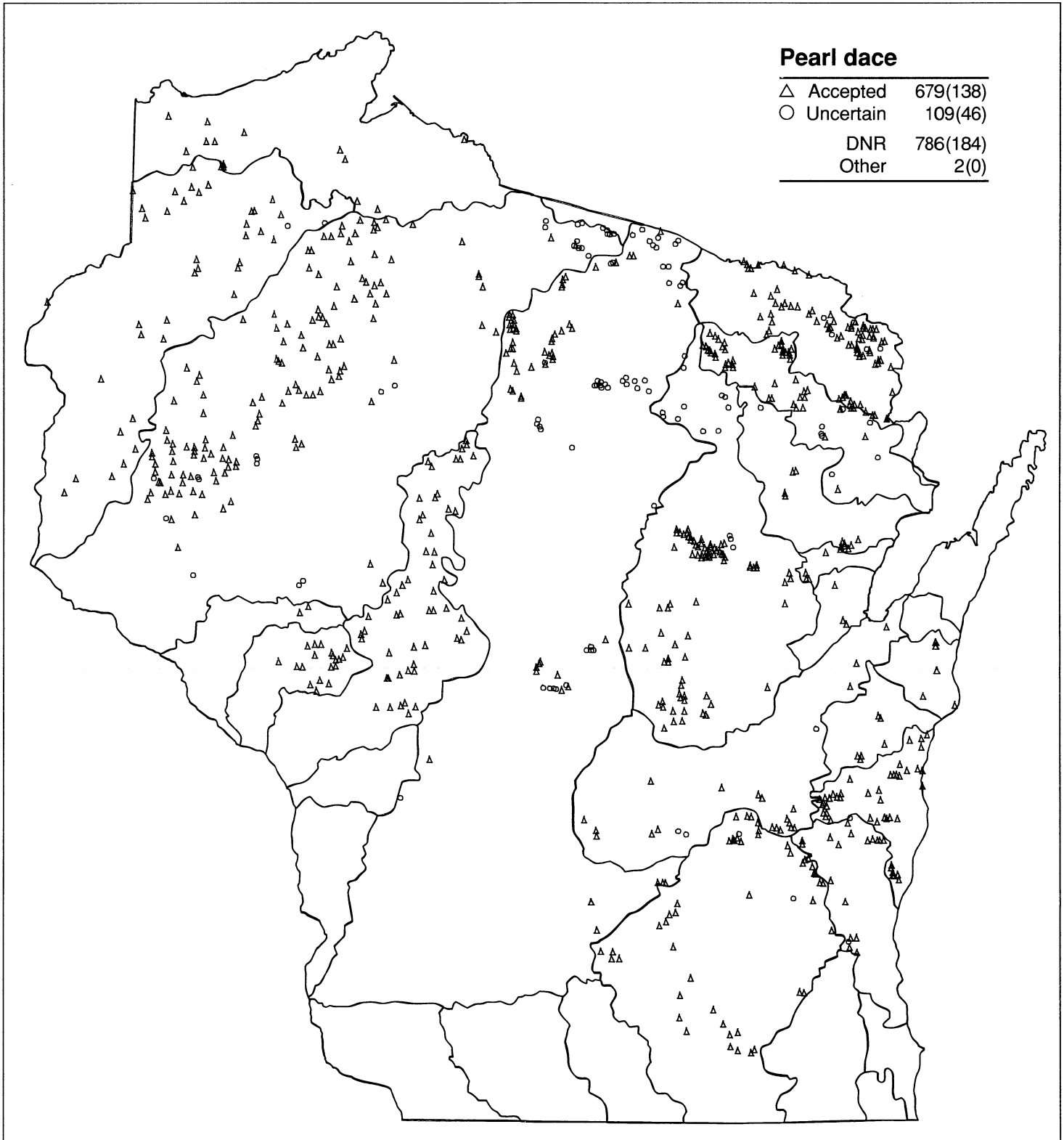




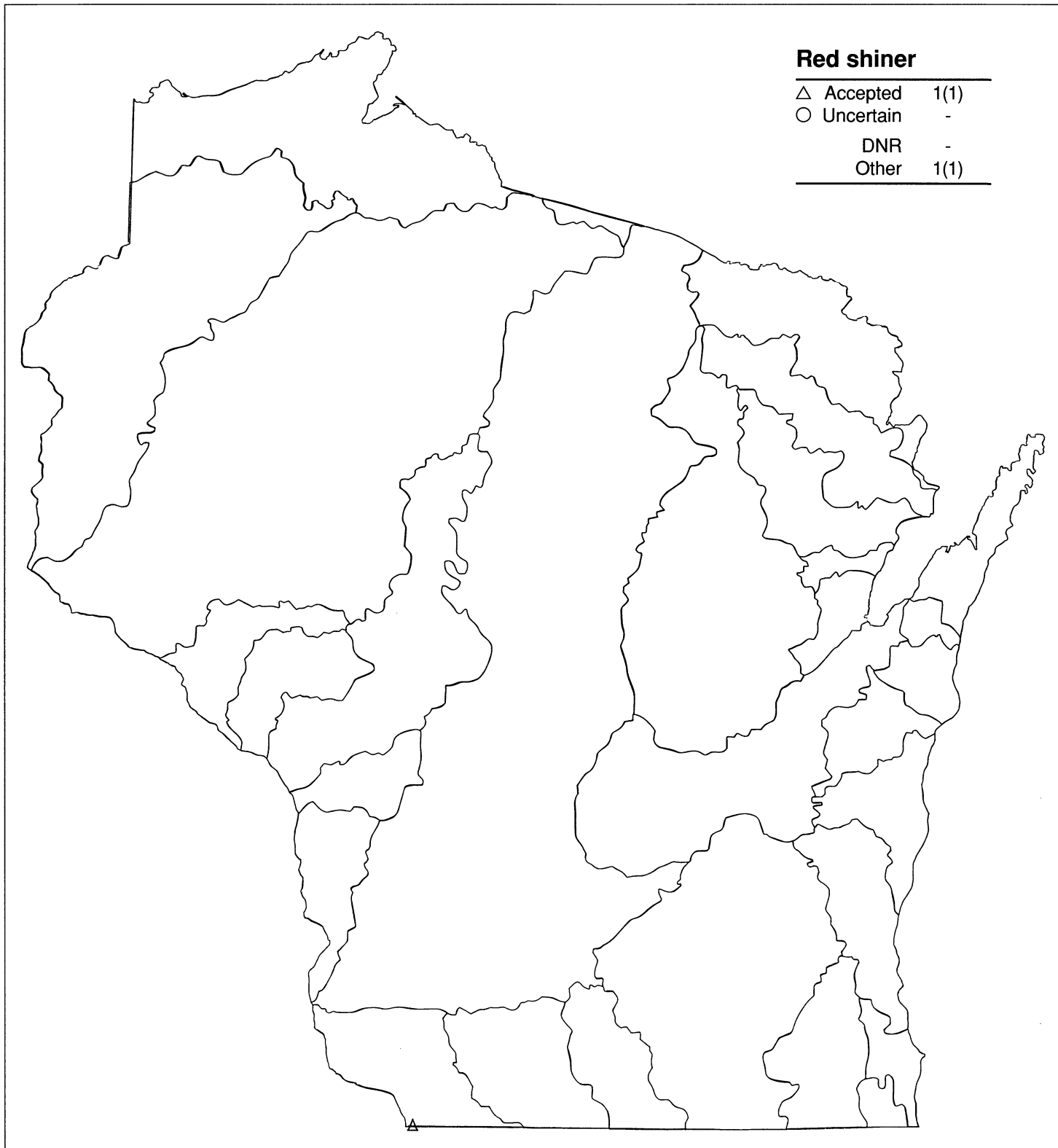
Map 74(E)



Map 74(L)

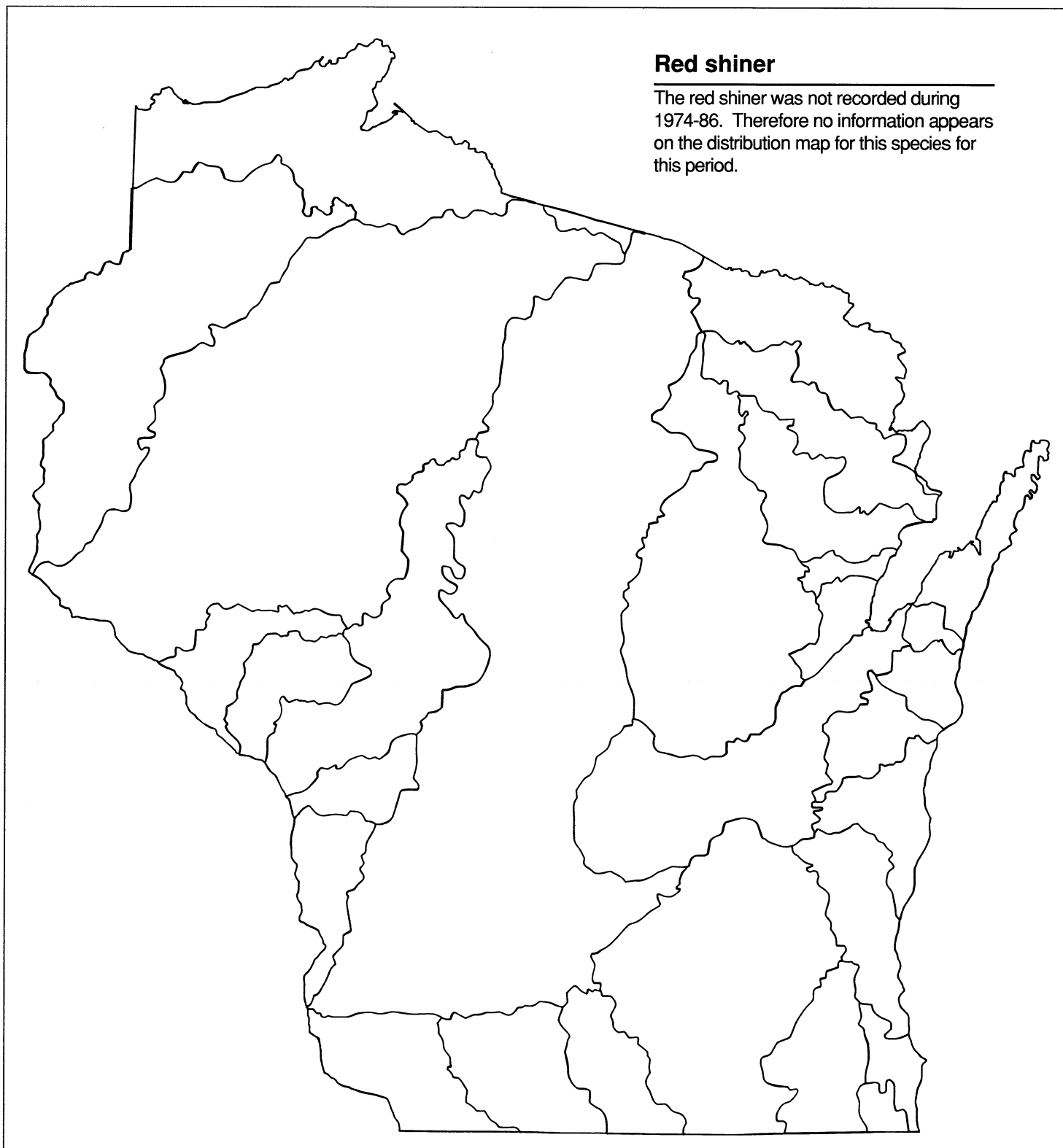


Map 75(E)

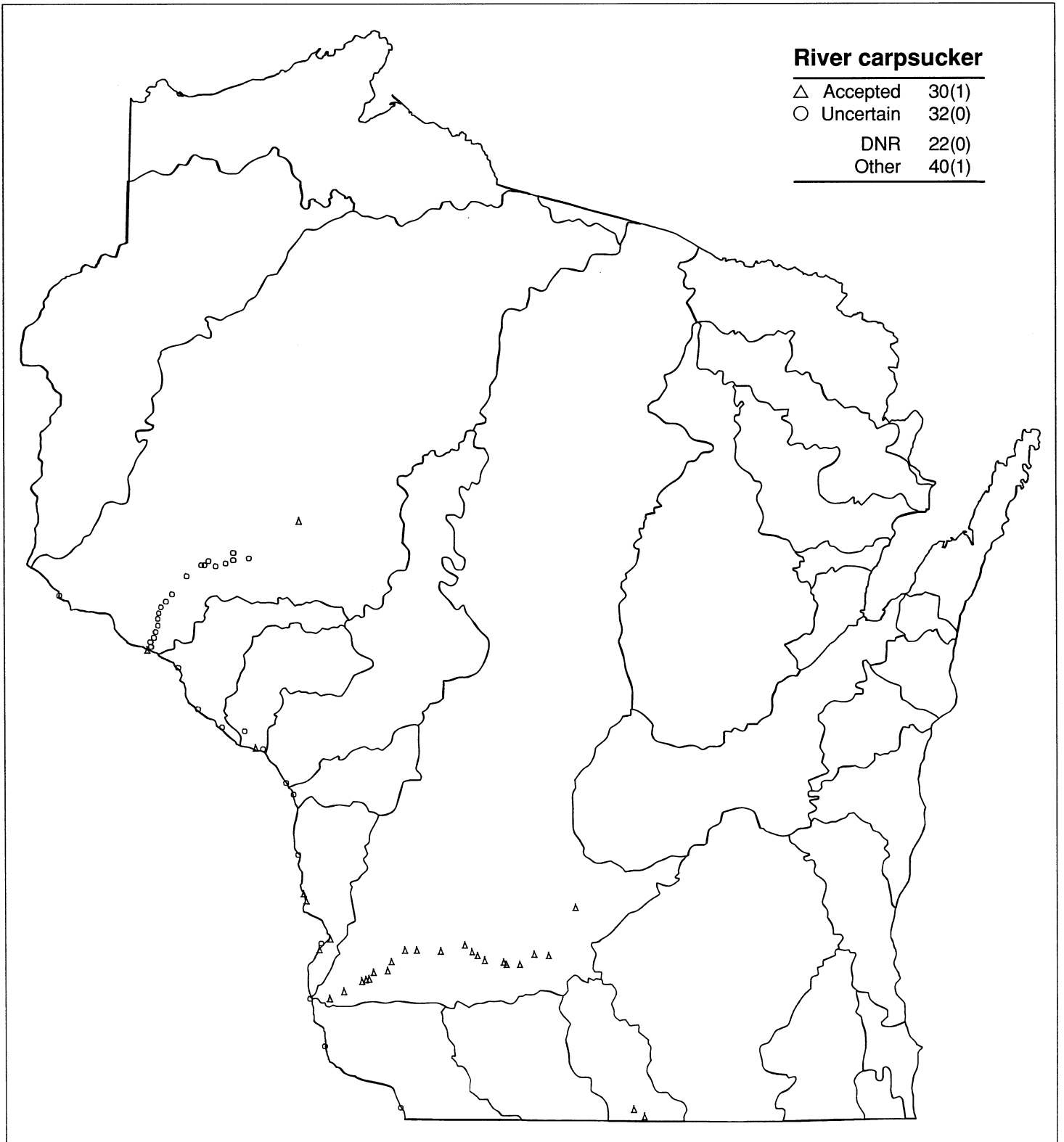


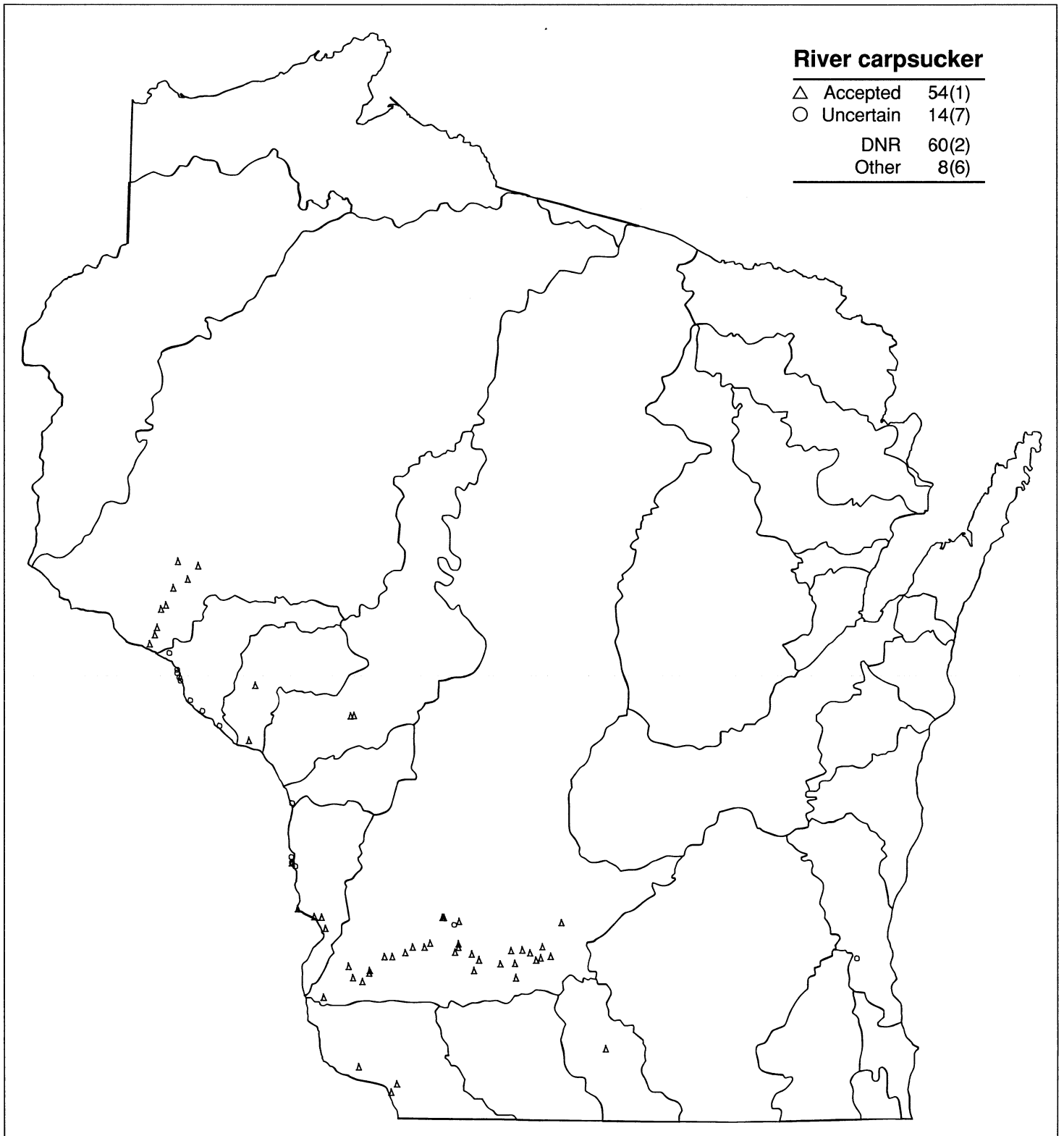
Red shiner

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

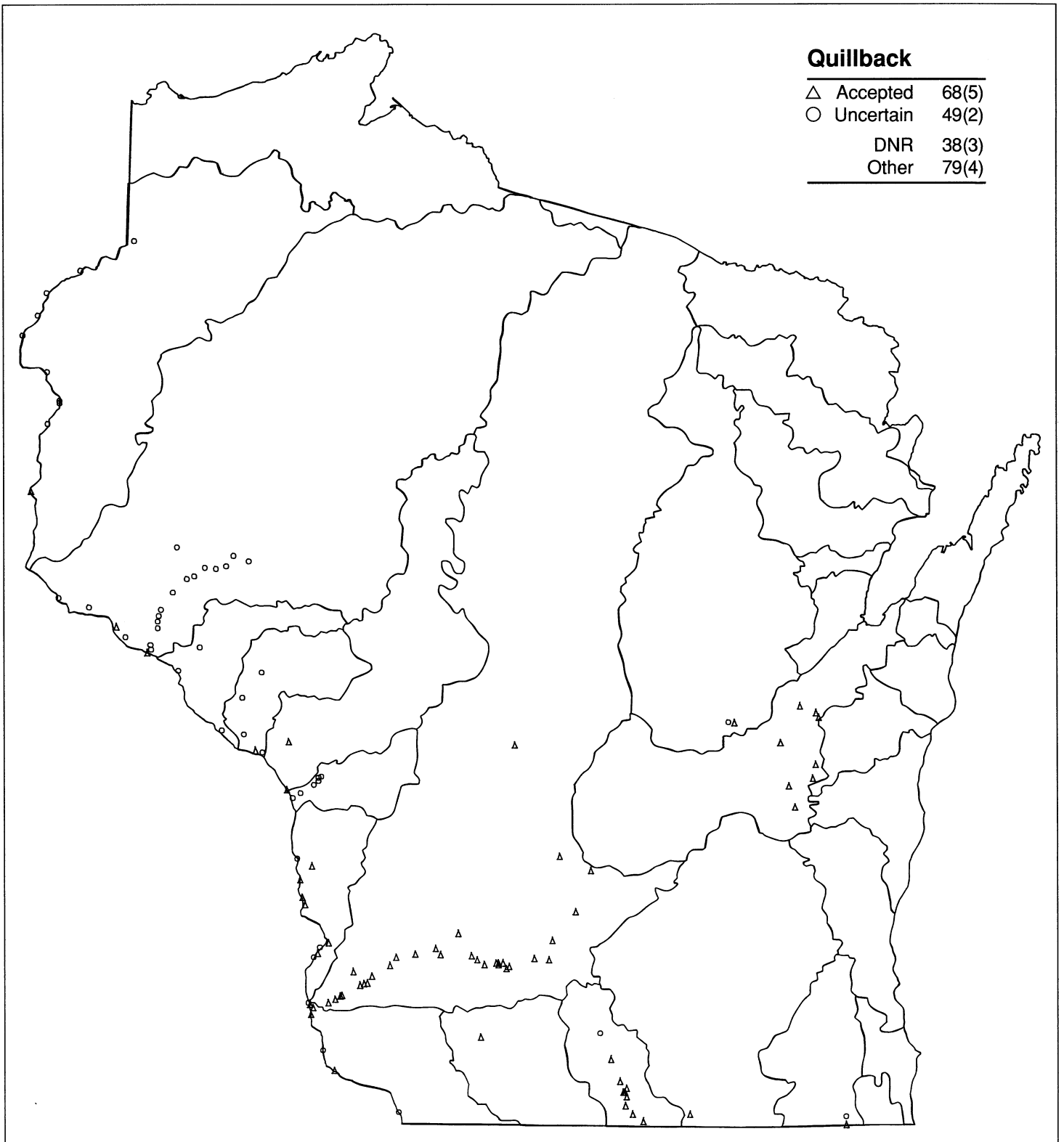


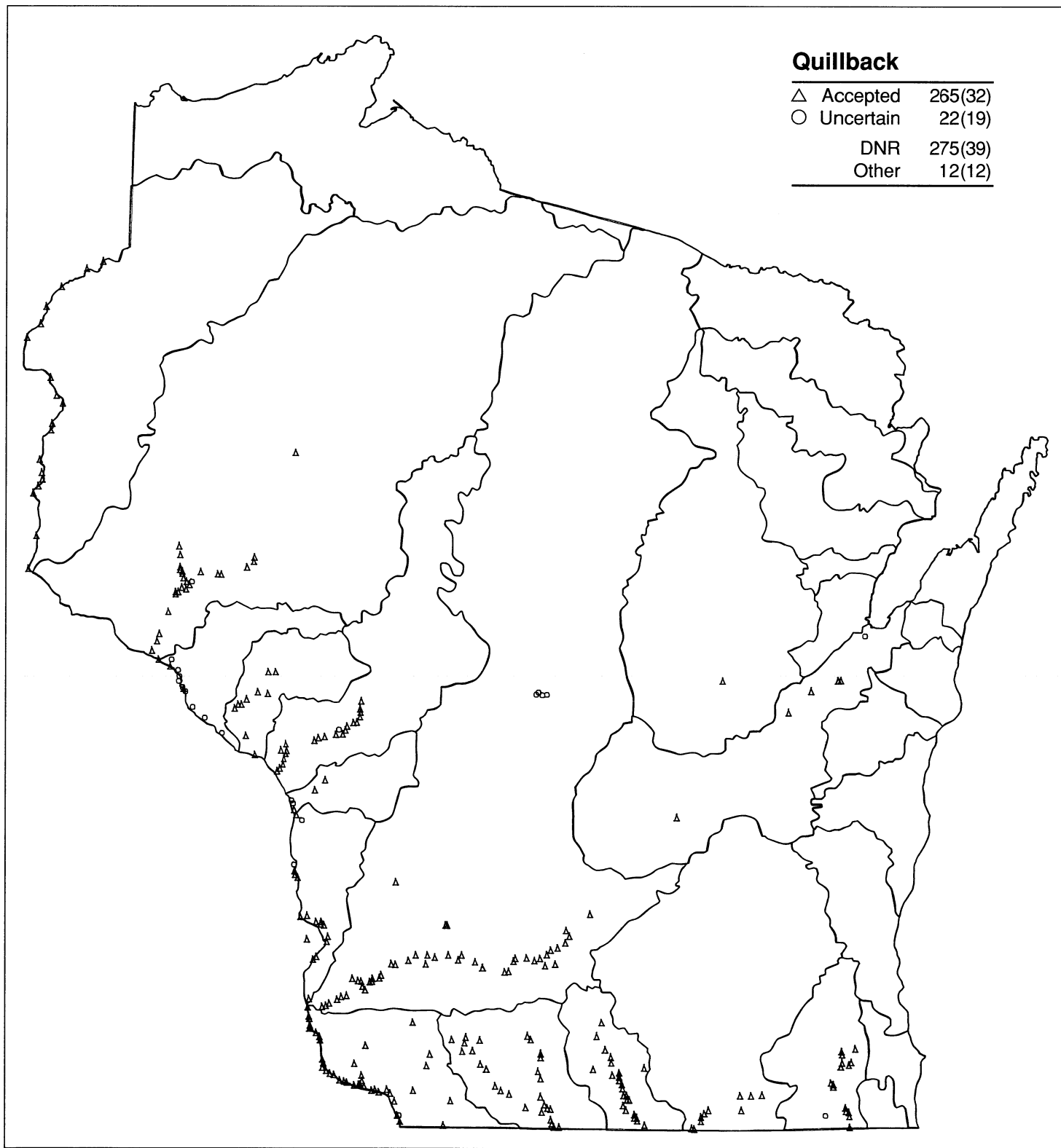
Map 76(E)



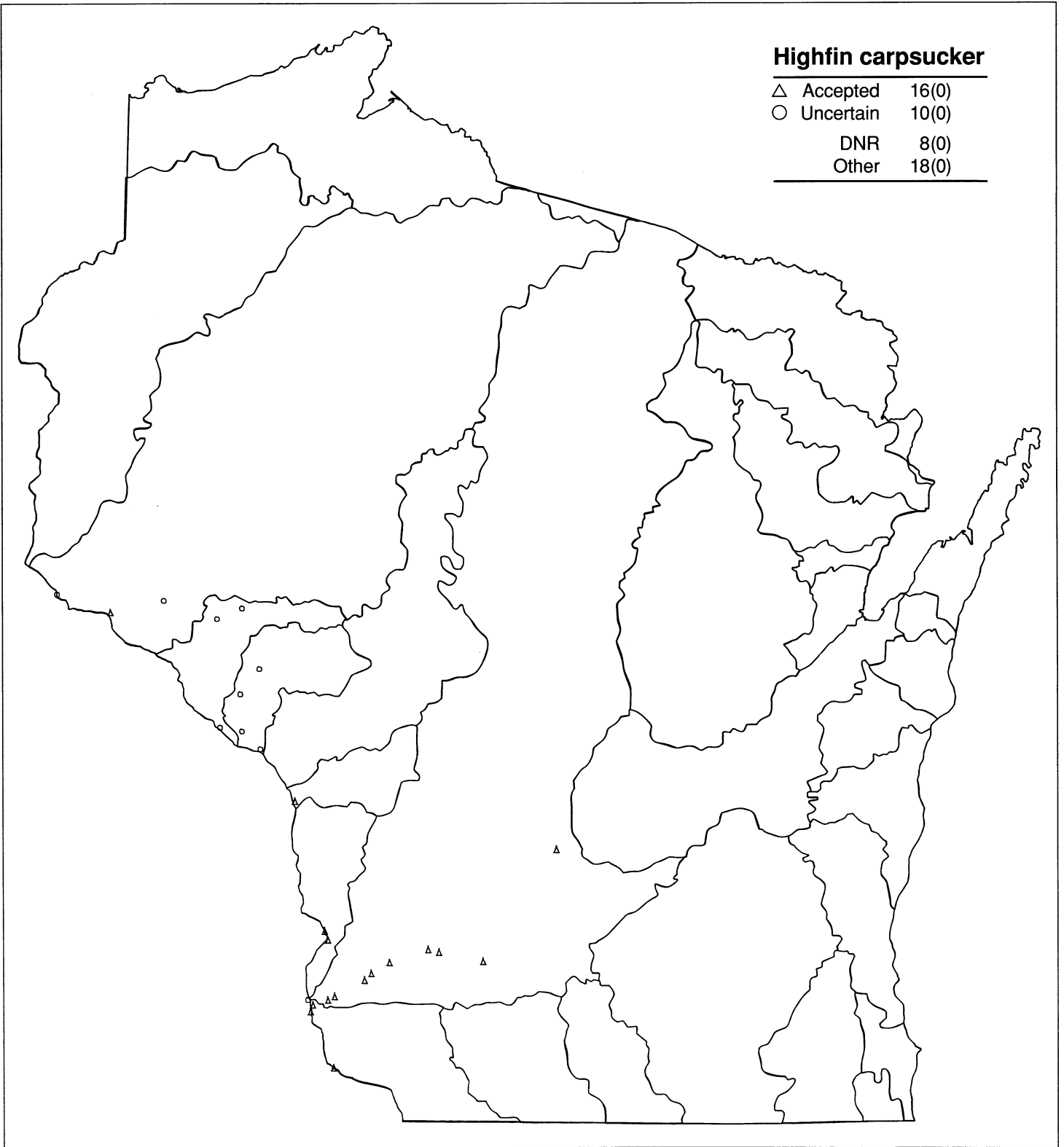


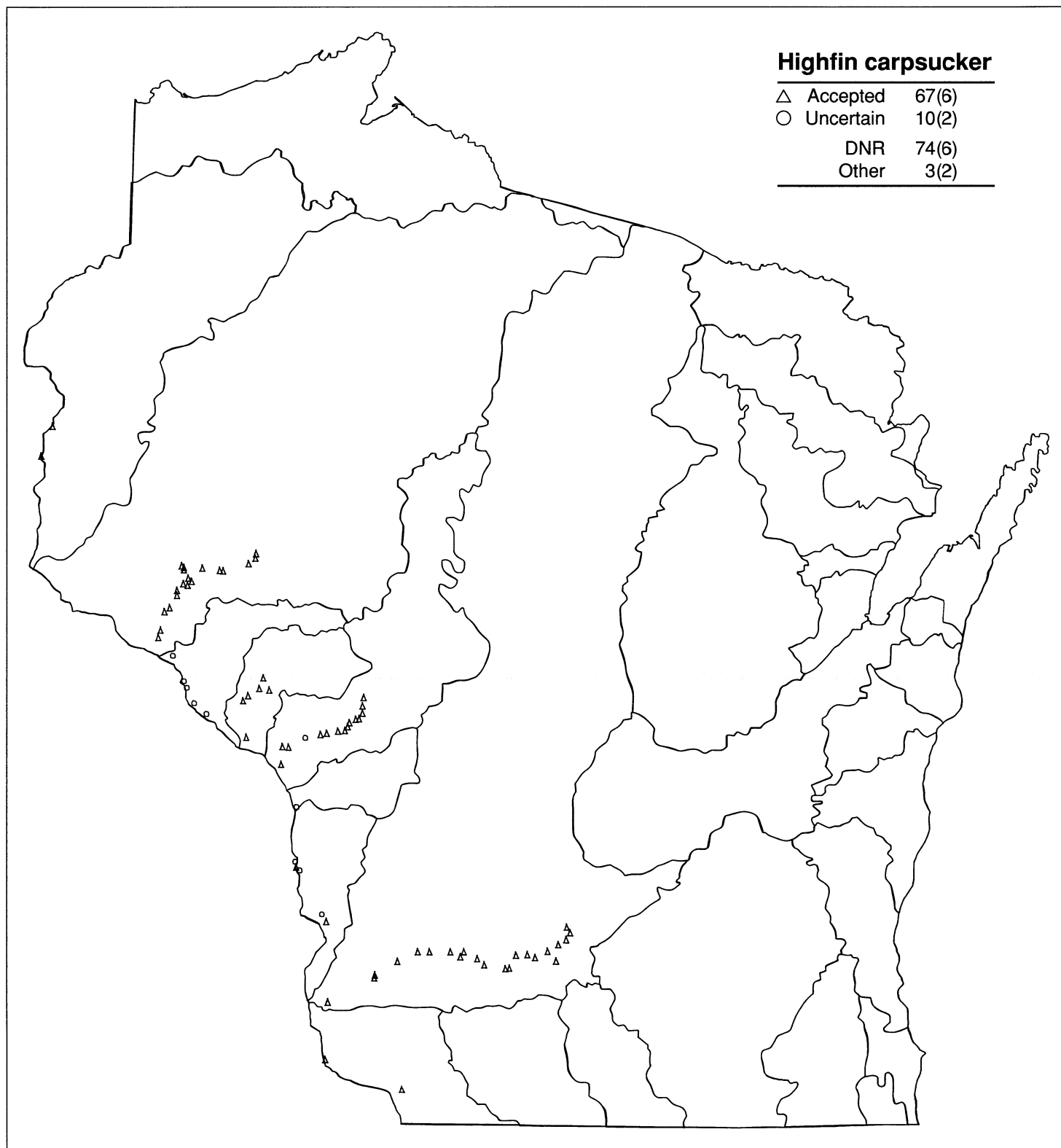
Map 77(E)





Map 78(E)

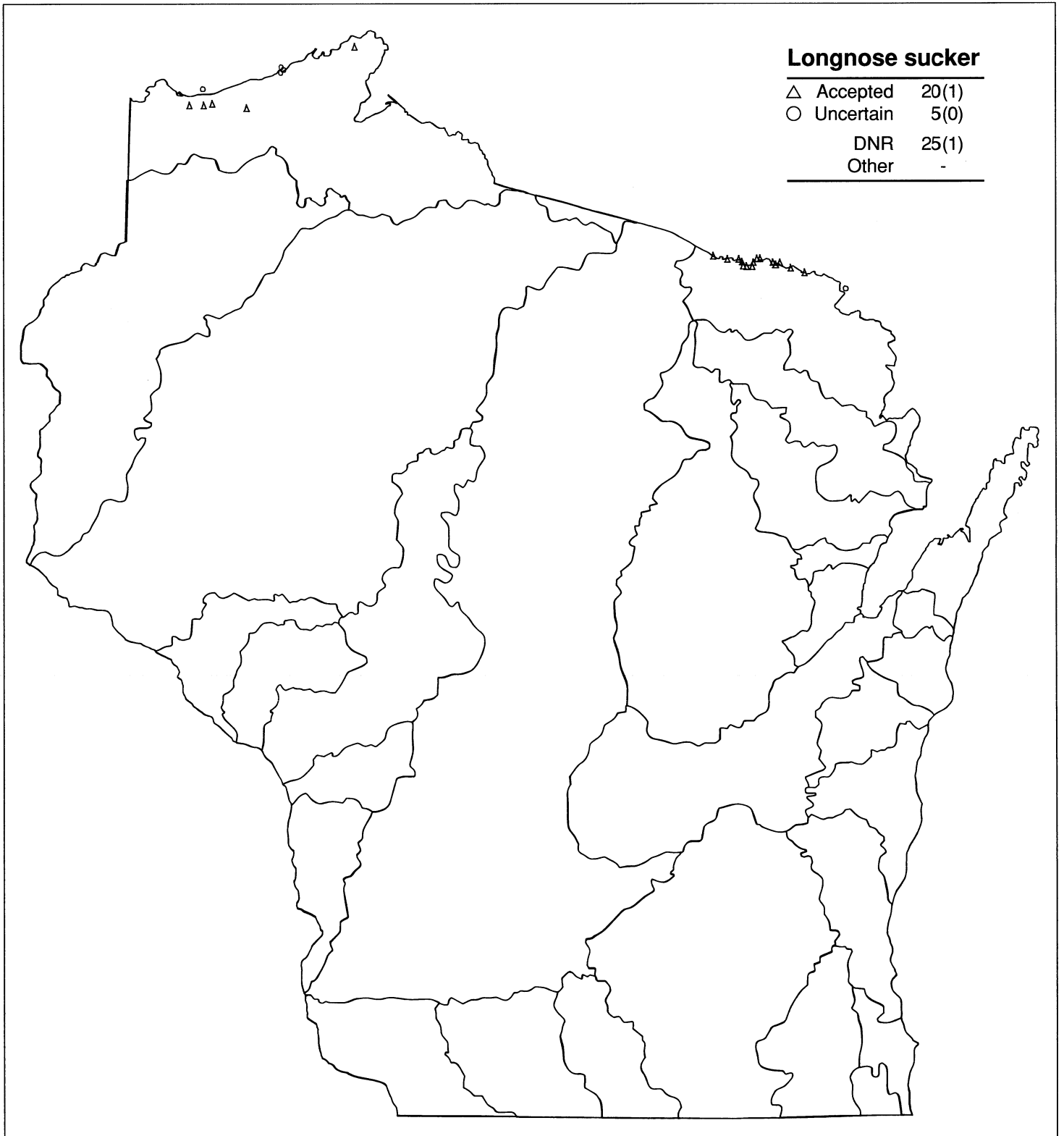




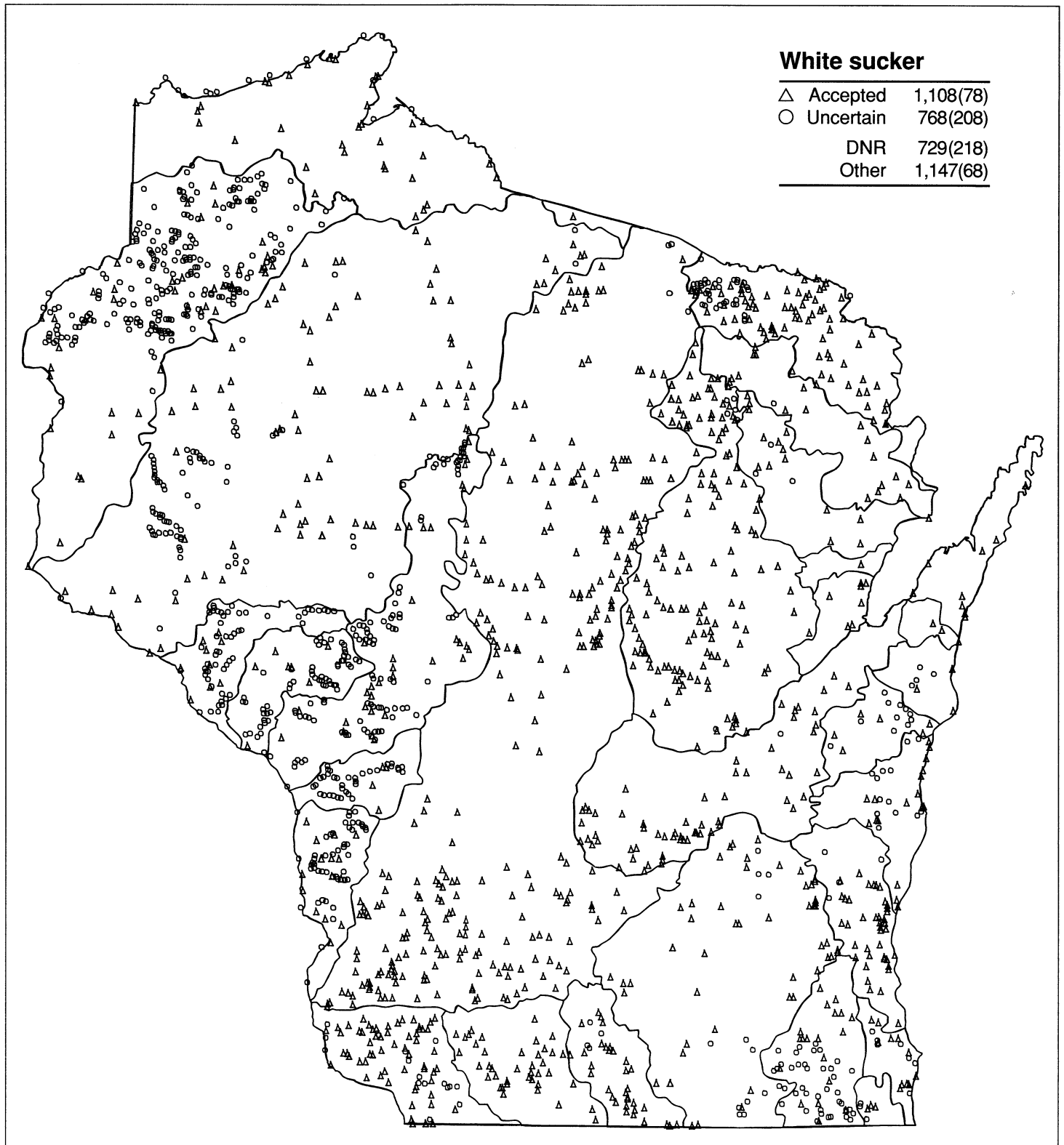
Map 79(E)

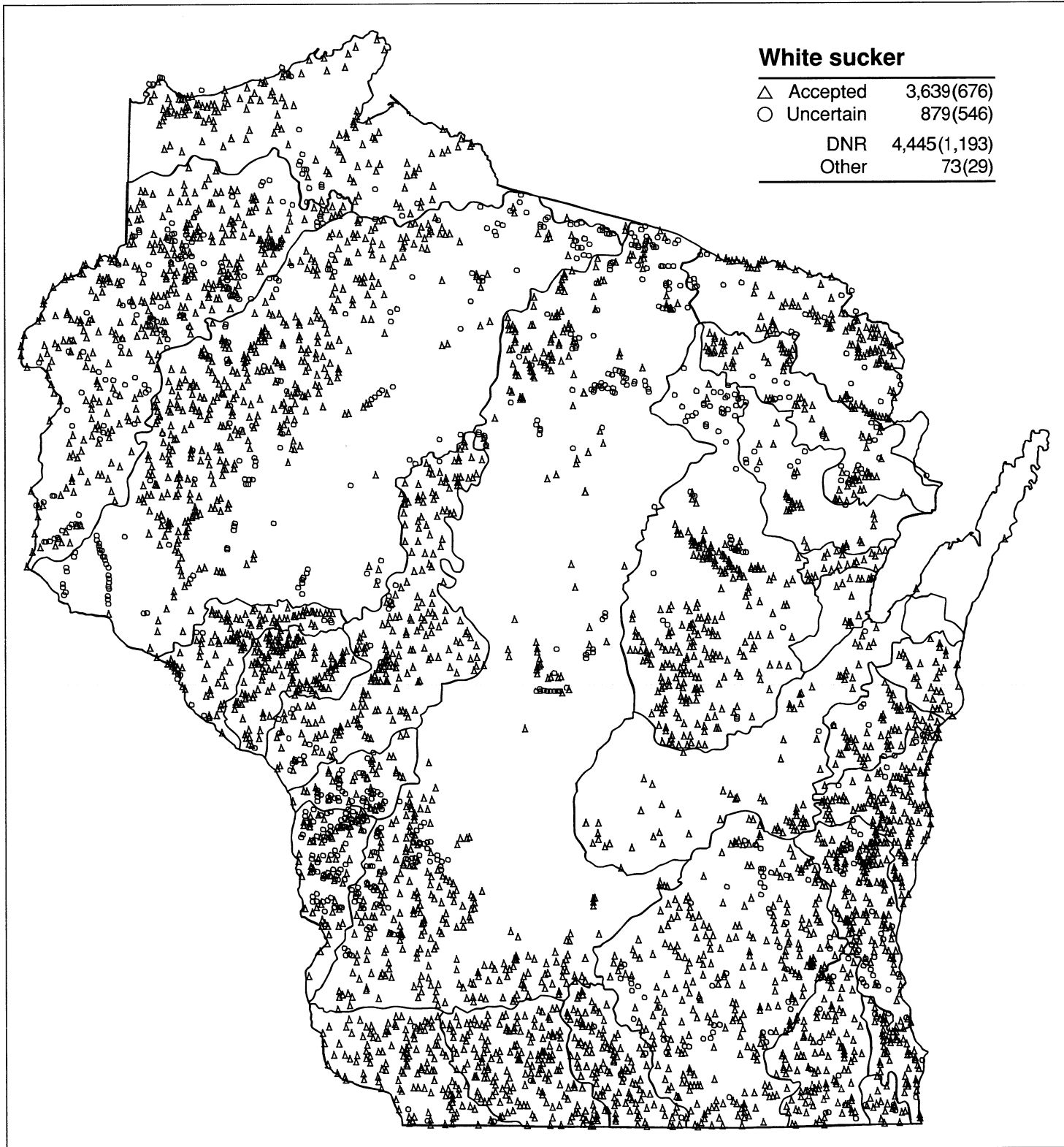


Map 79(L)

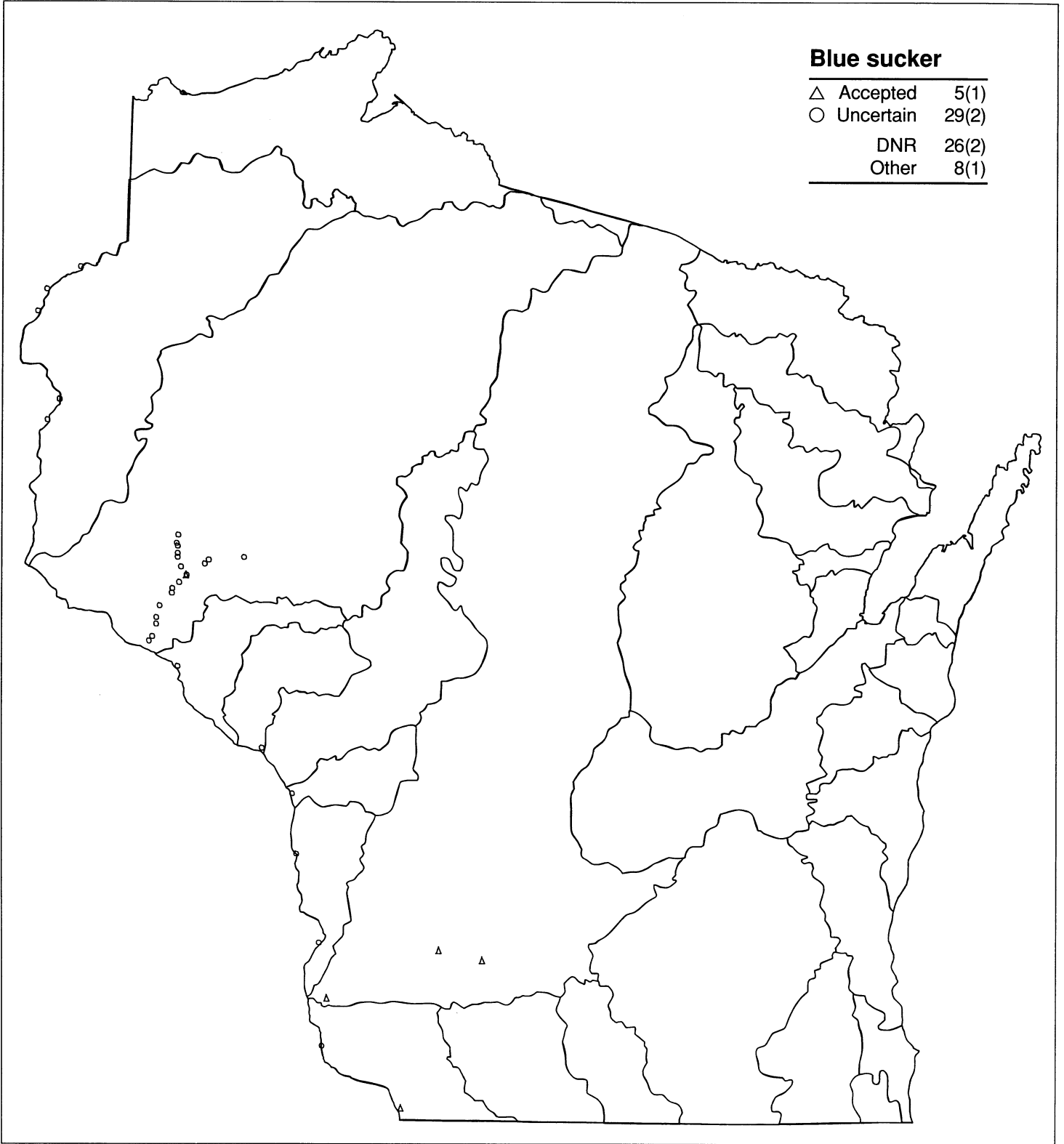


Map 80(E)

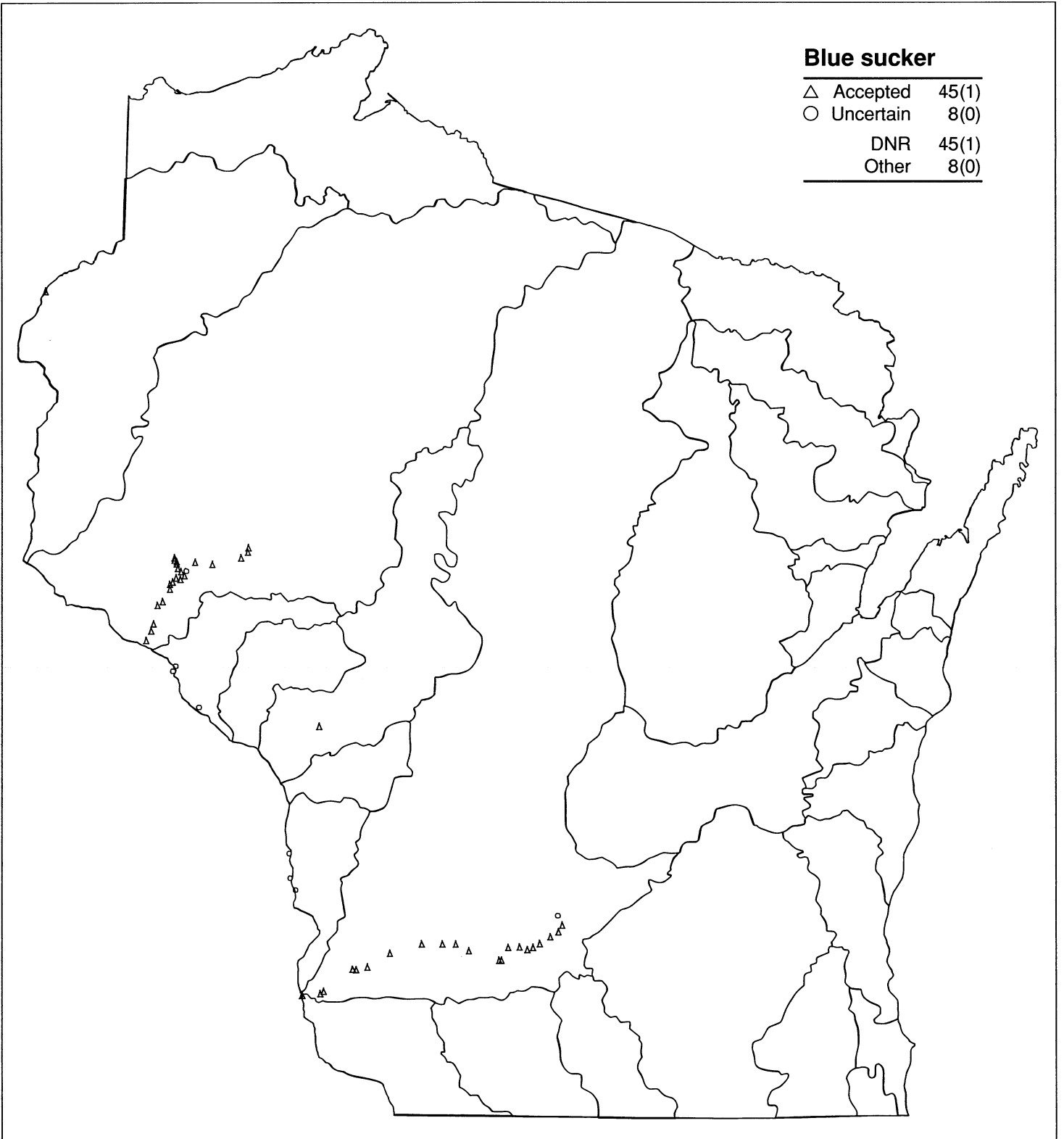




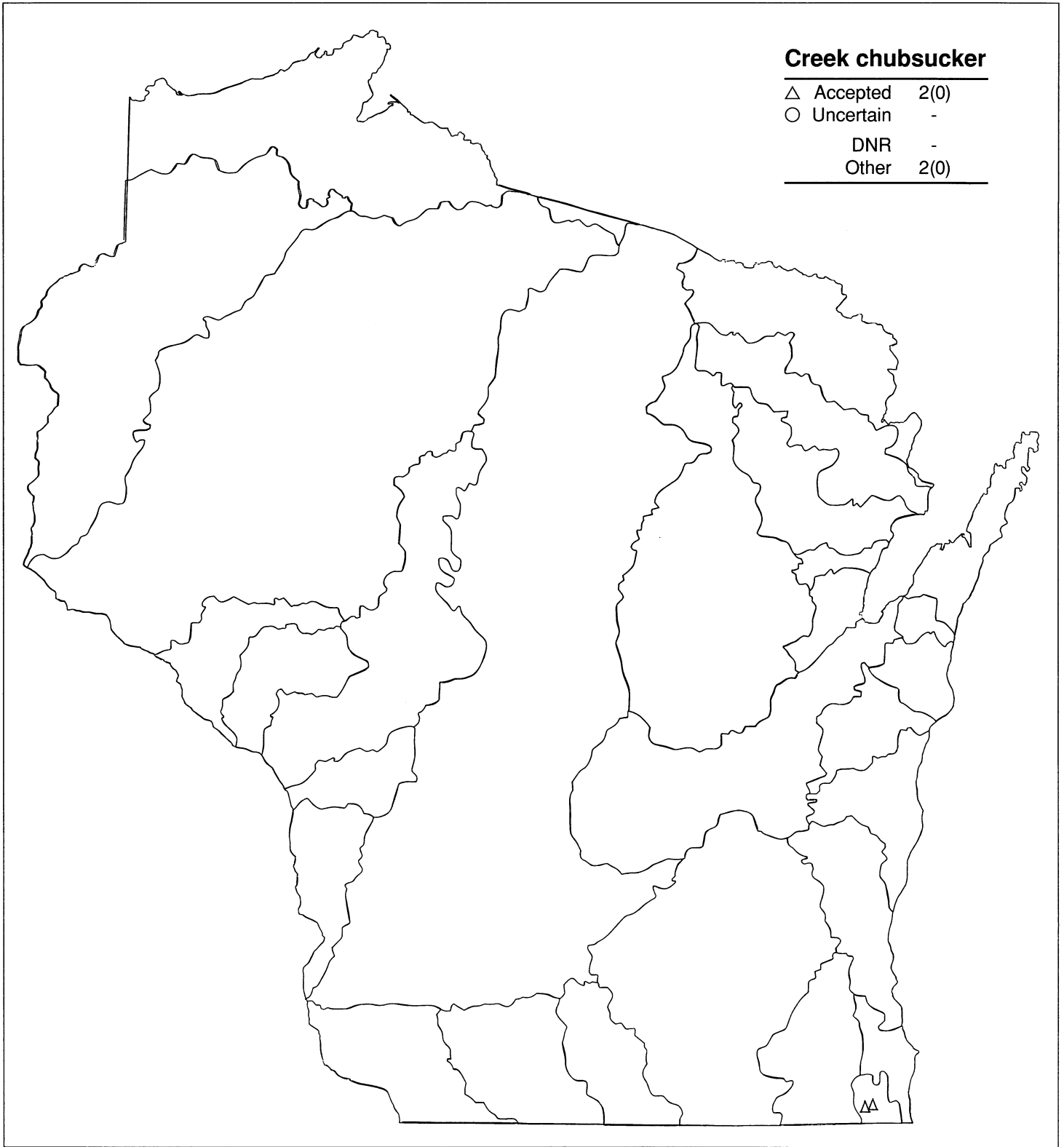
Map 81(E)



Map 81(L)



Map 82(E)

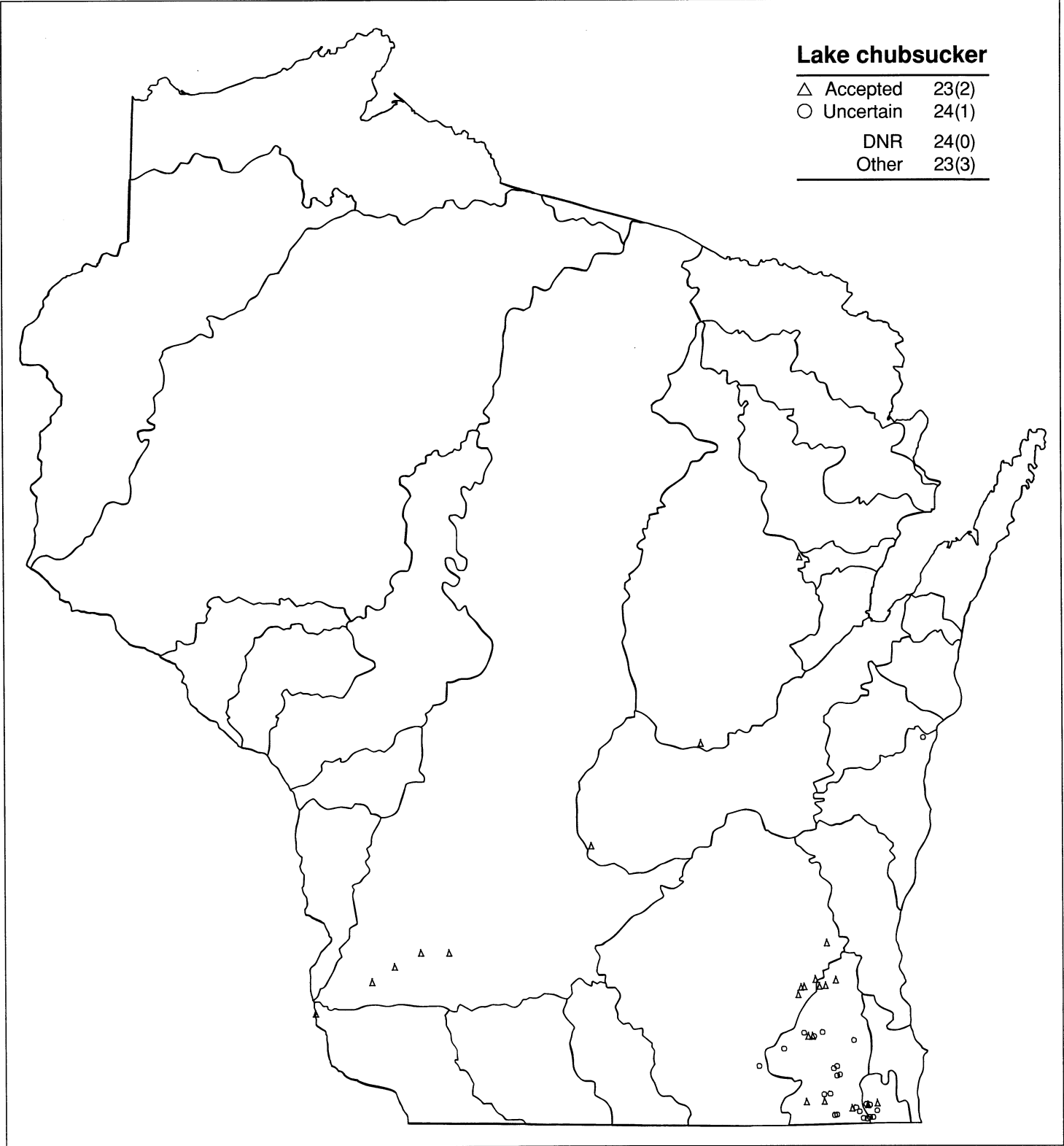


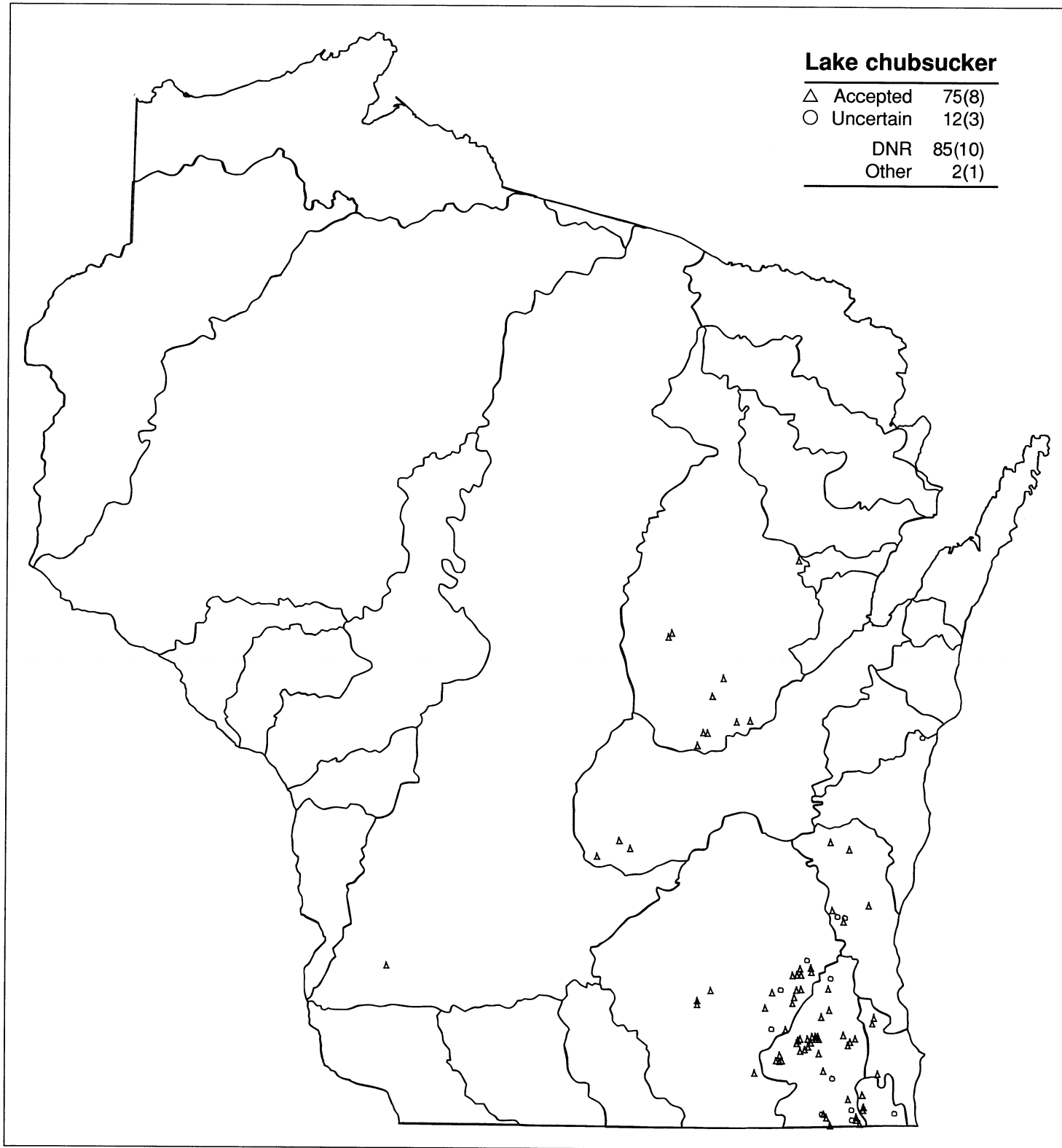
Creek chubsucker

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

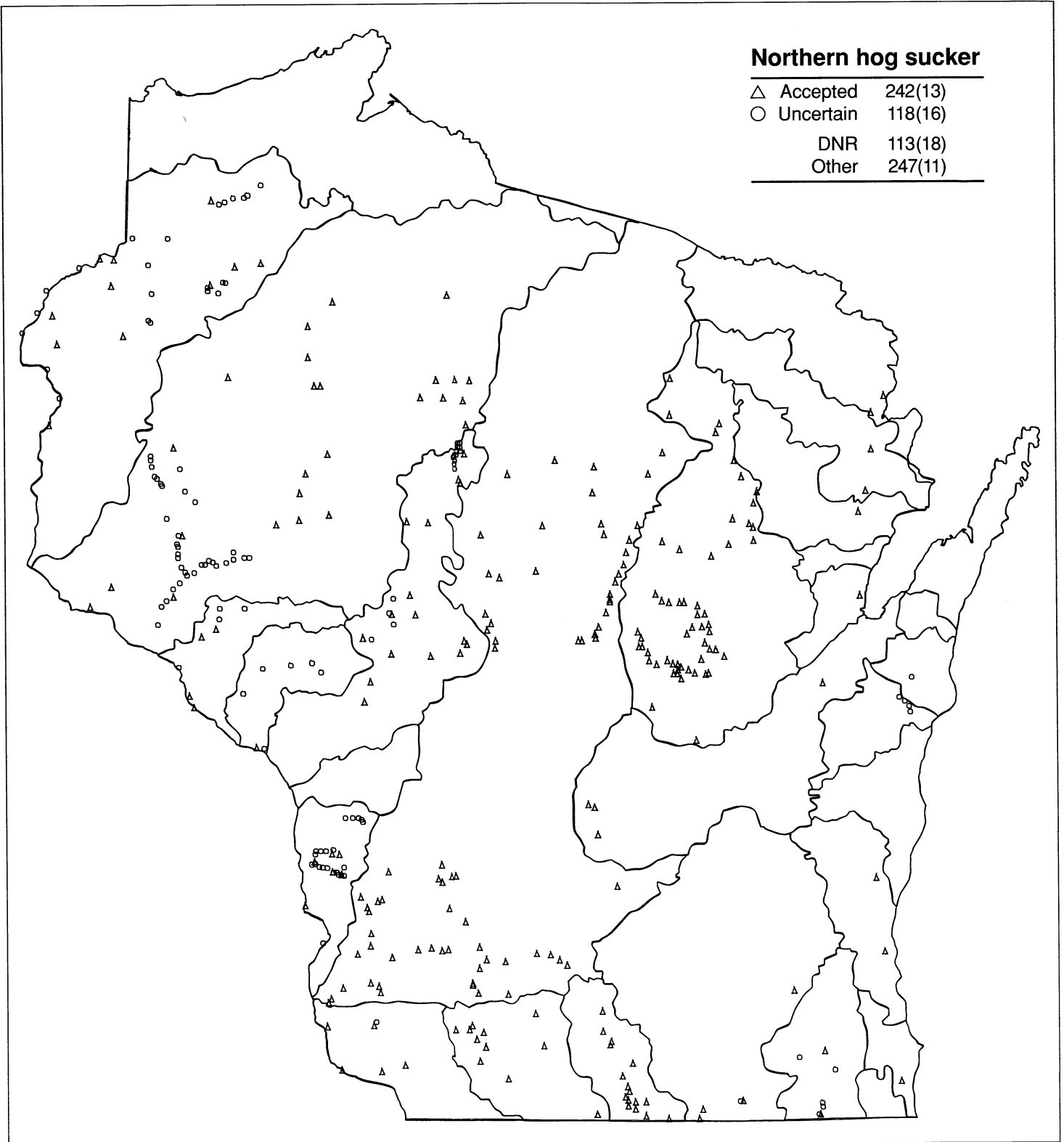


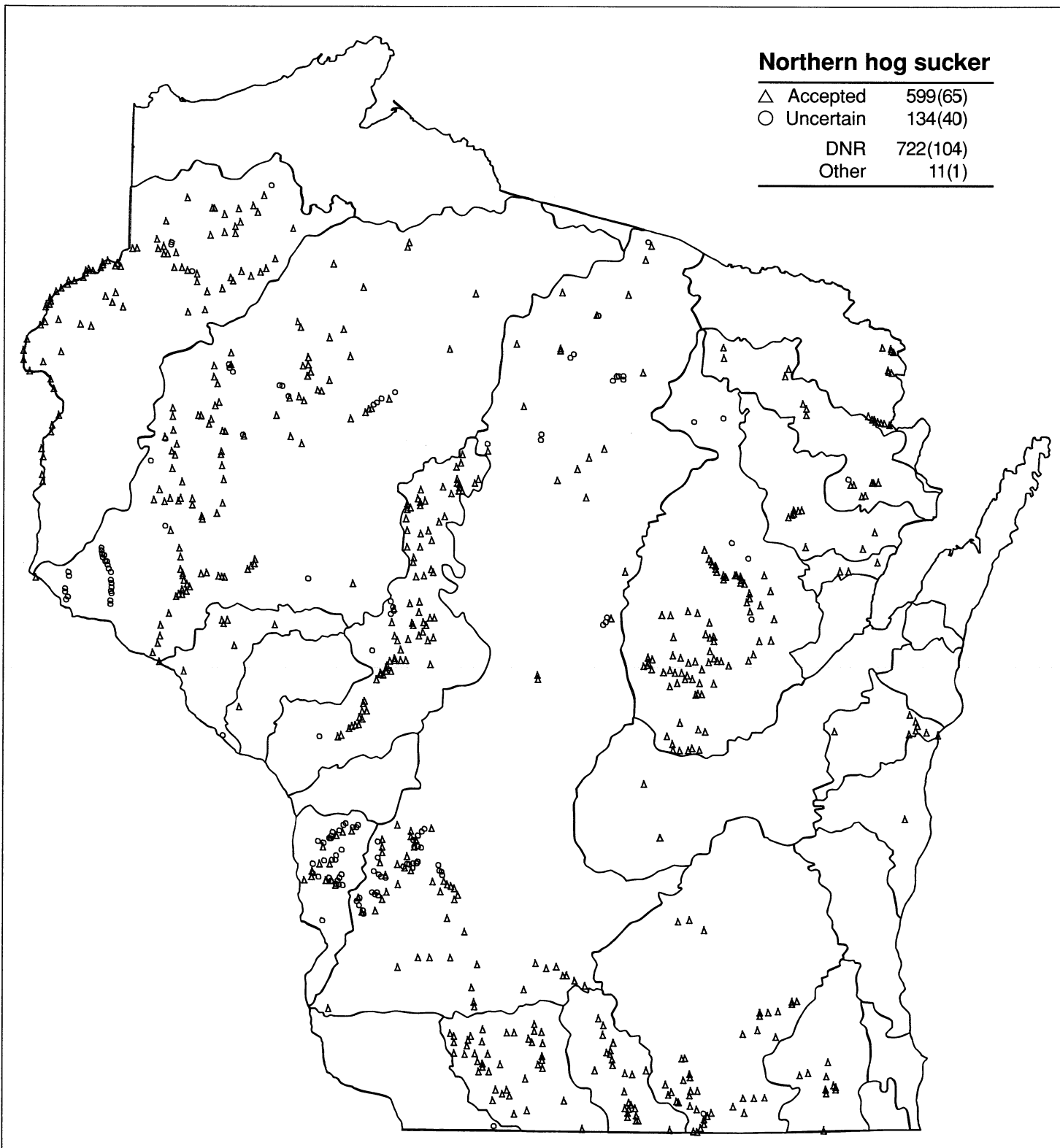
Map 83(E)





Map 84(E)





Map 85(E)

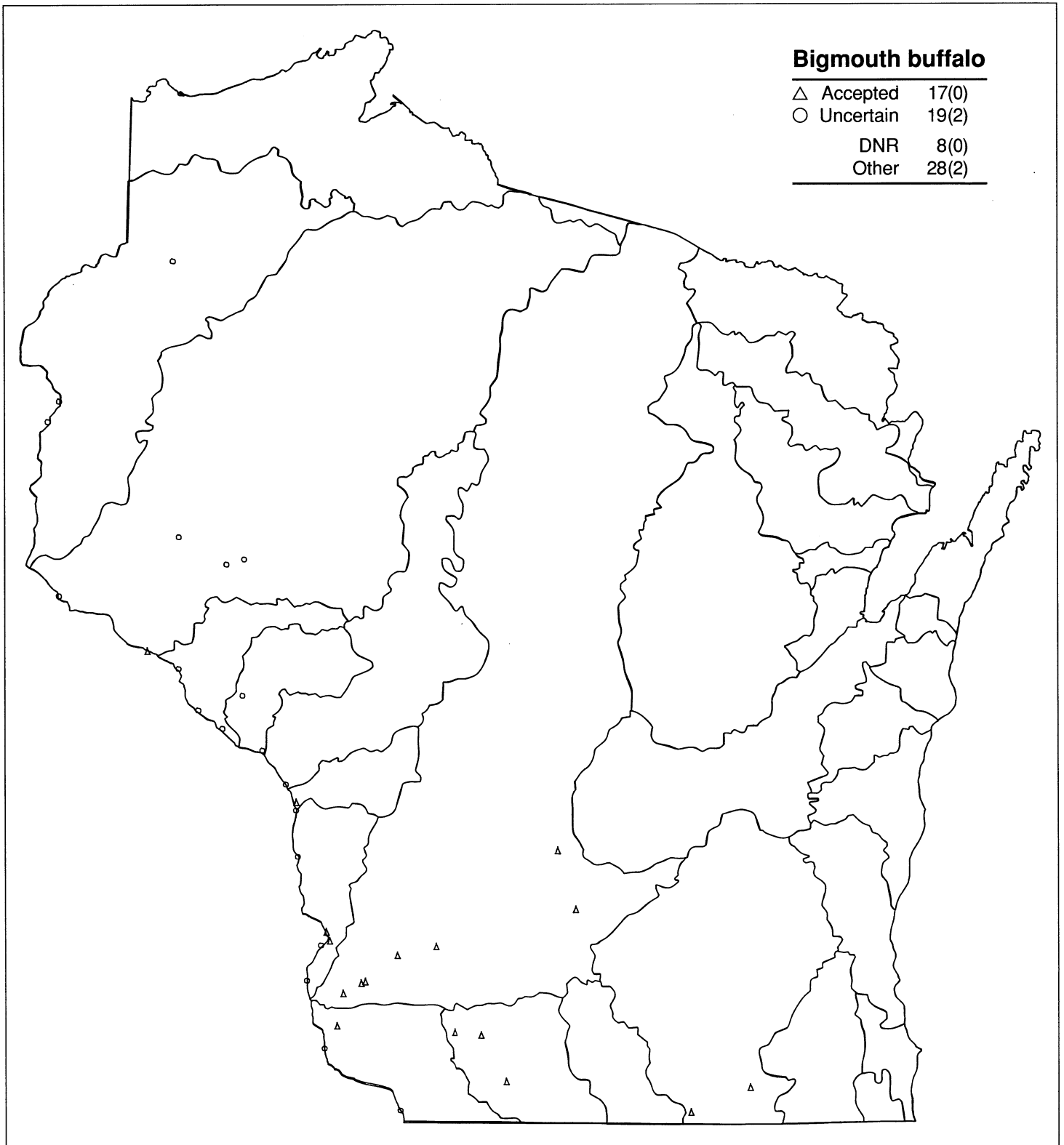


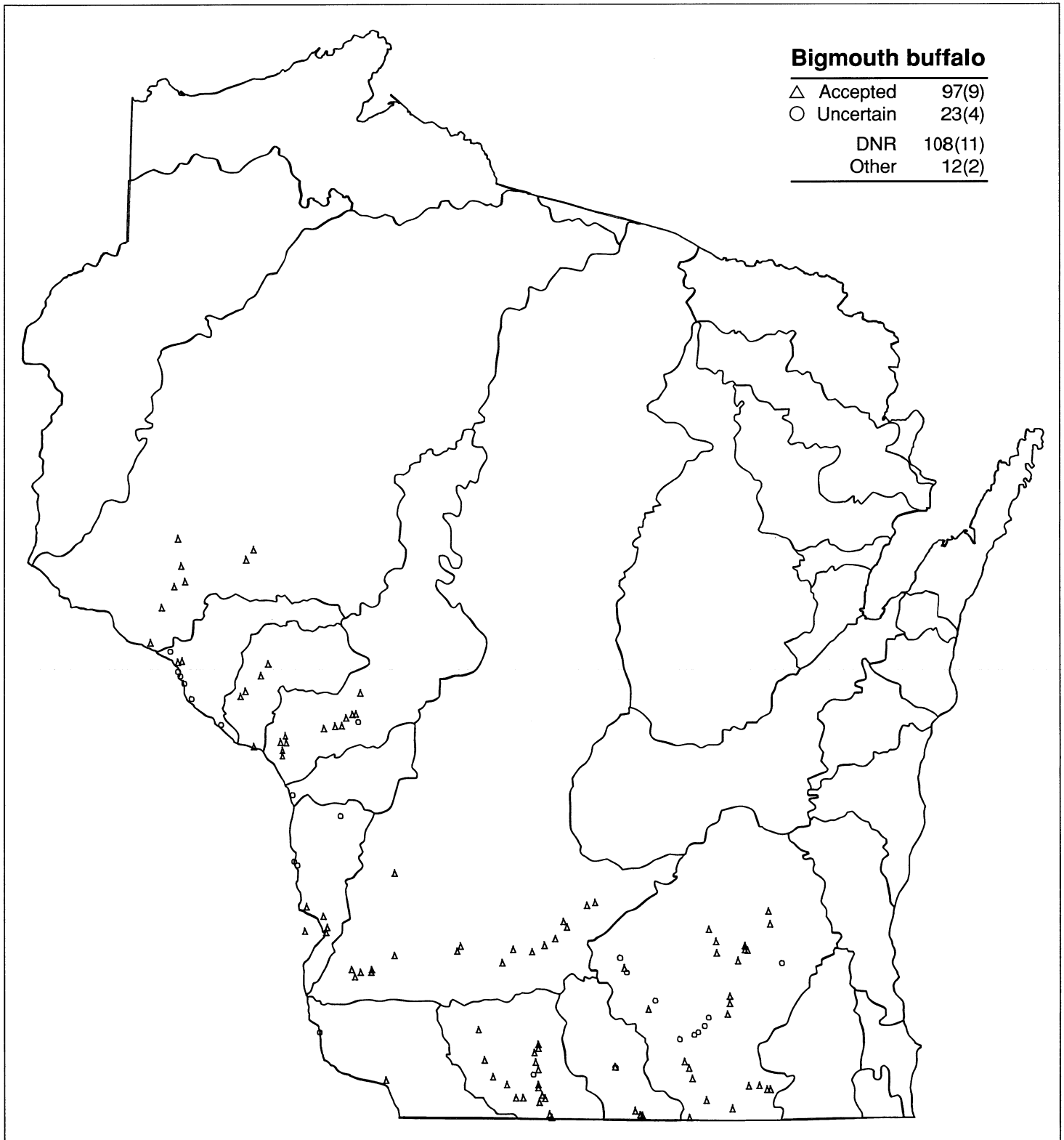
Smallmouth buffalo

| | | |
|---|-----------|-------|
| △ | Accepted | 58(5) |
| ○ | Uncertain | 14(5) |
| | DNR | 61(5) |
| | Other | 11(5) |

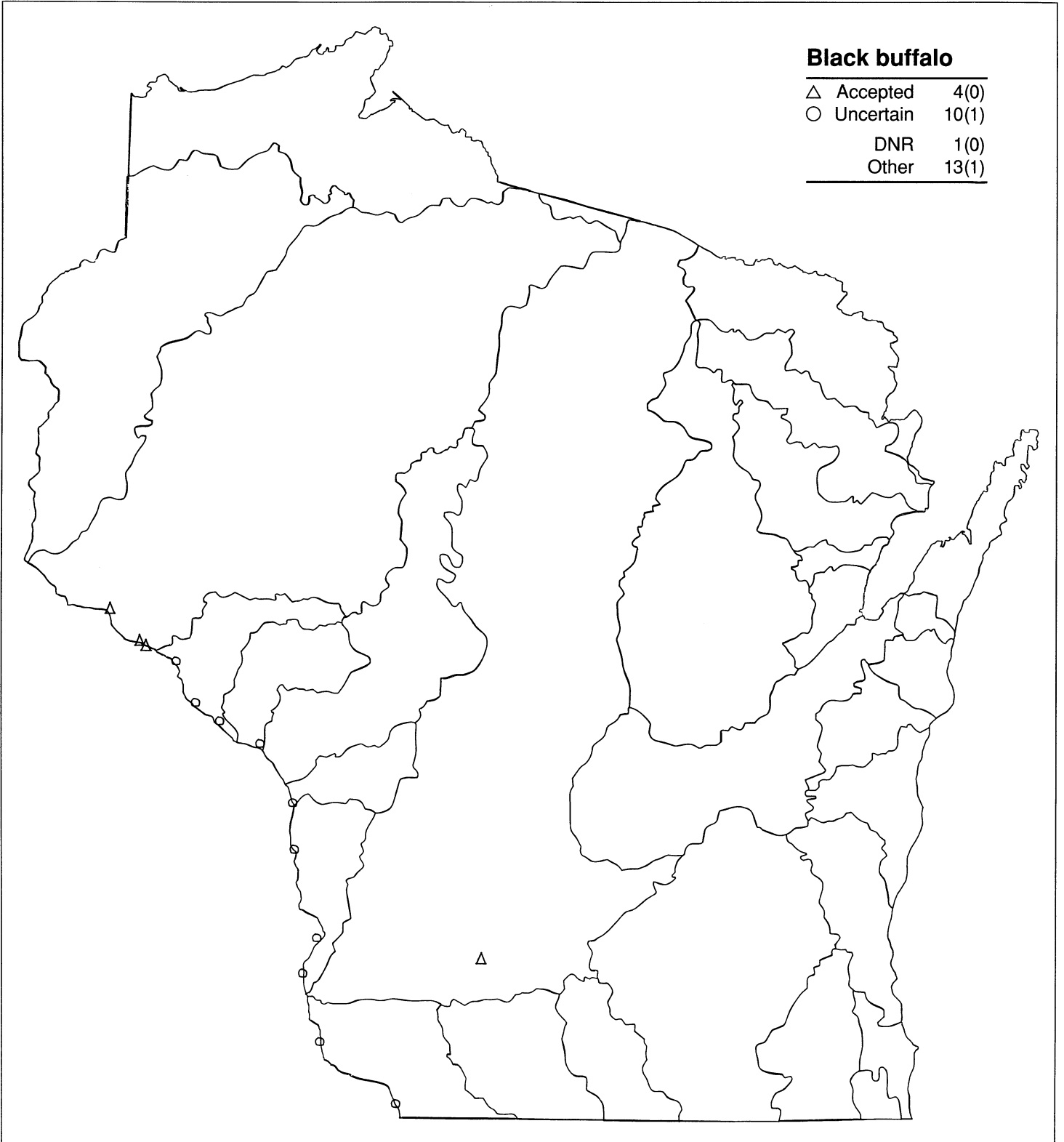


Map 86(E)

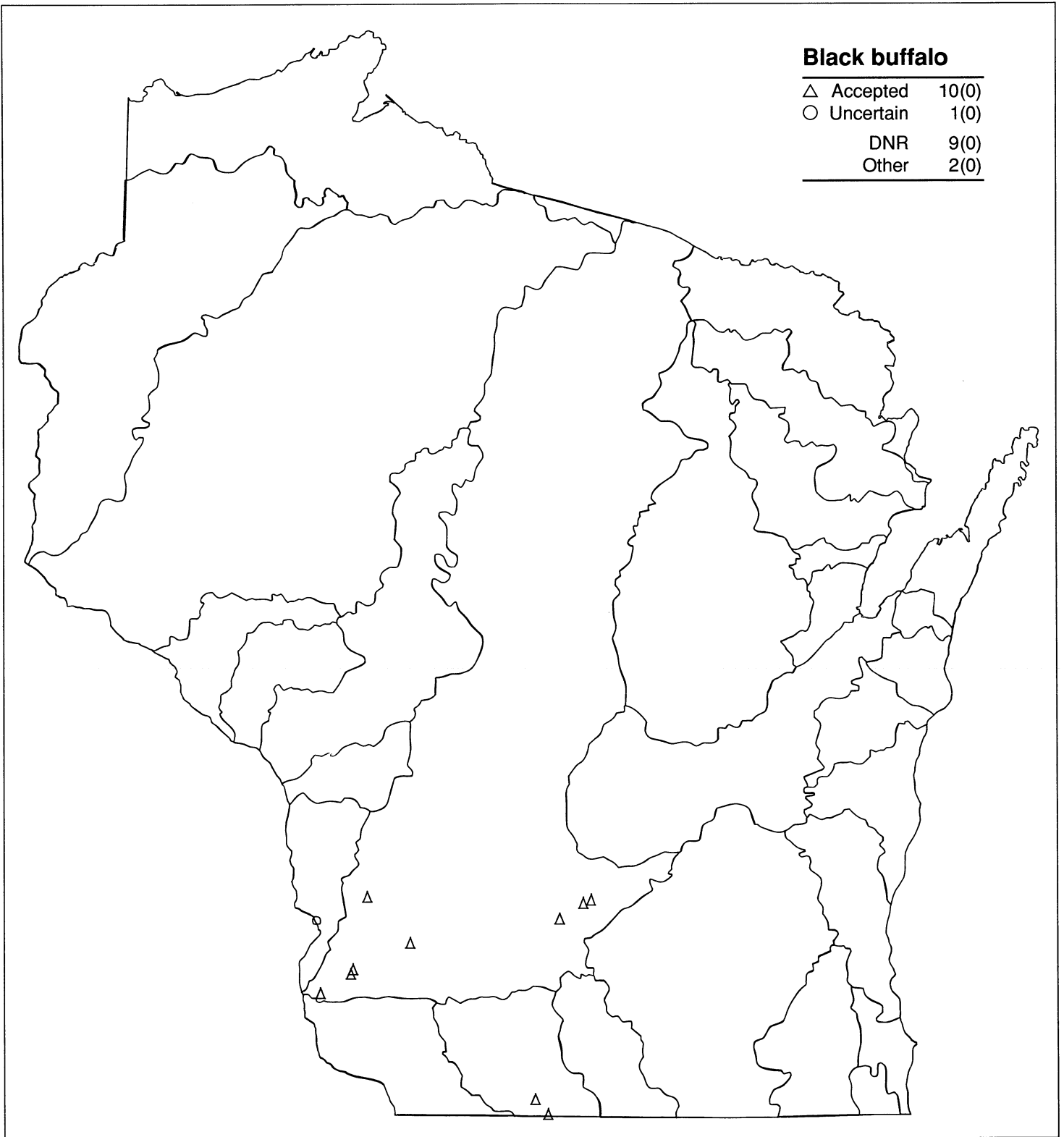




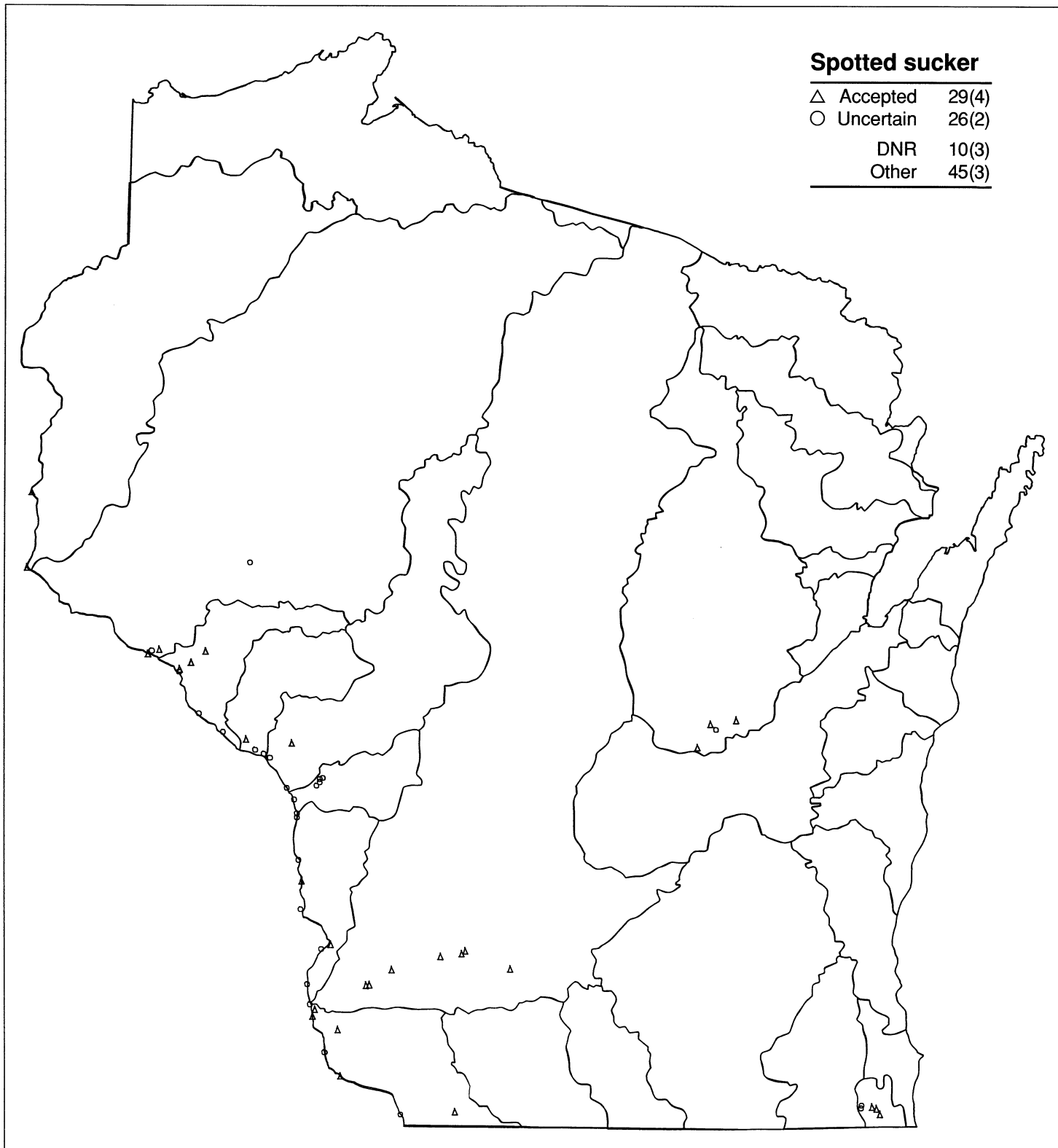
Map 87(E)

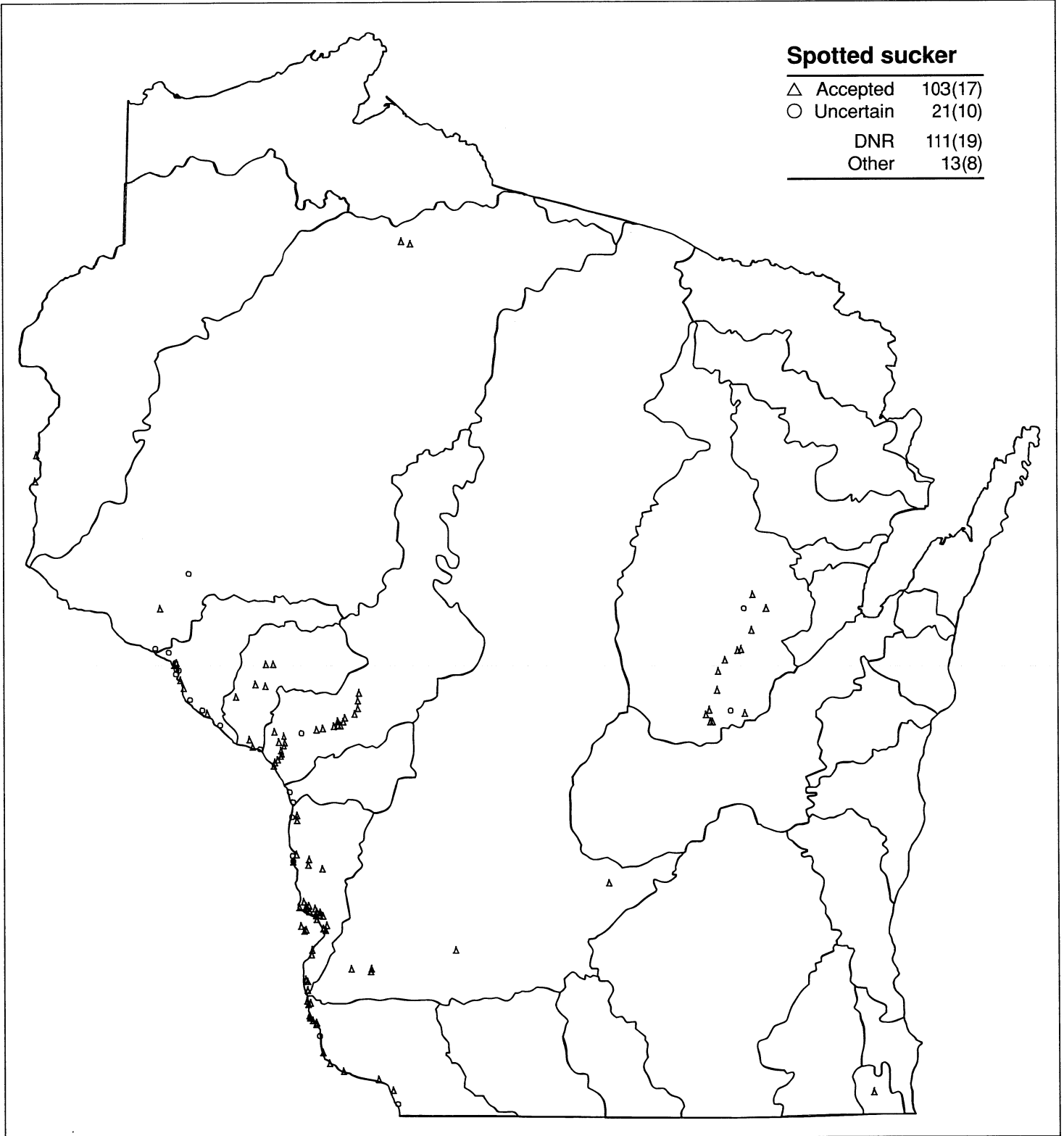


Map 87(L)

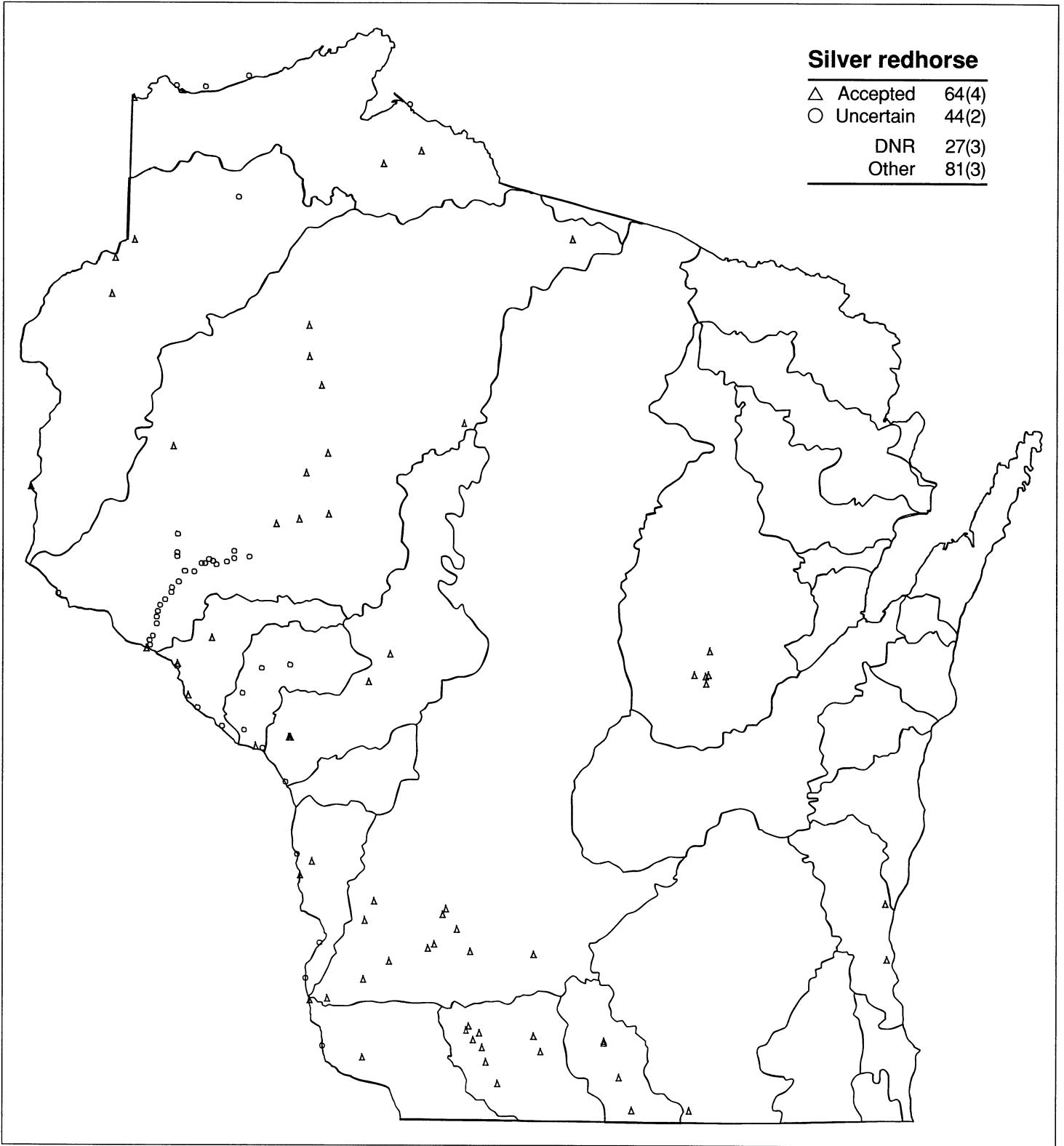


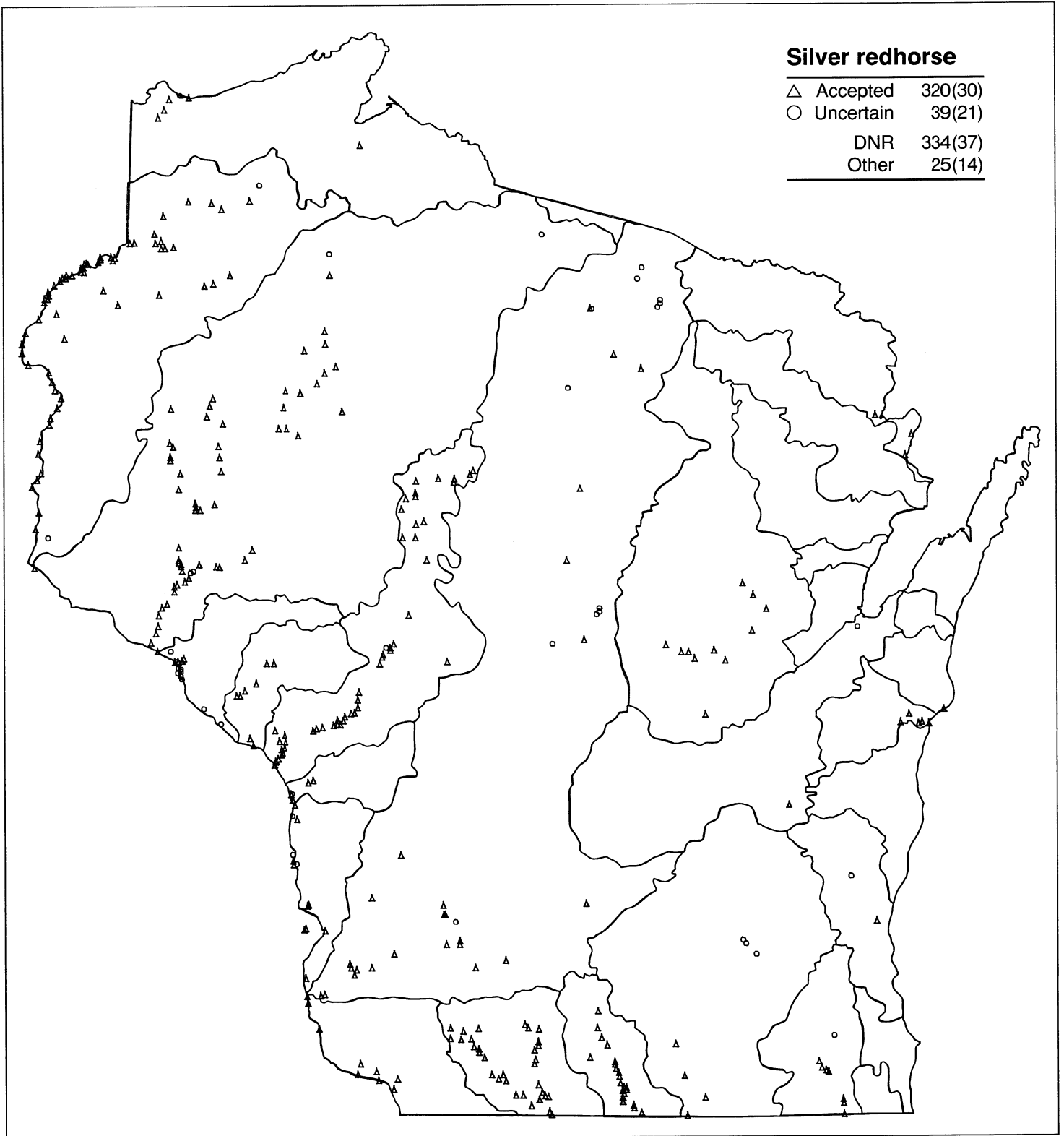
Map 88(E)



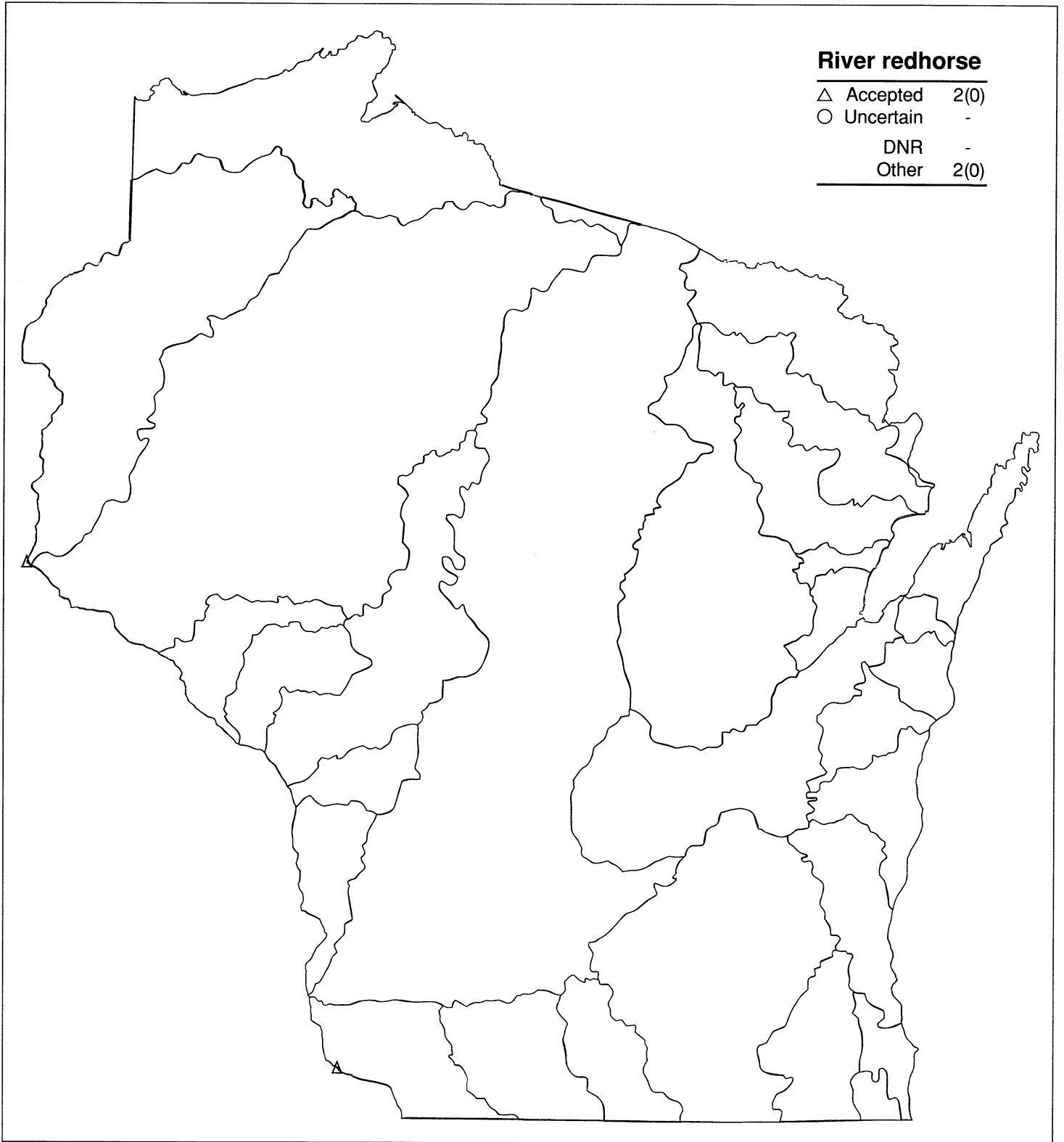


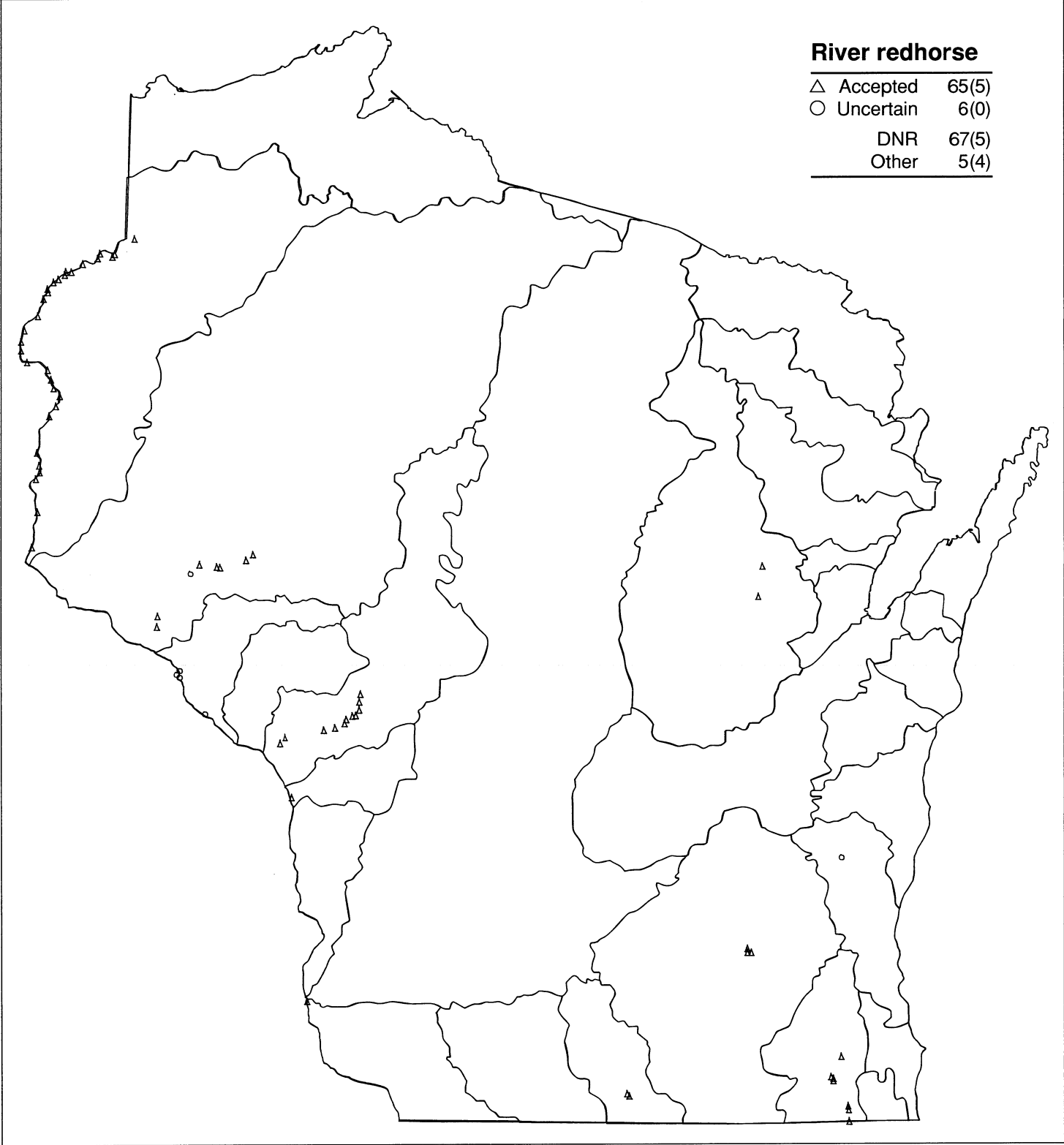
Map 89(E)





Map 90(E)

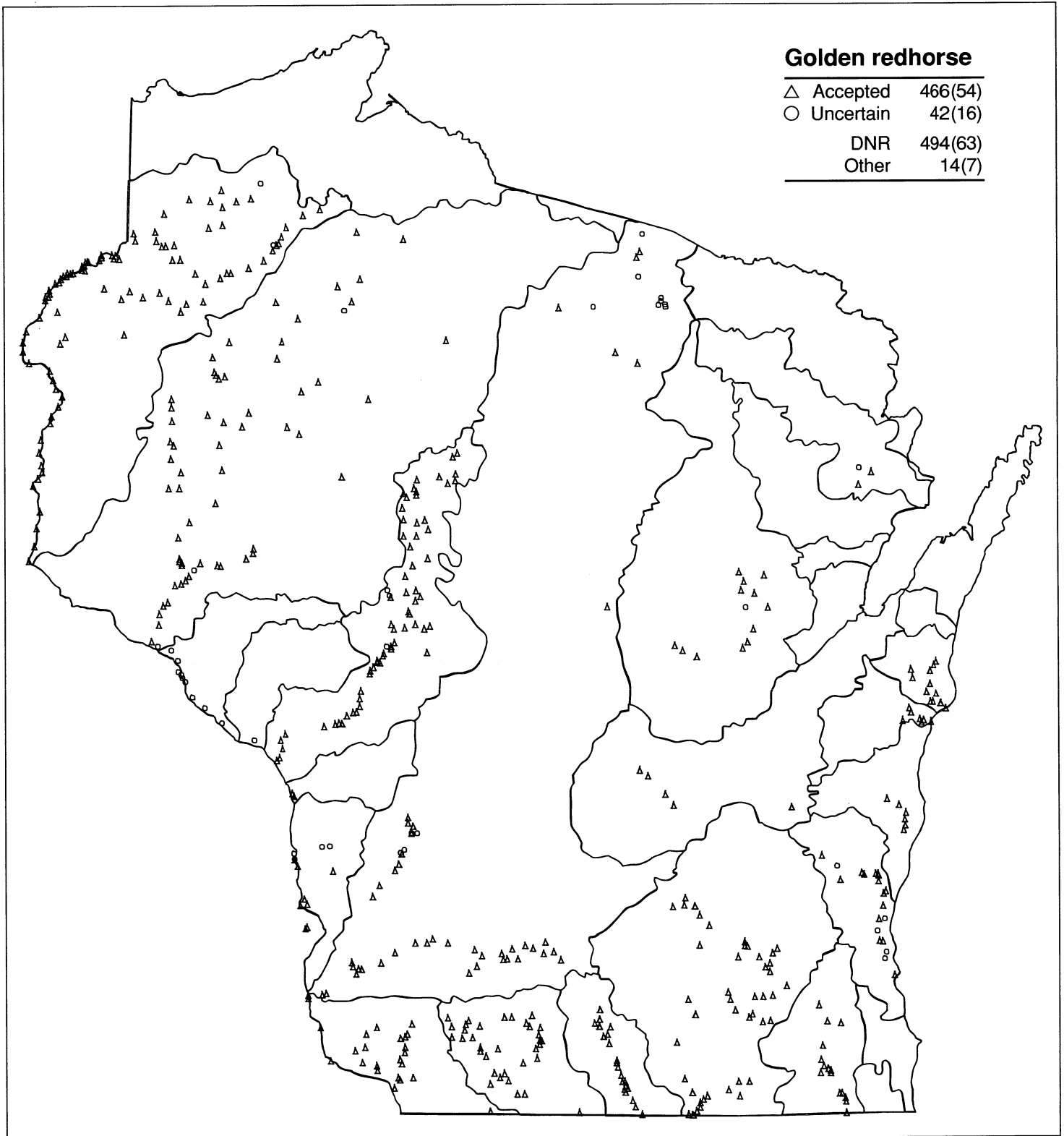




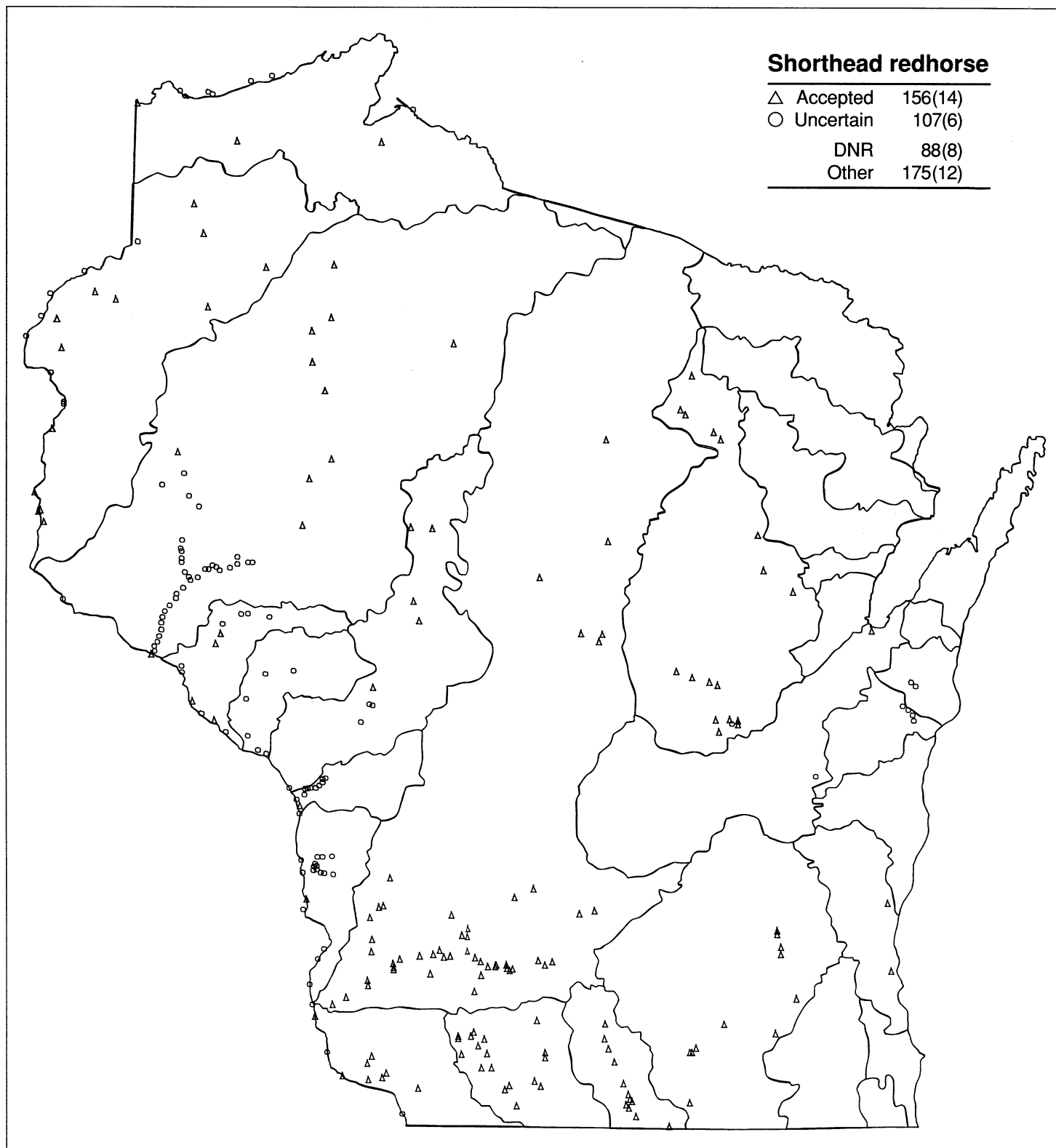
Map 91(E)



Map 91(L)

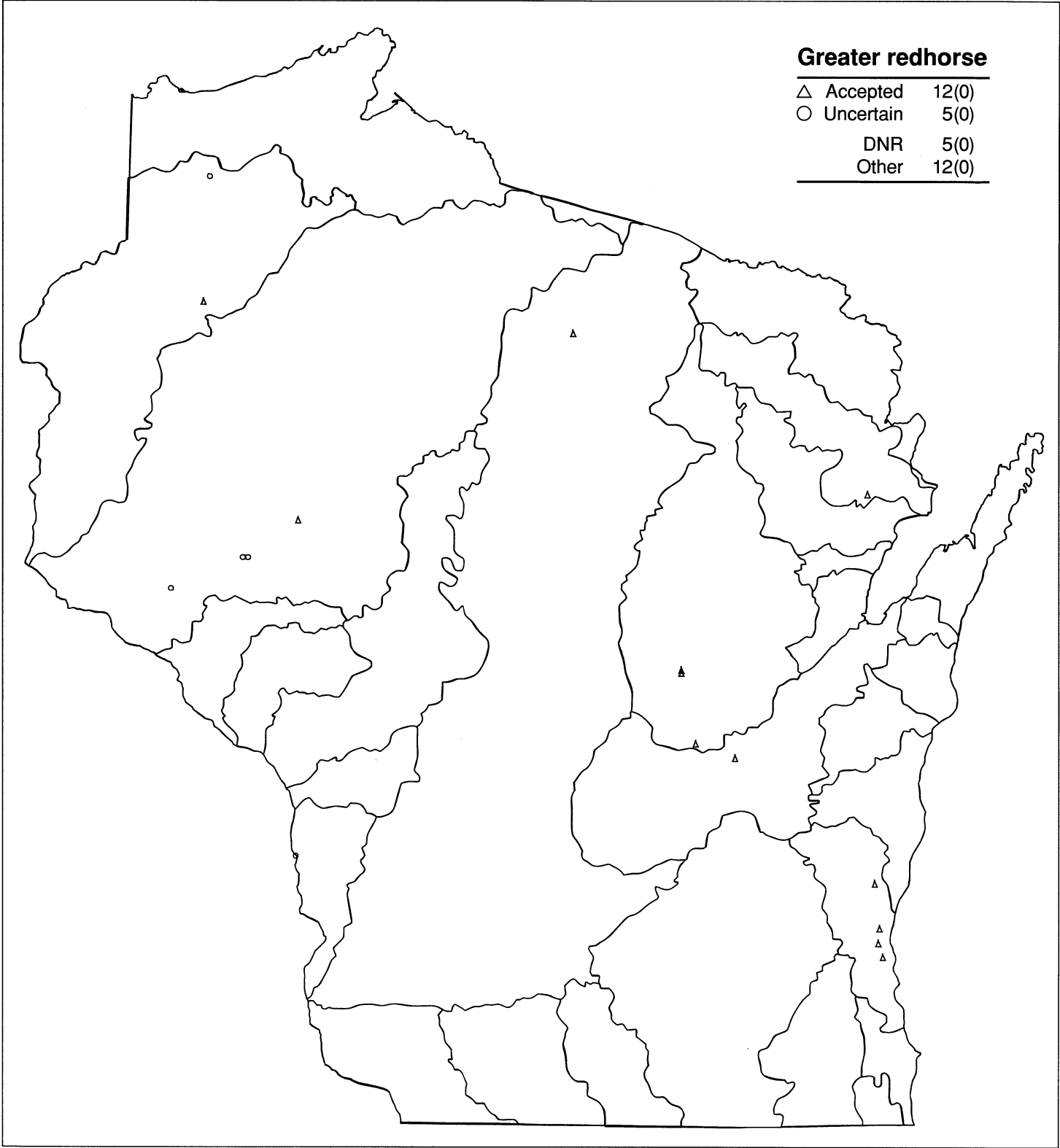


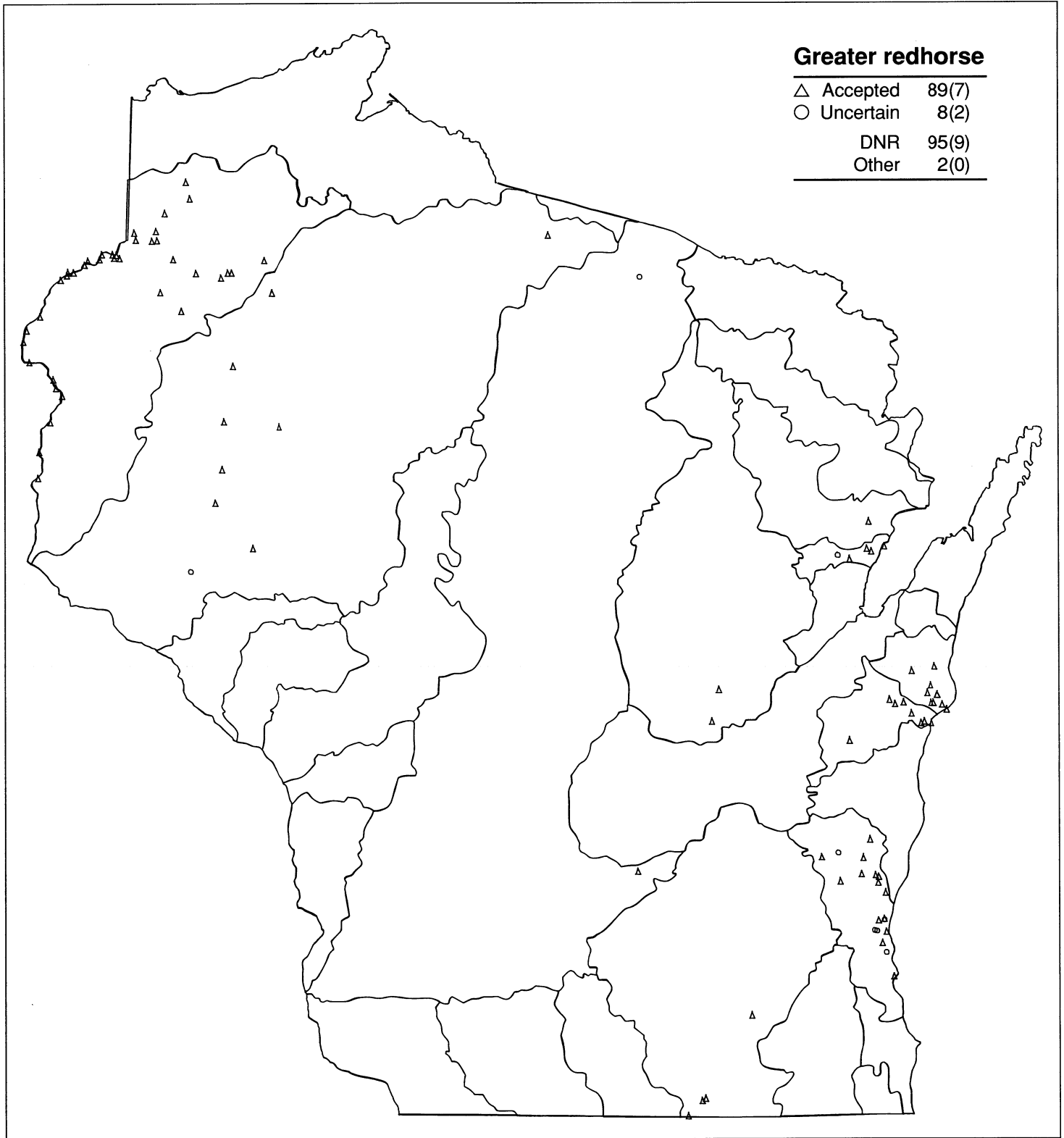
Map 92(E)



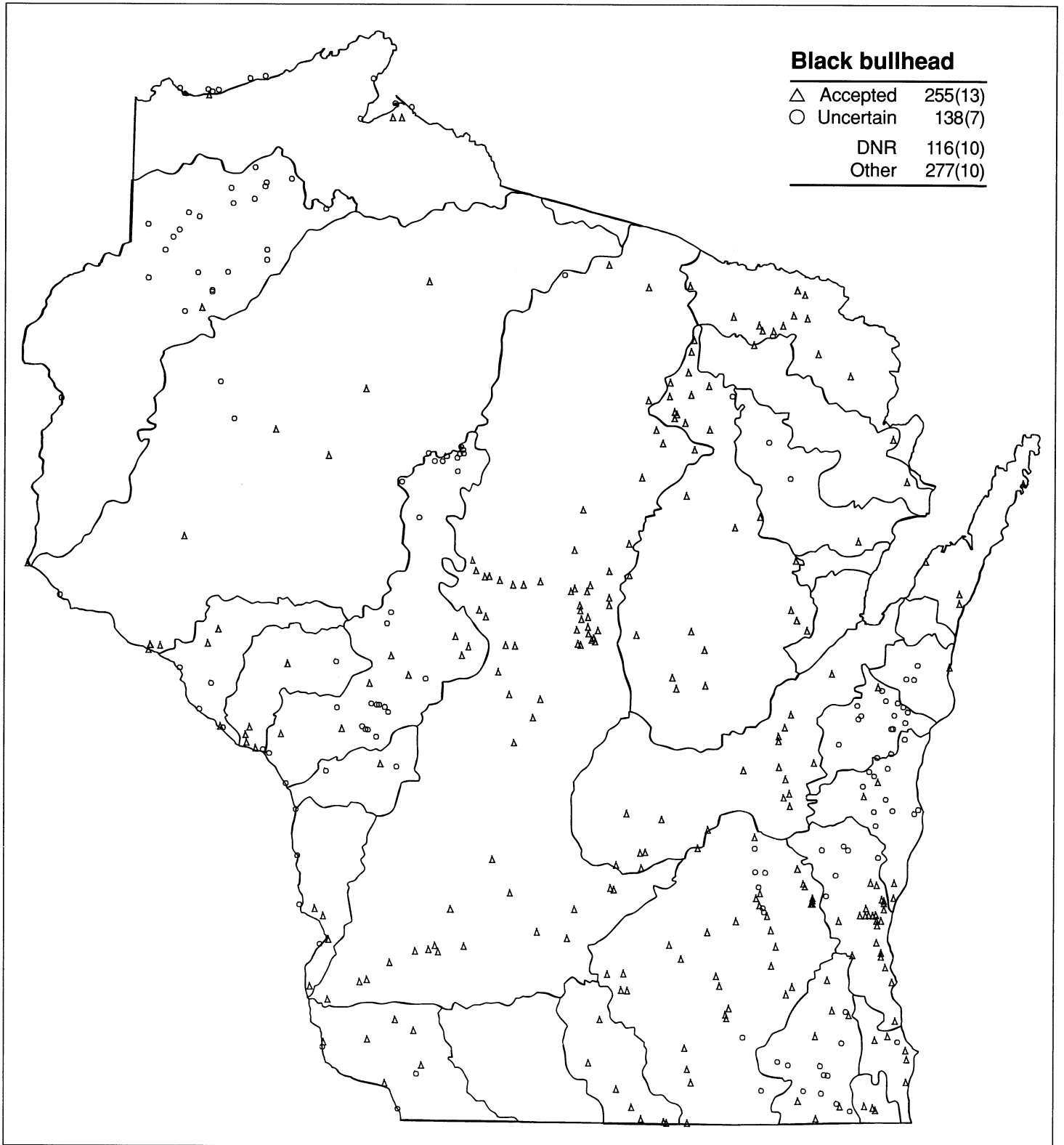


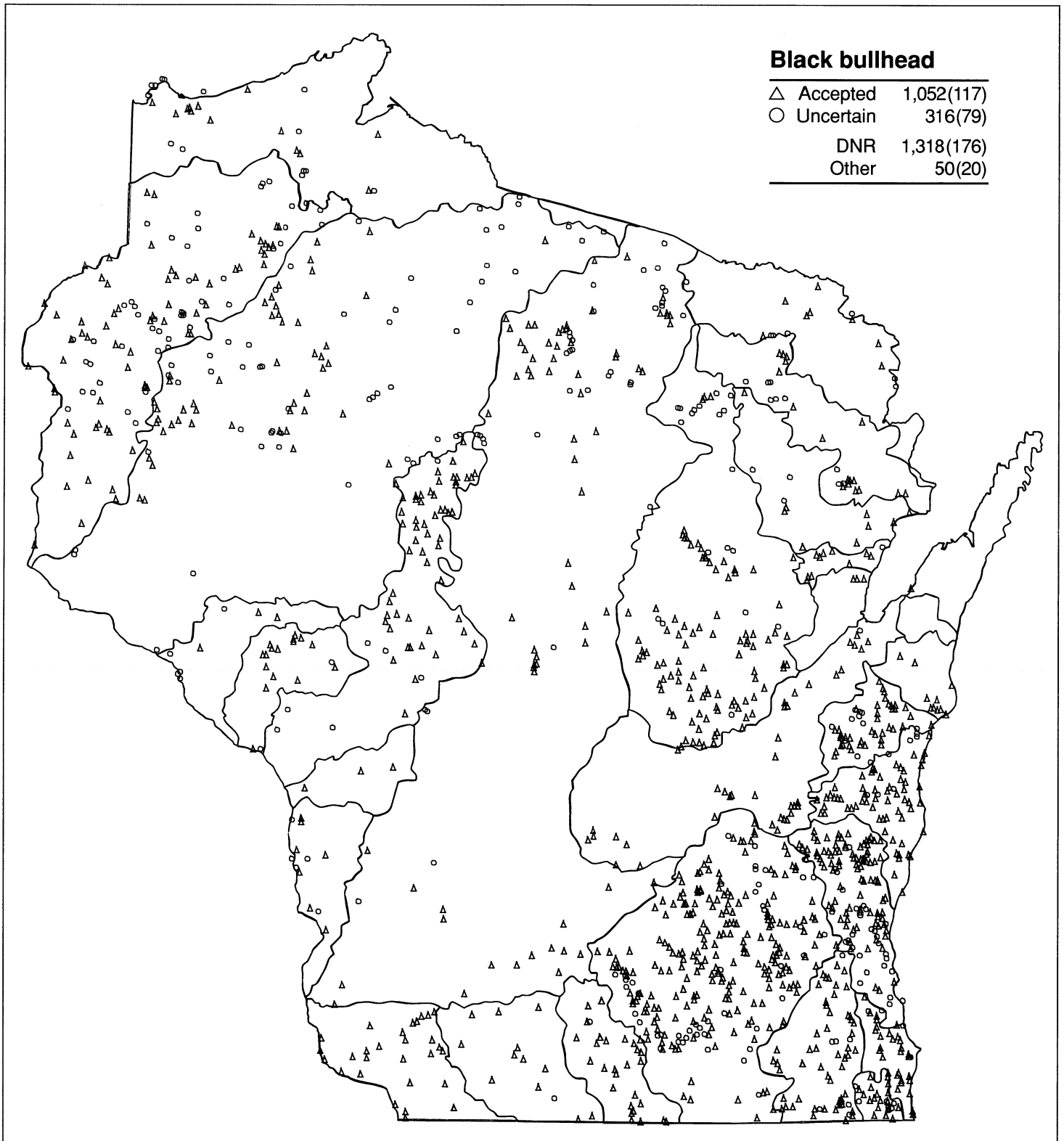
Map 93(E)



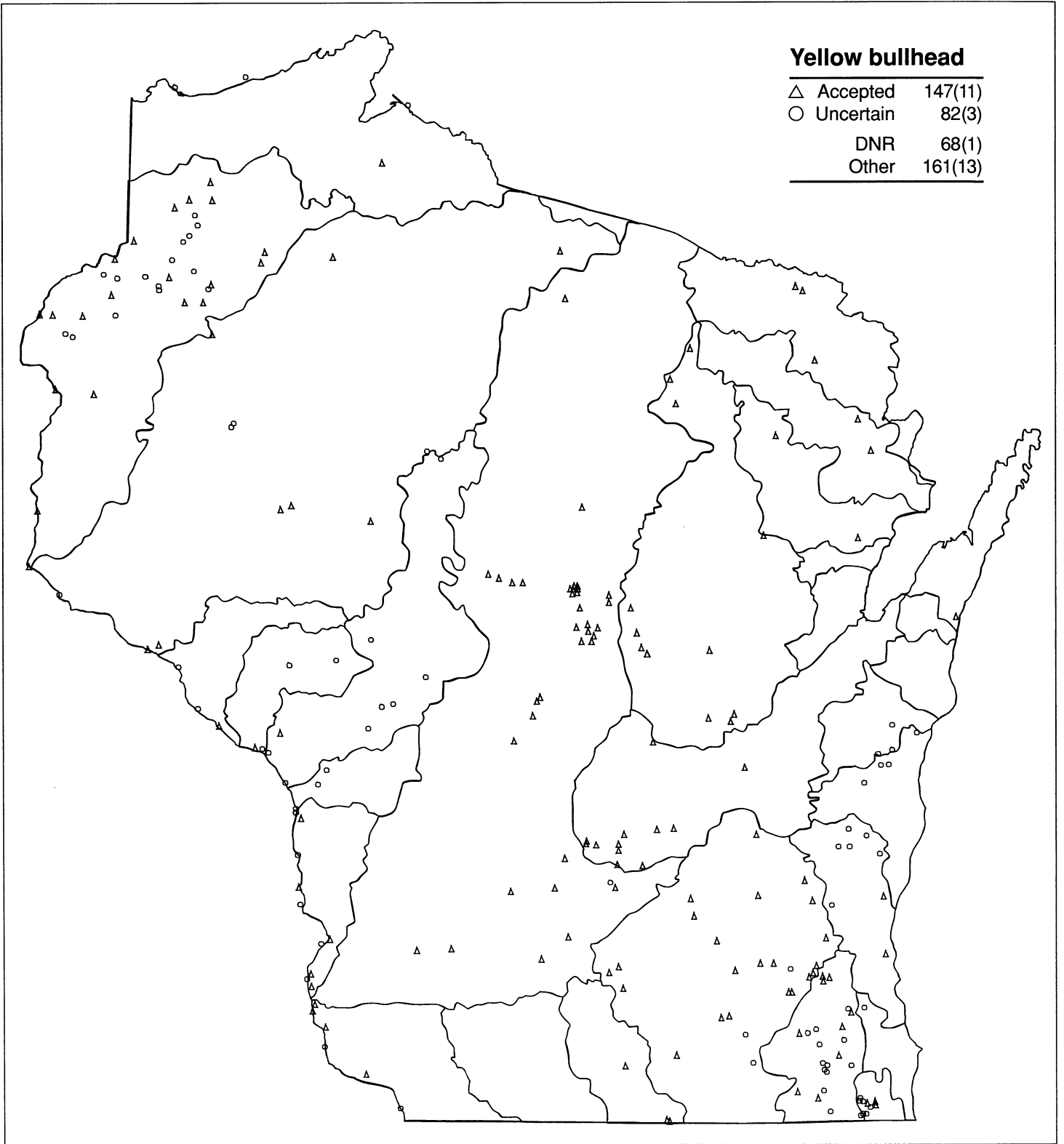


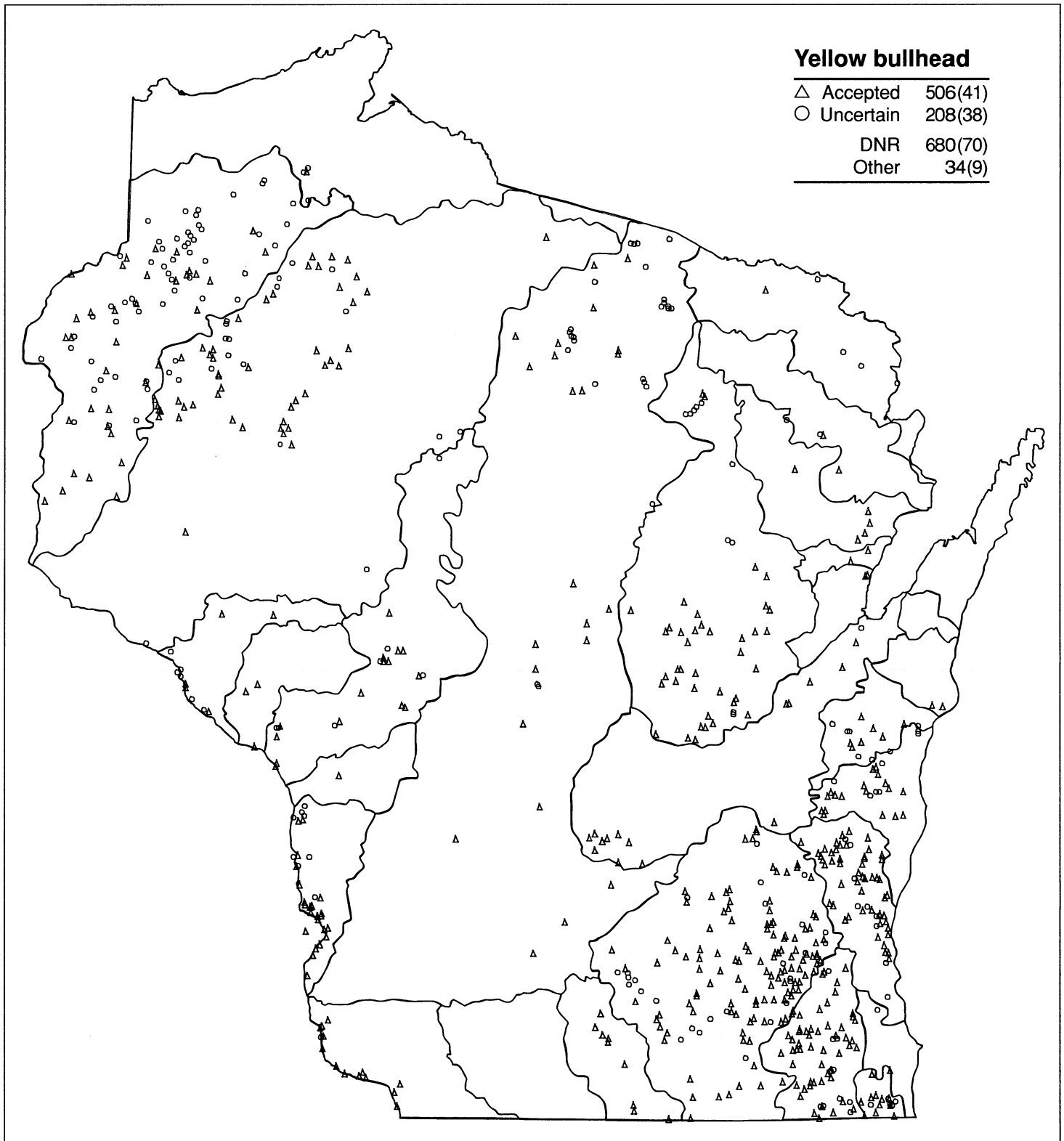
Map 94(E)





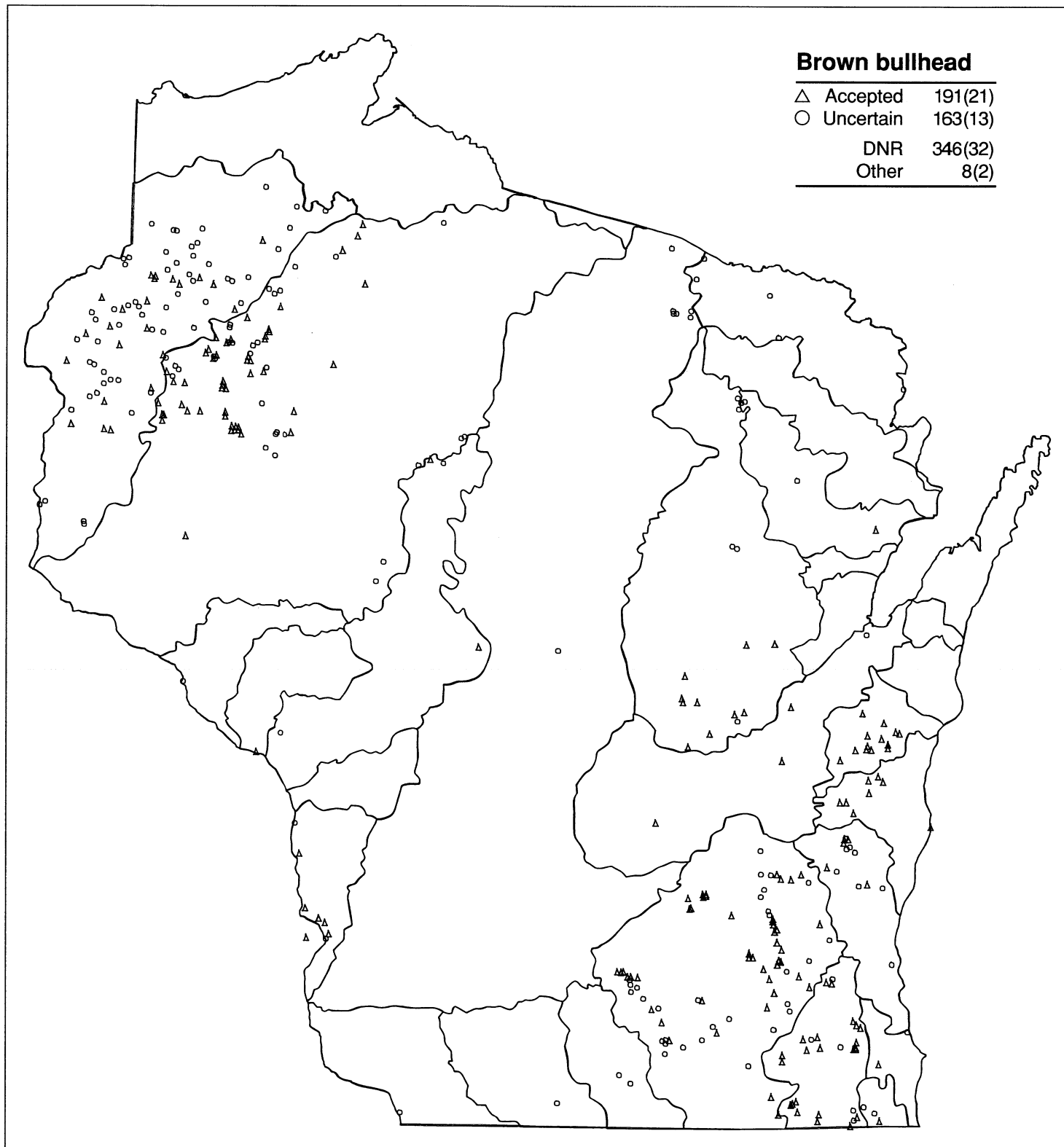
Map 95(E)



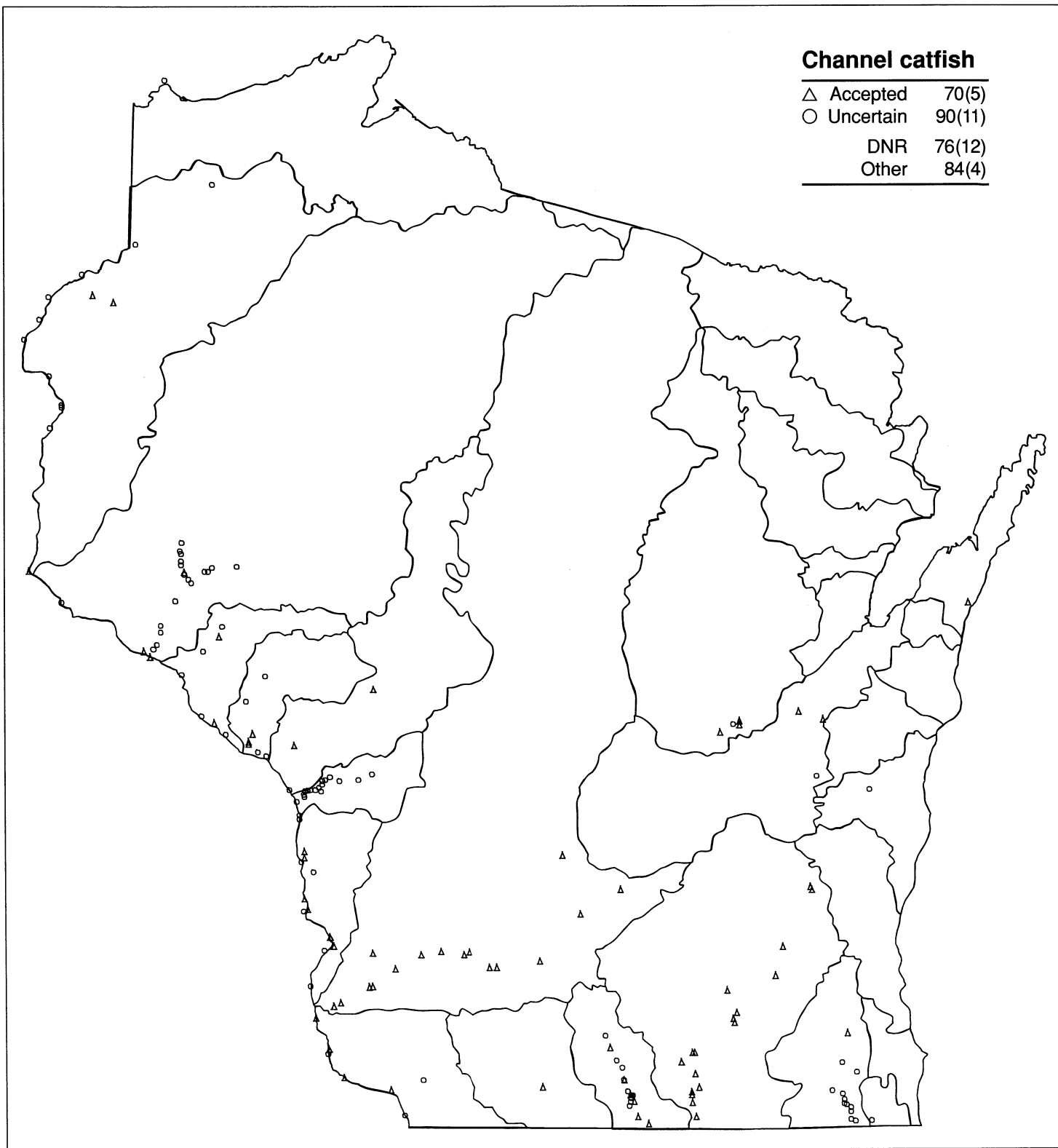


Map 96(E)

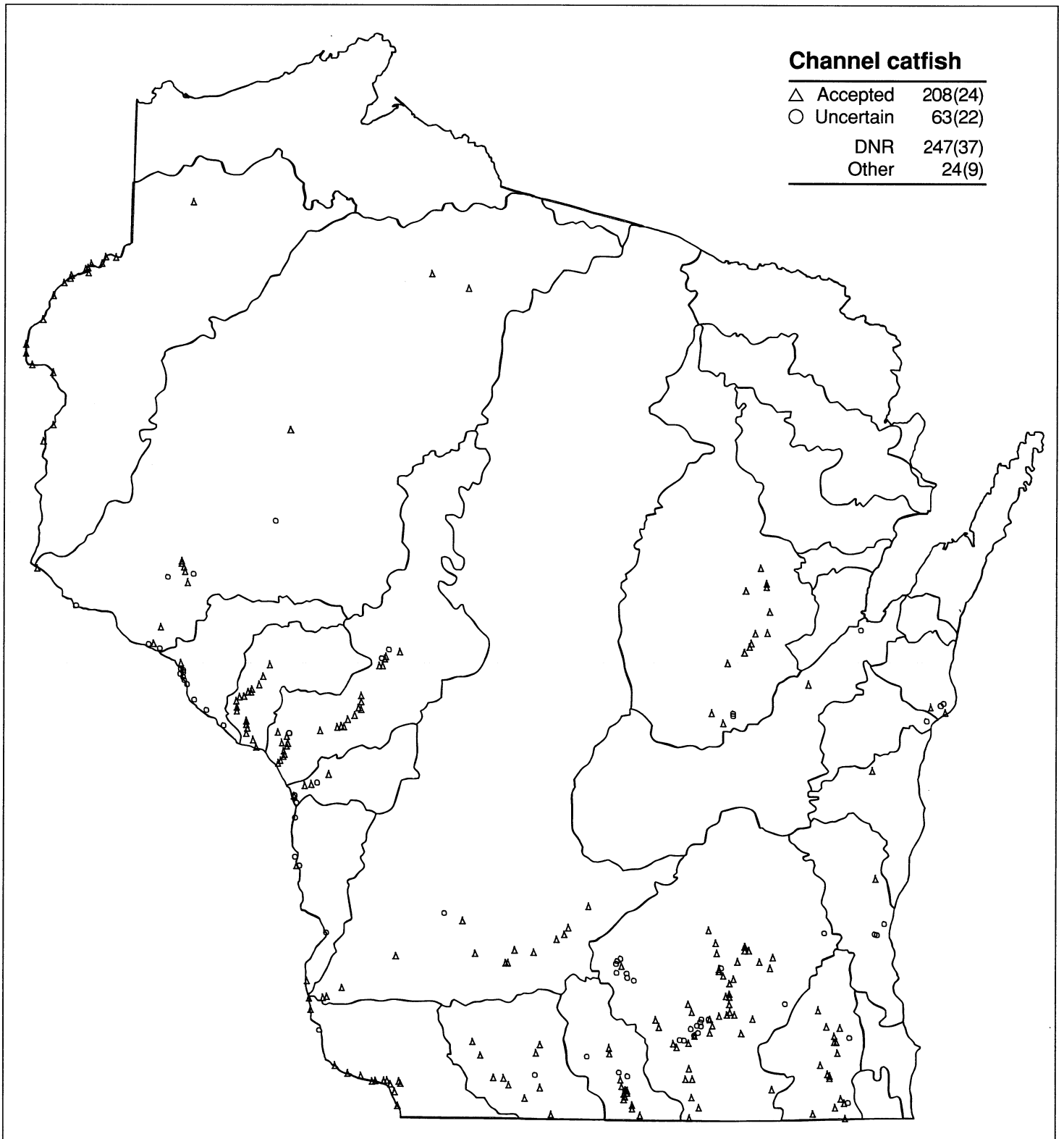




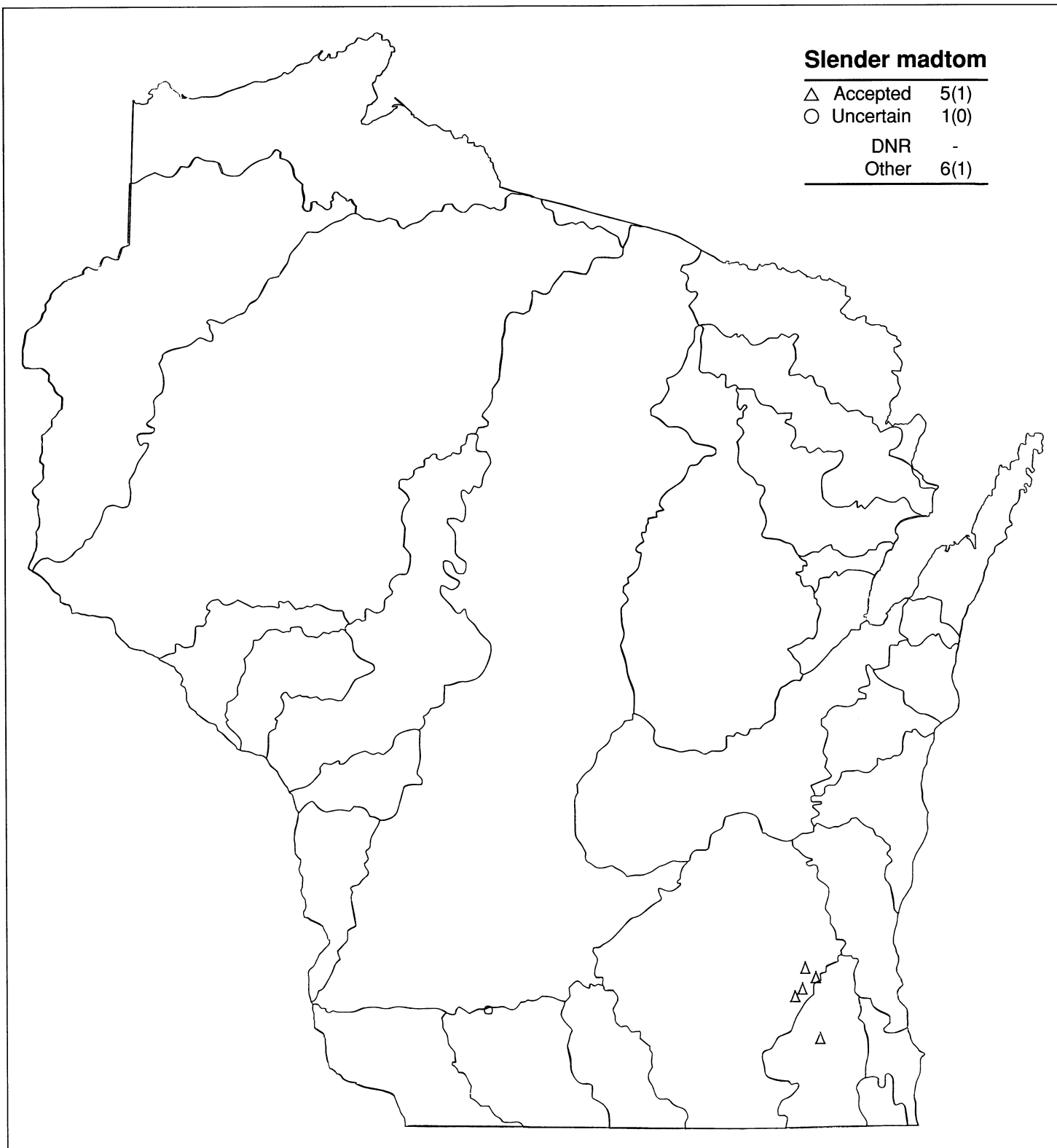
Map 97(E)



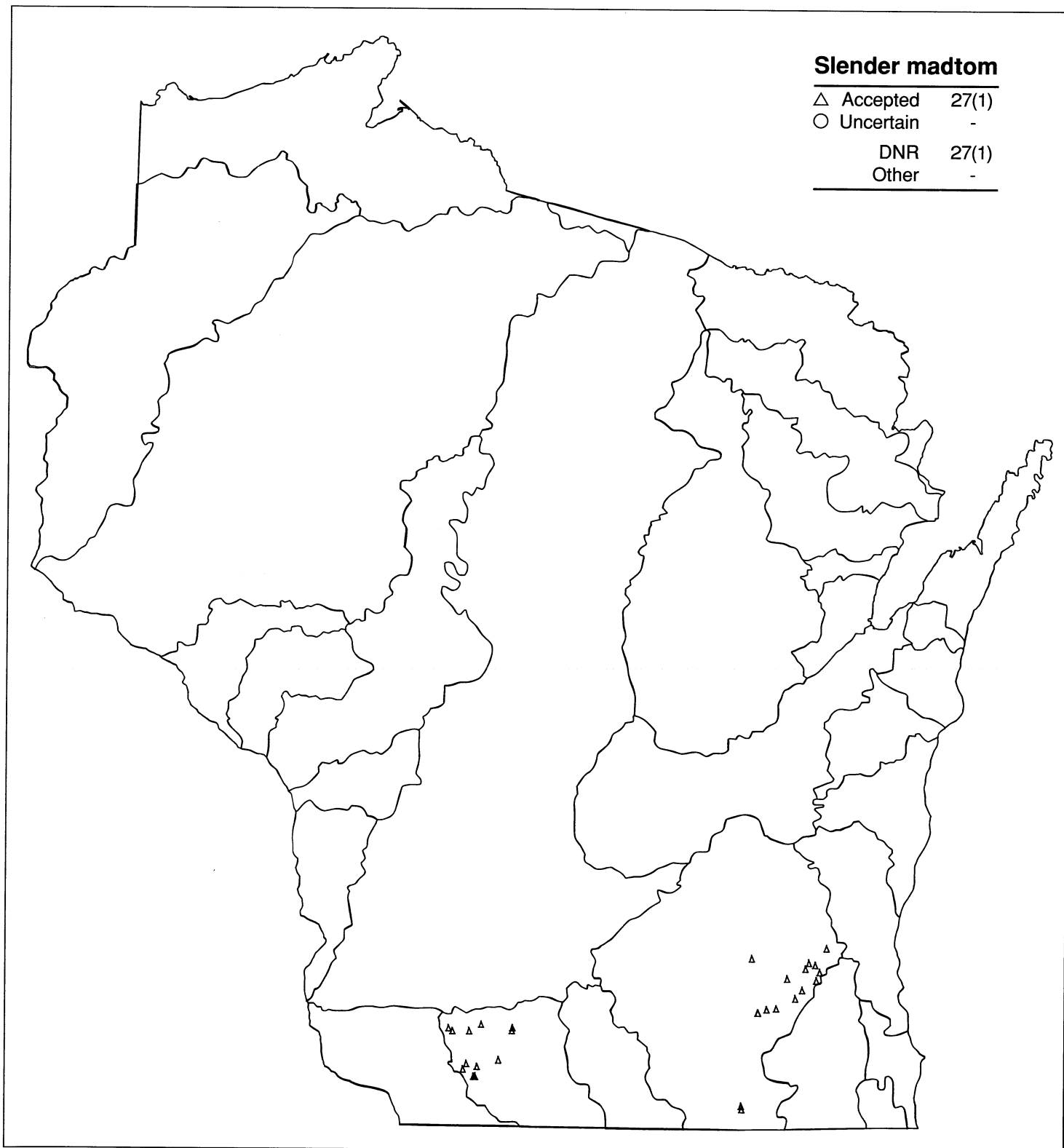
Map 97(L)



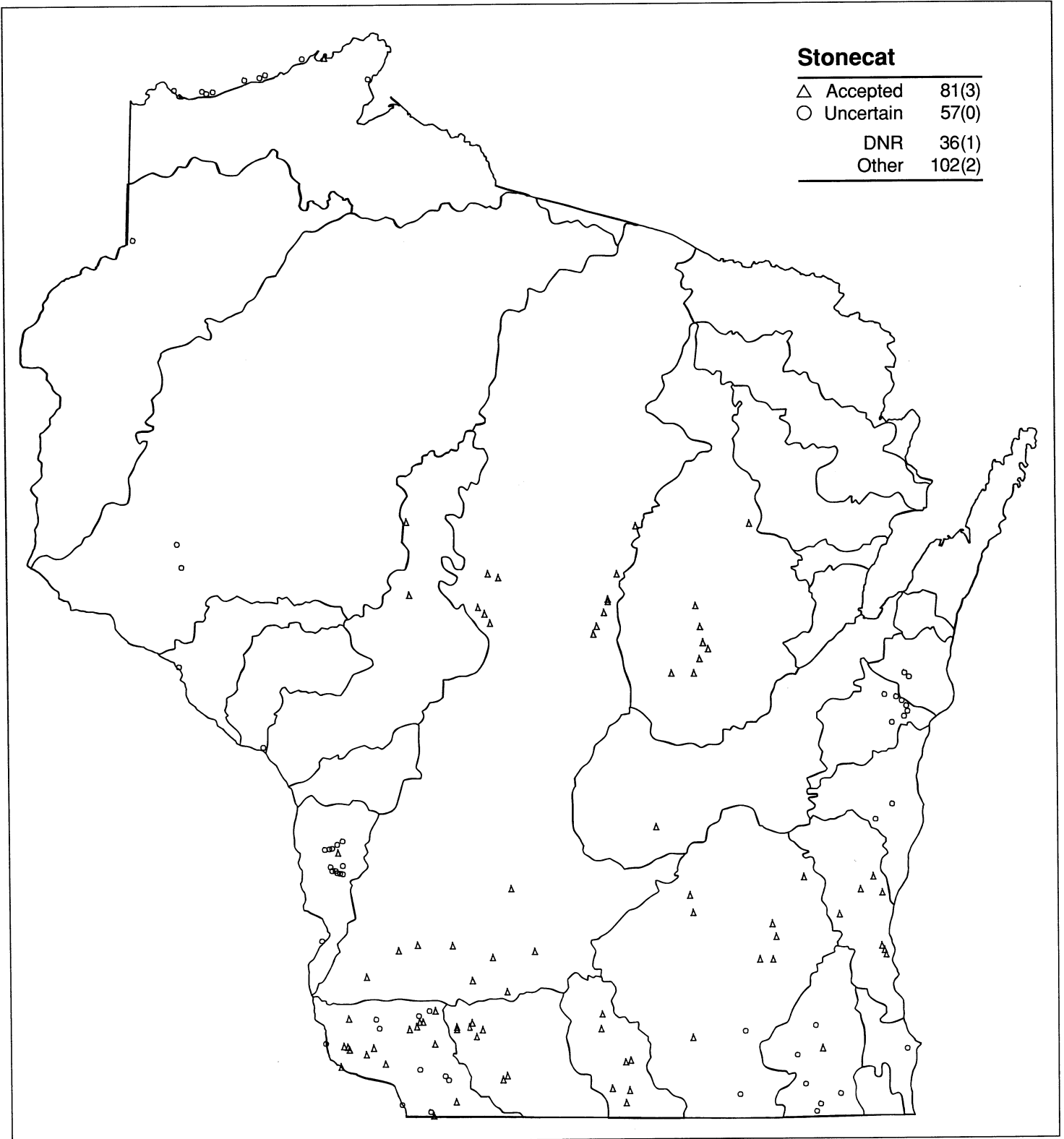
Map 98(E)

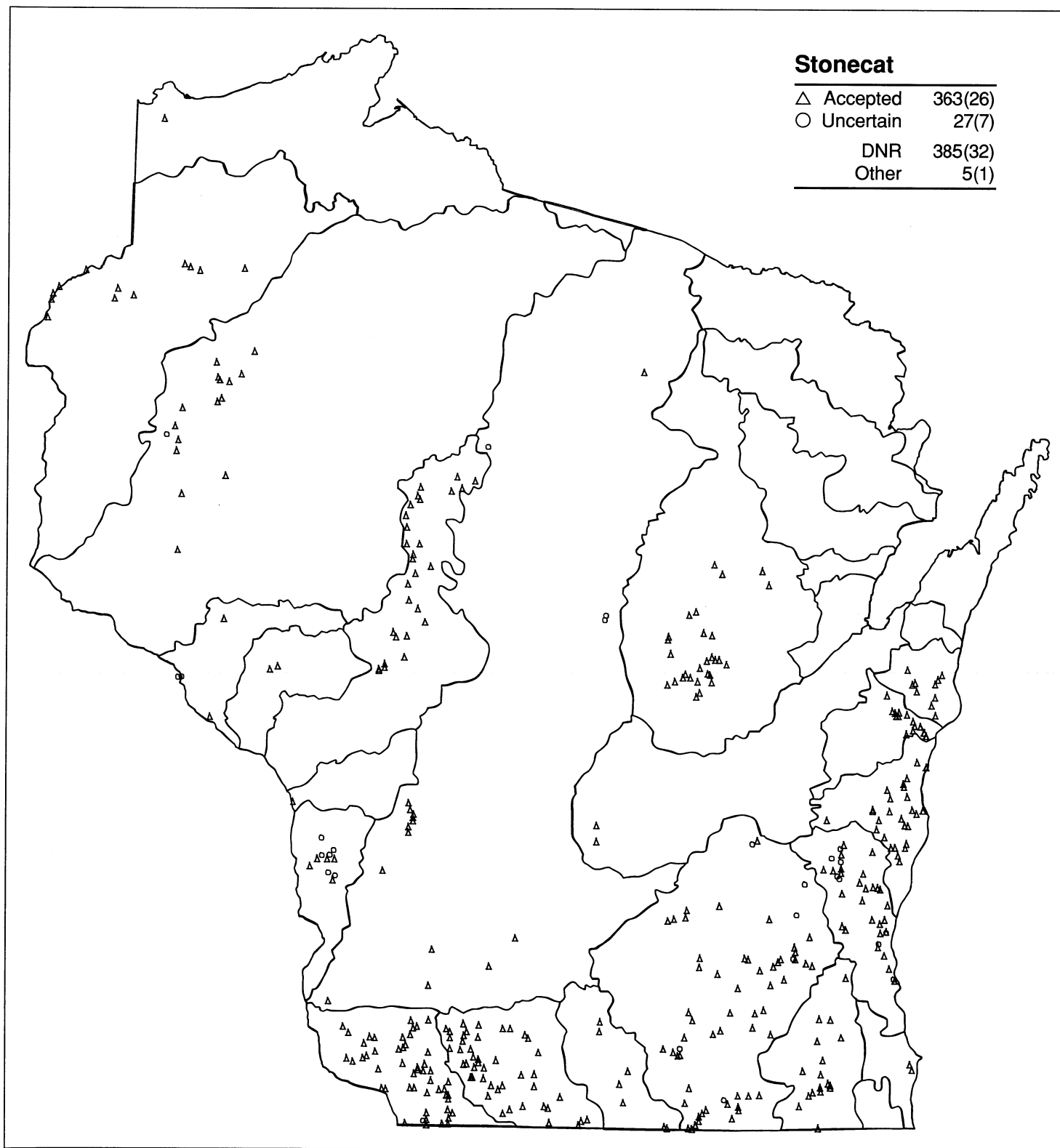


Map 98(L)

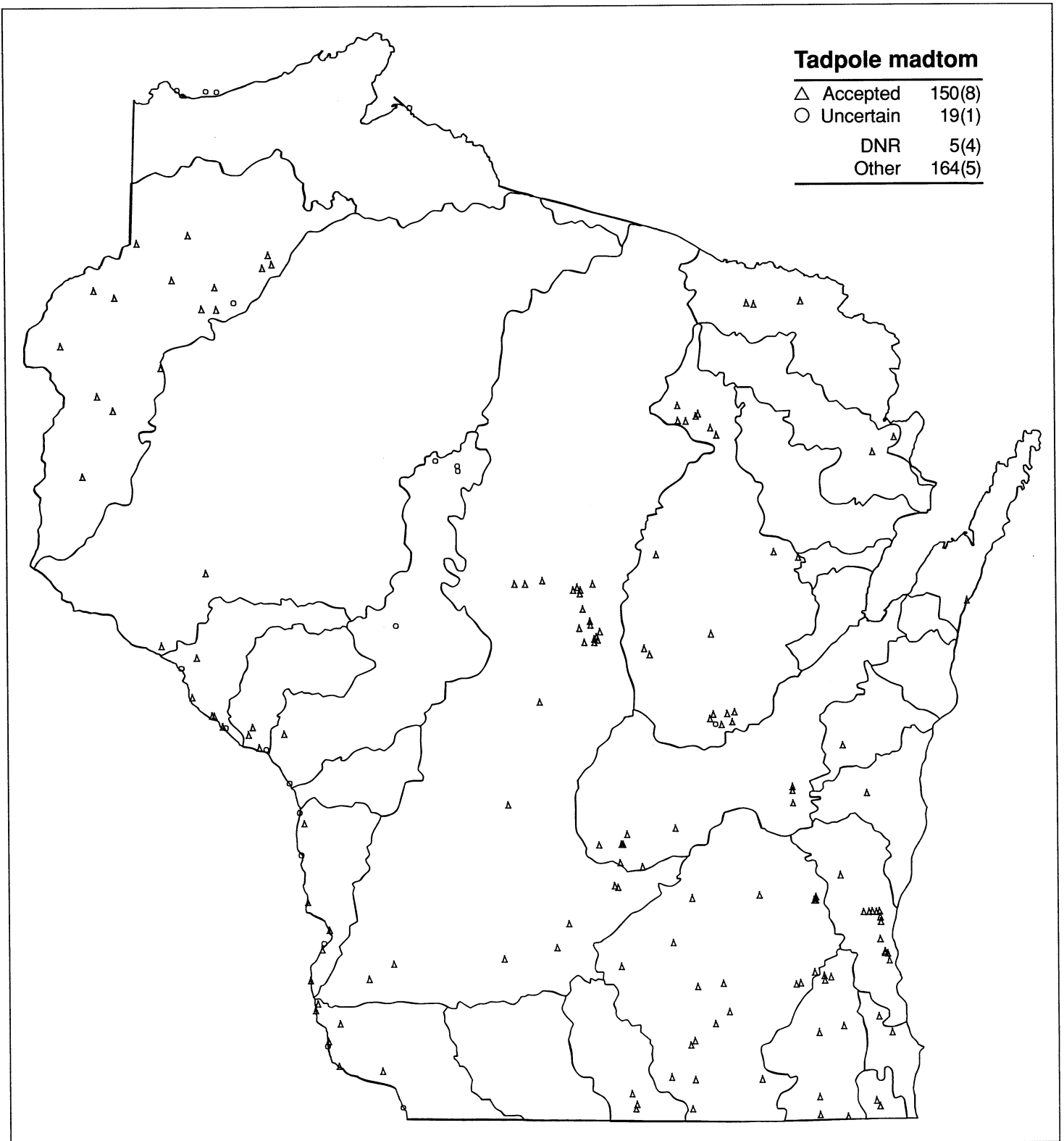


Map 99(E)





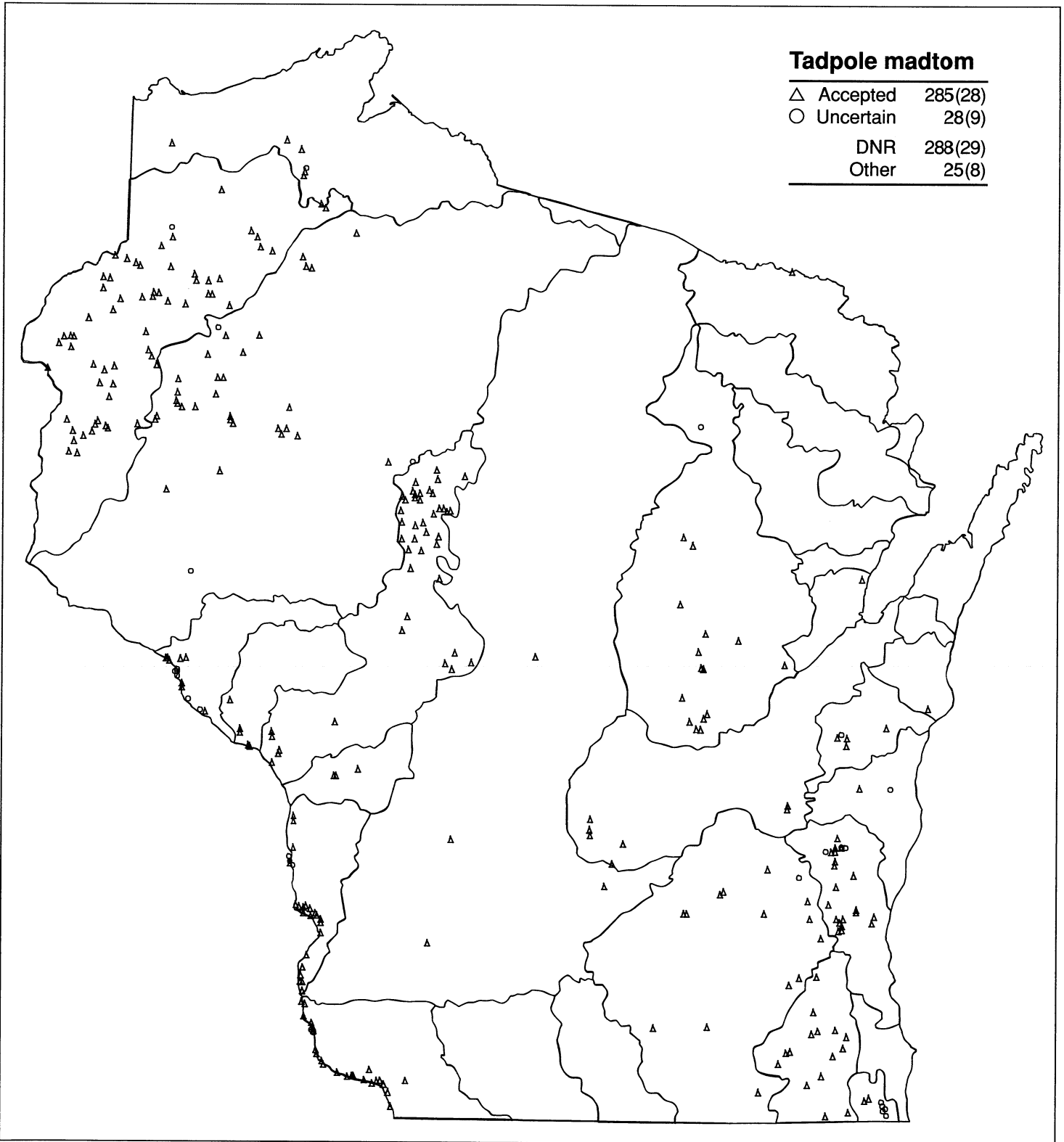
Map 100(E)



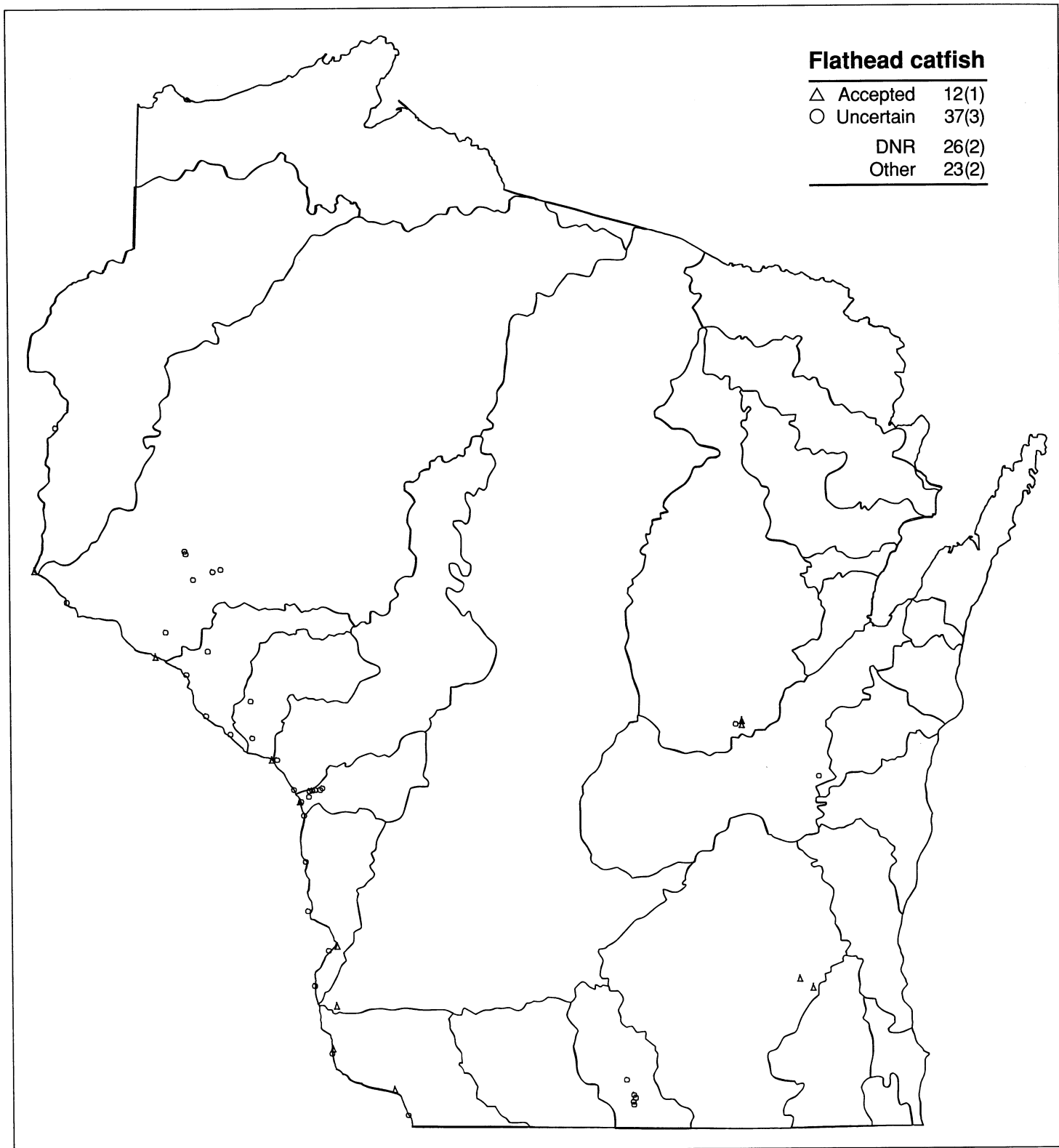
Map 100(L)

Tadpole madtom

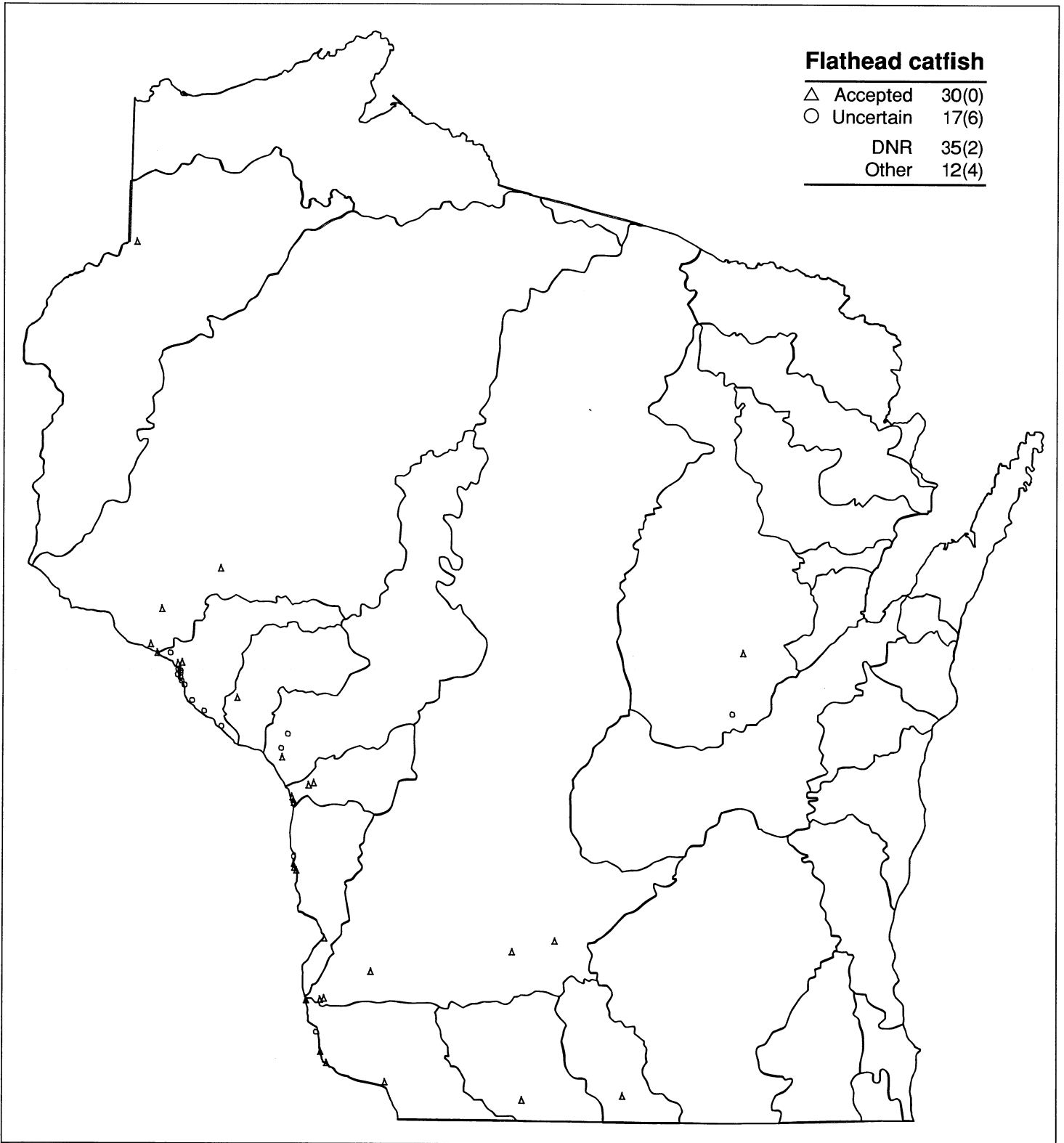
| | | |
|---|-----------|---------|
| △ | Accepted | 285(28) |
| ○ | Uncertain | 28(9) |
| | DNR | 288(29) |
| | Other | 25(8) |



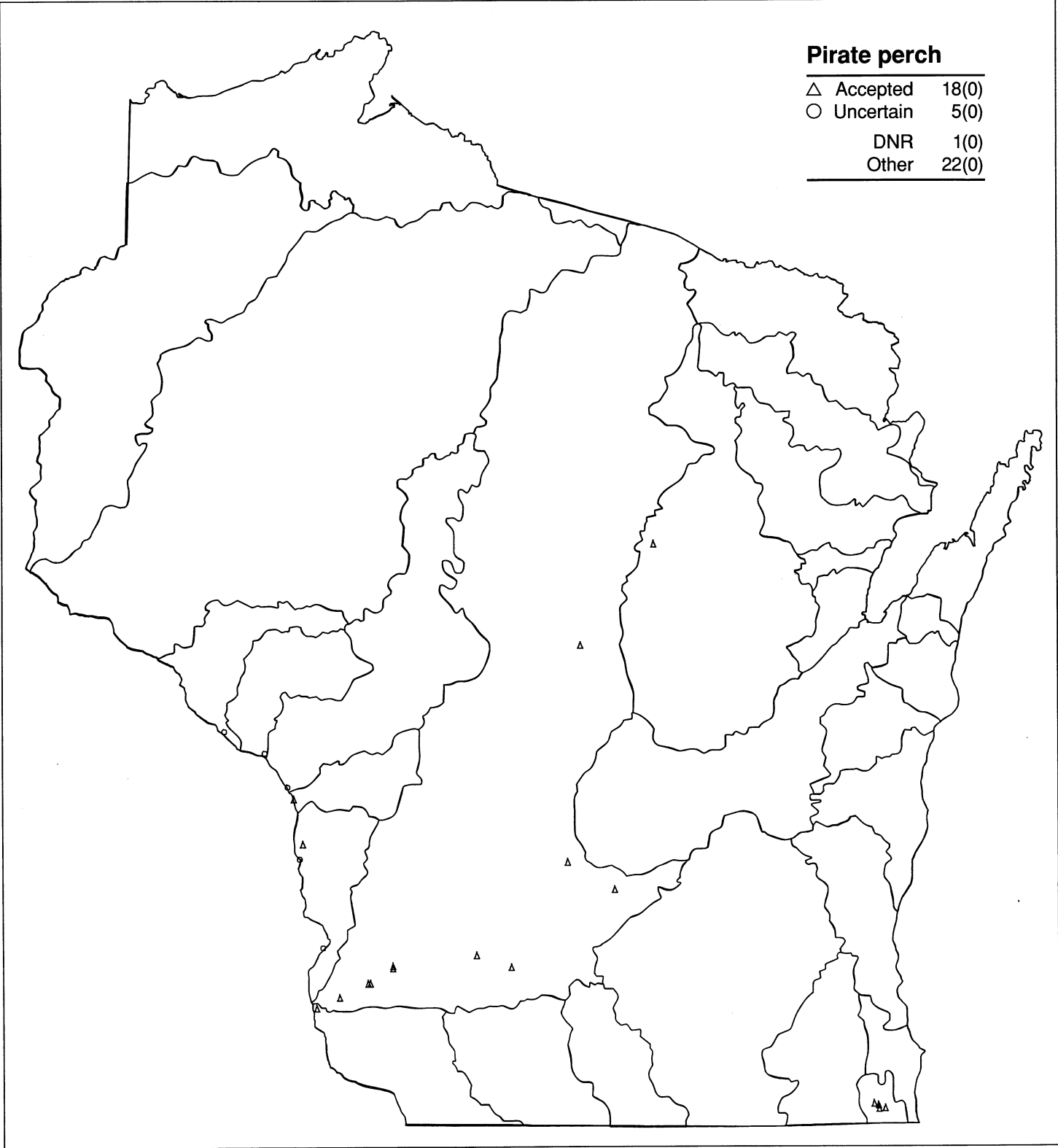
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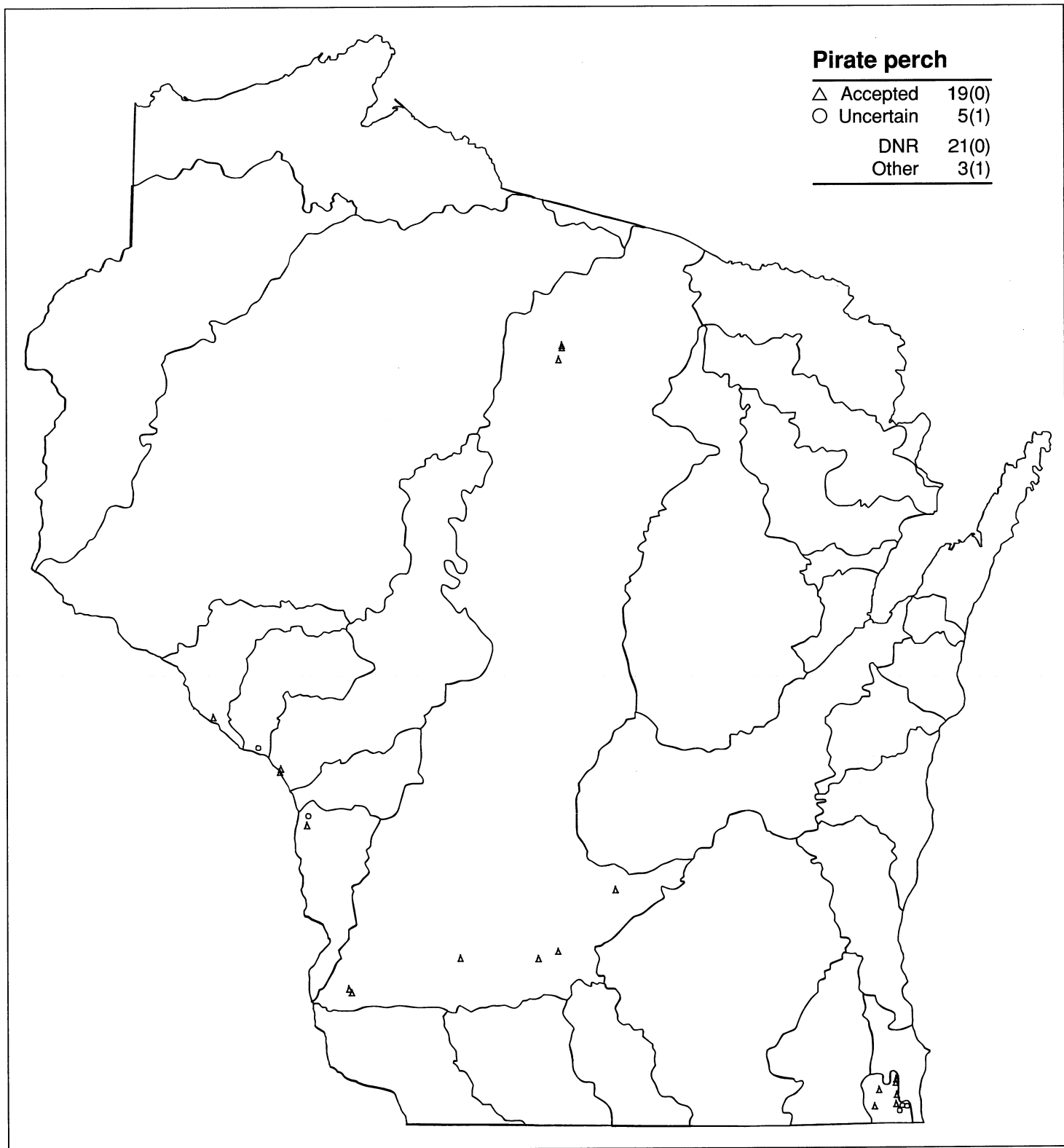


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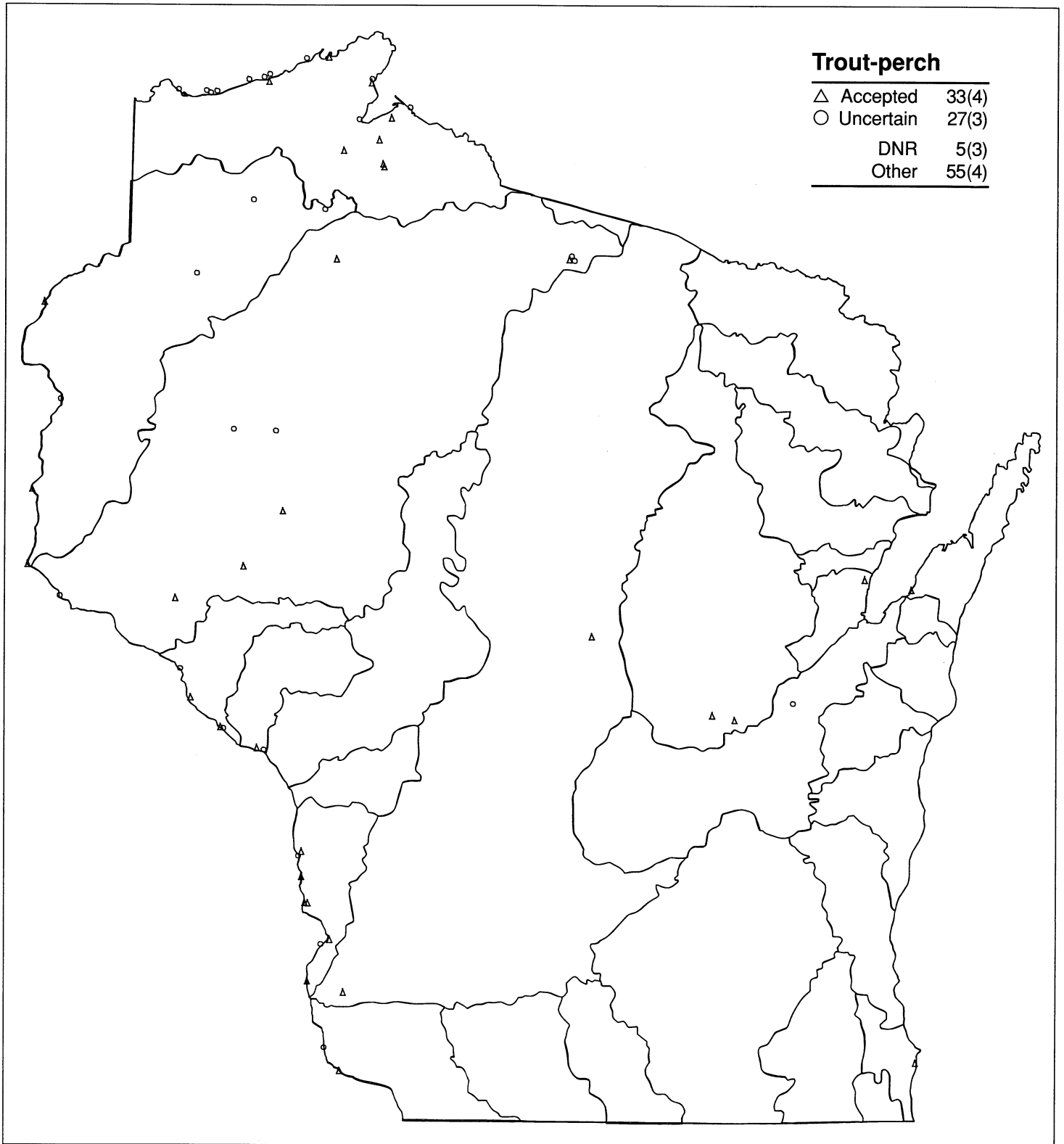


Map 102(E)





Map 103(E)



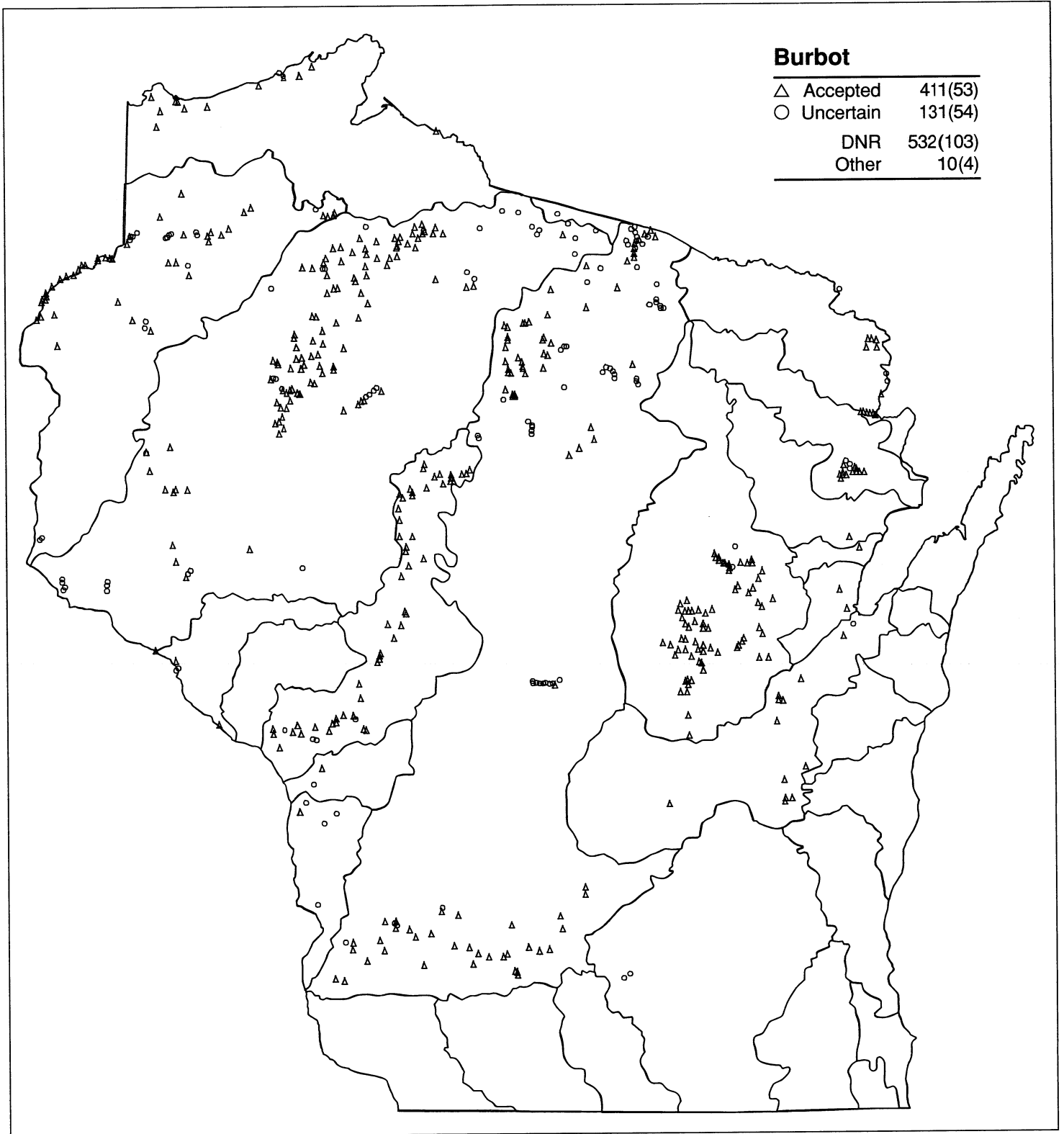
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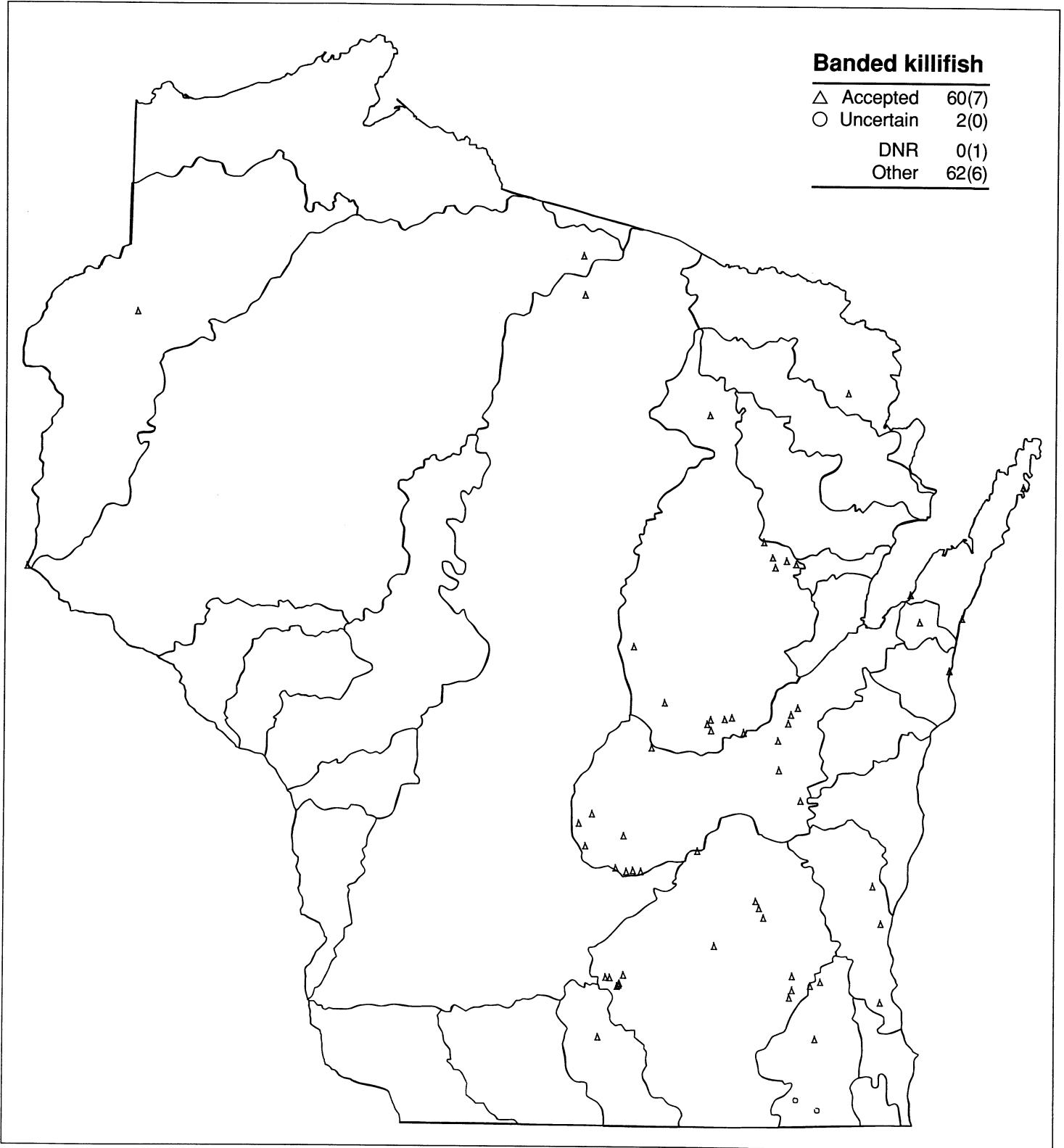
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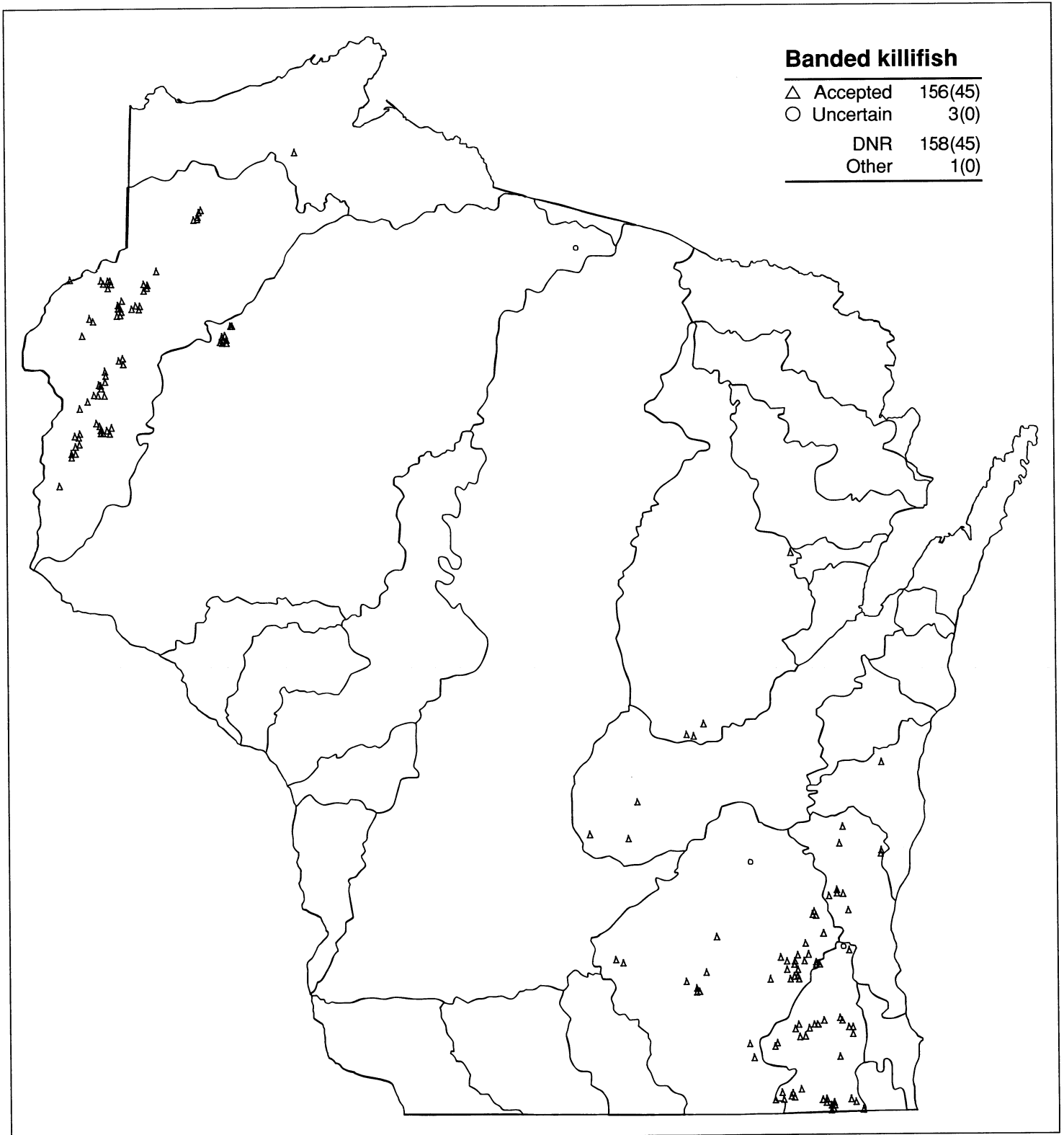
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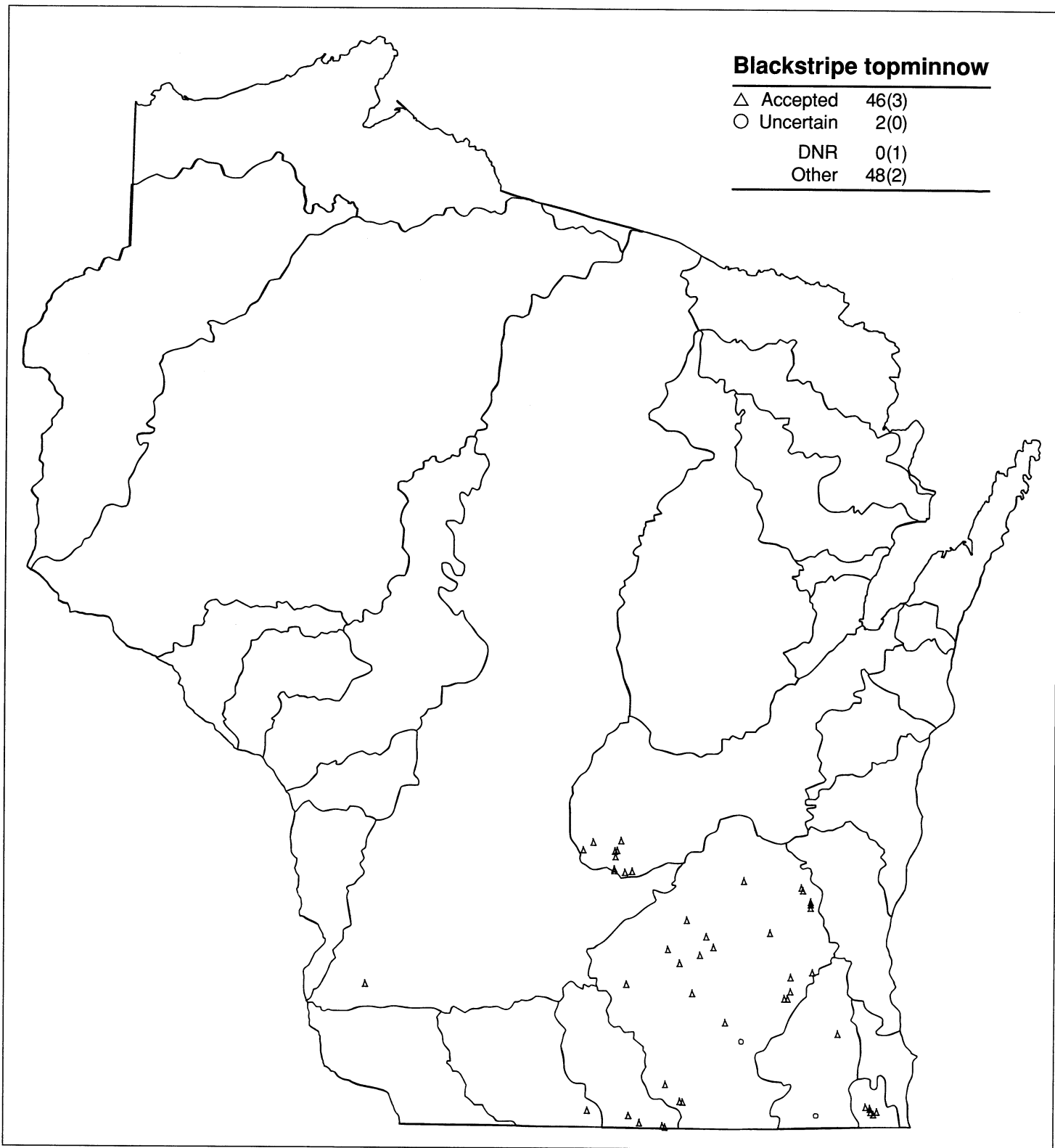
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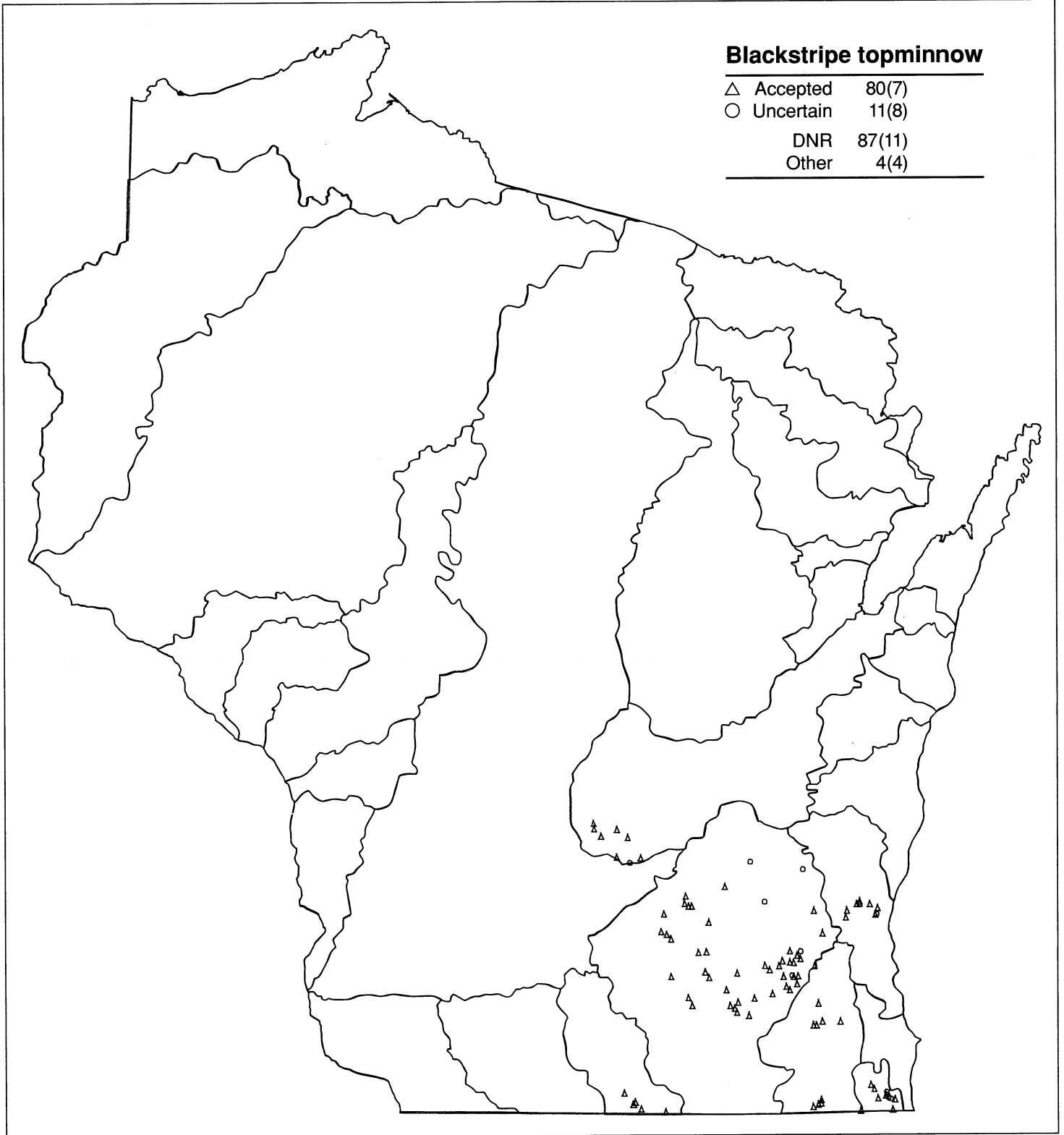


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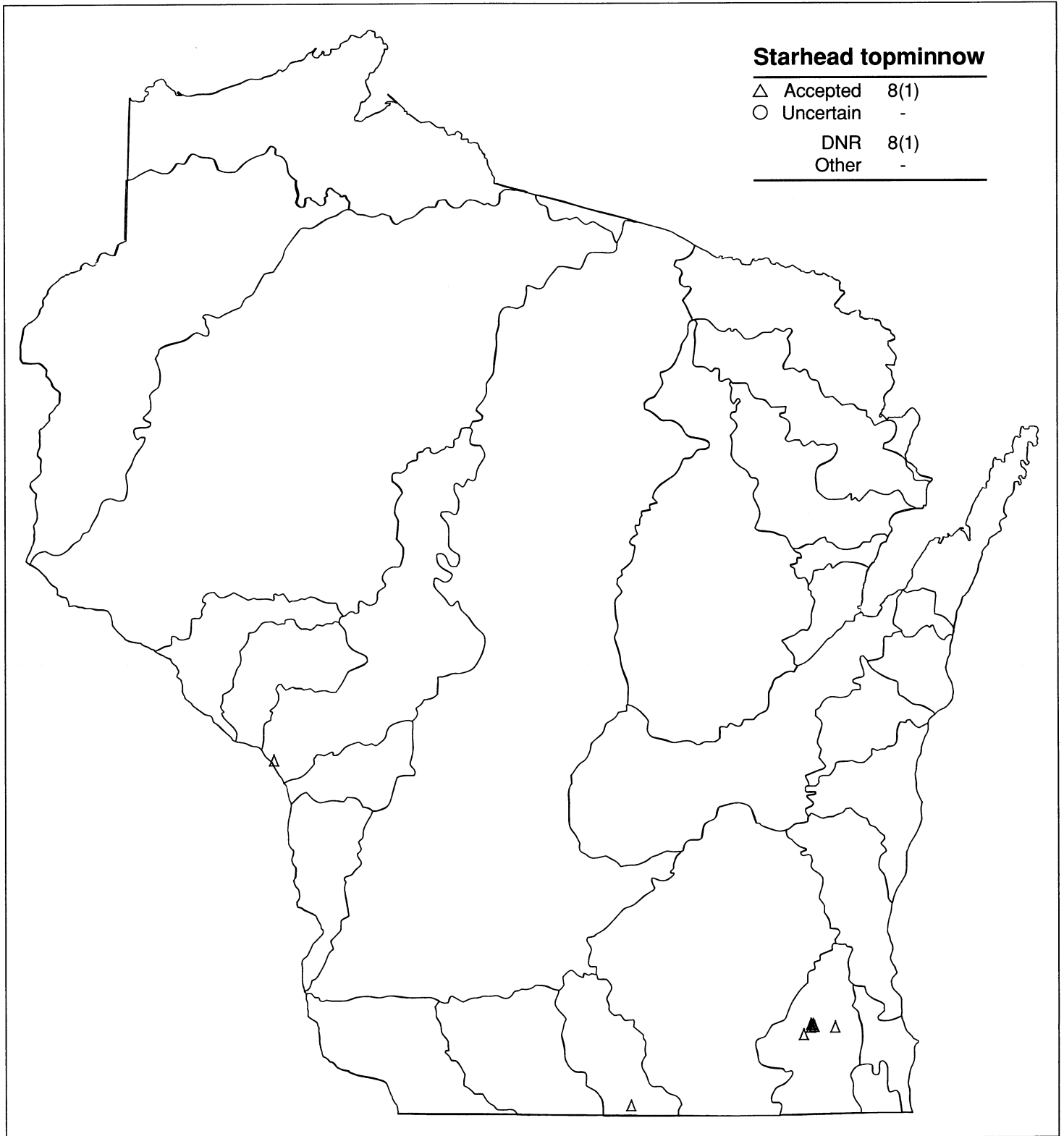
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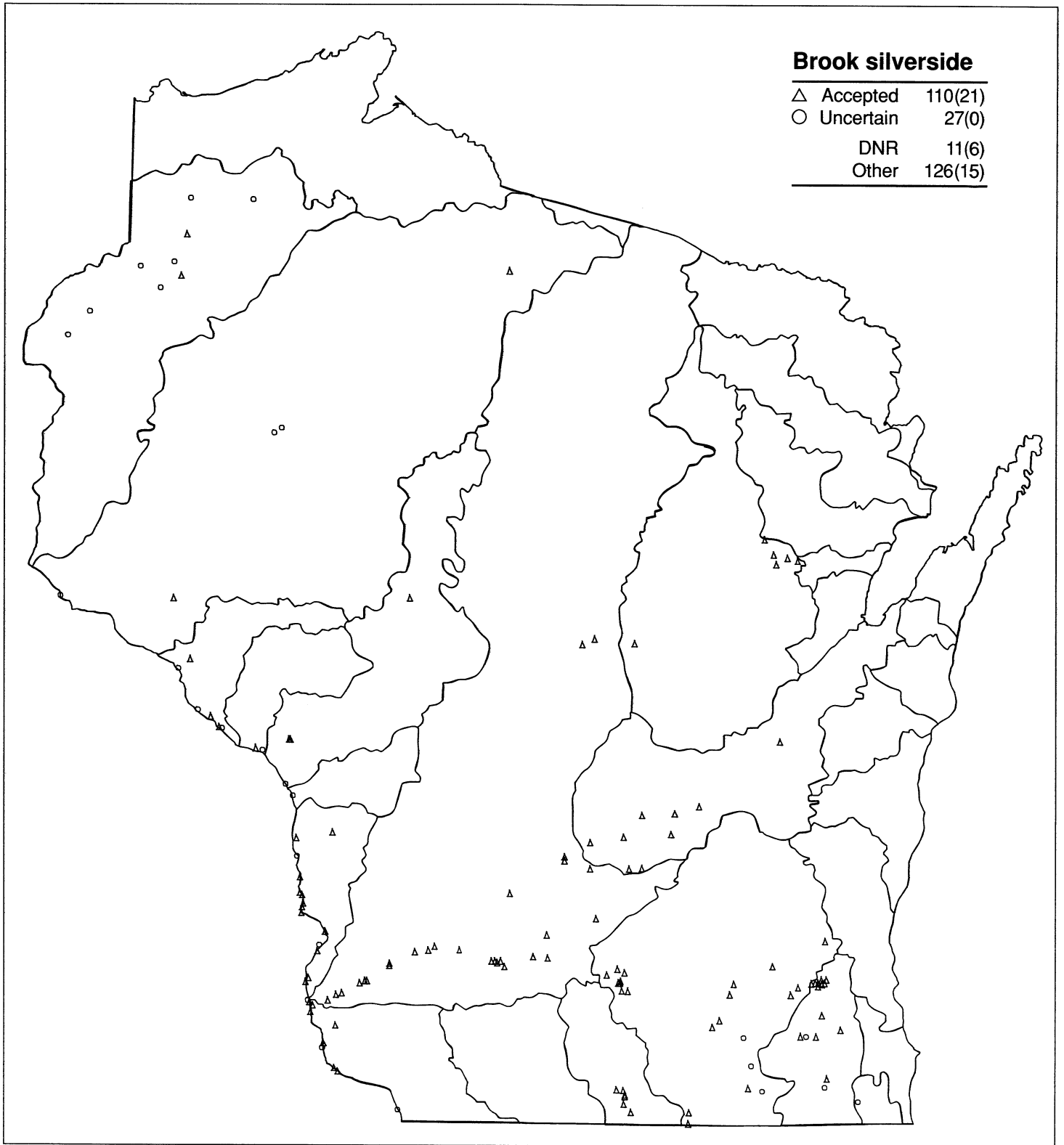


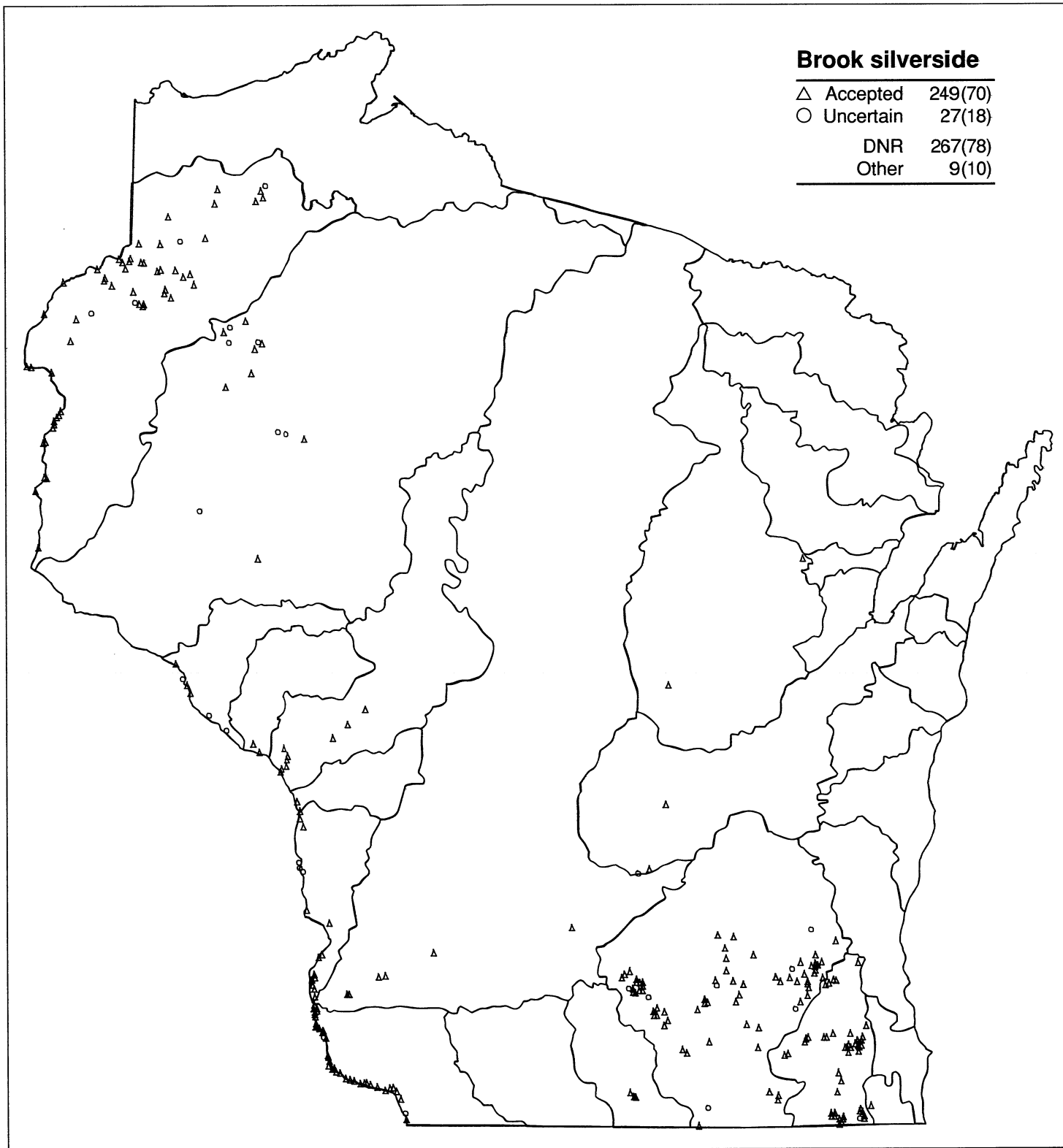
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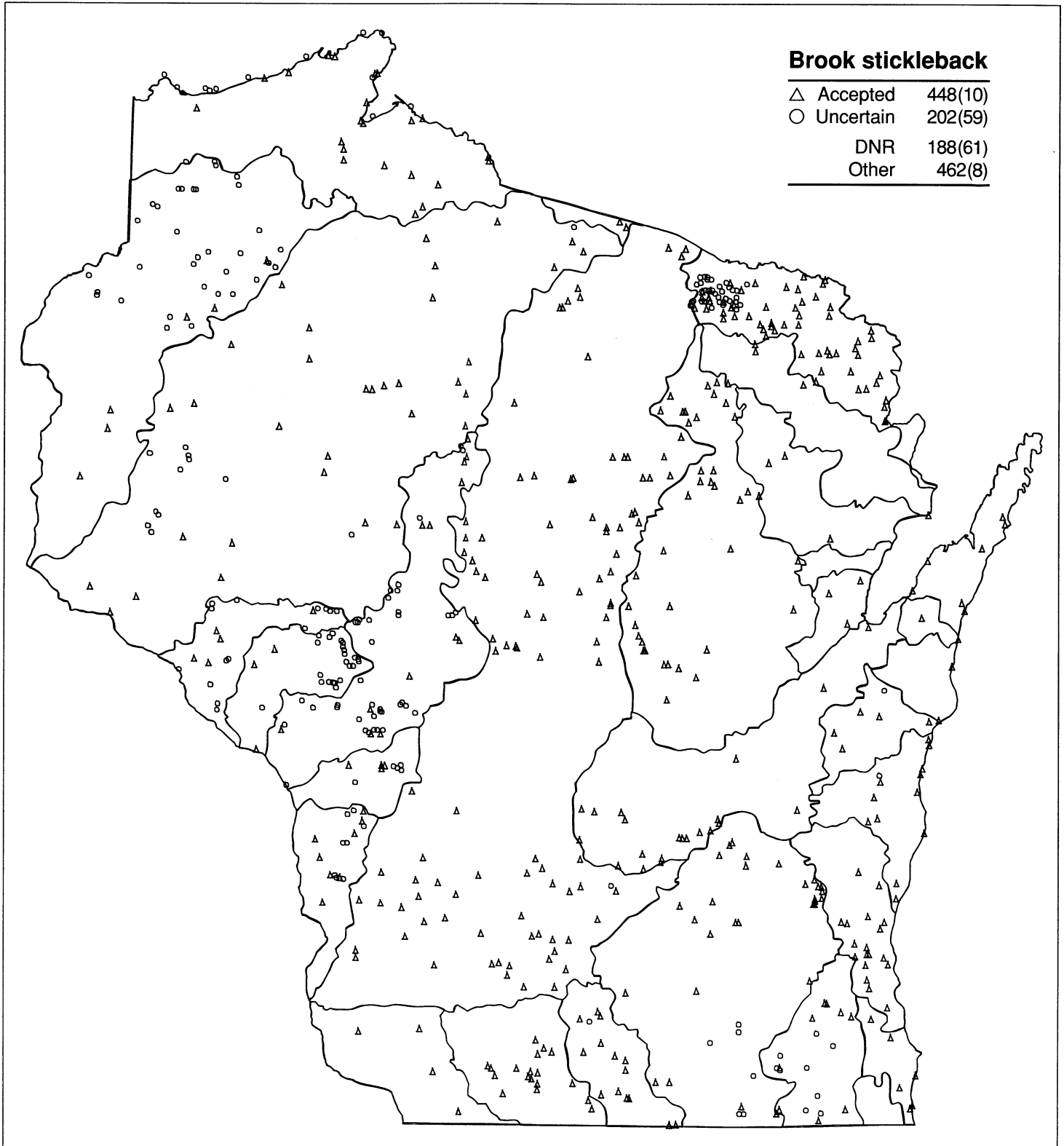


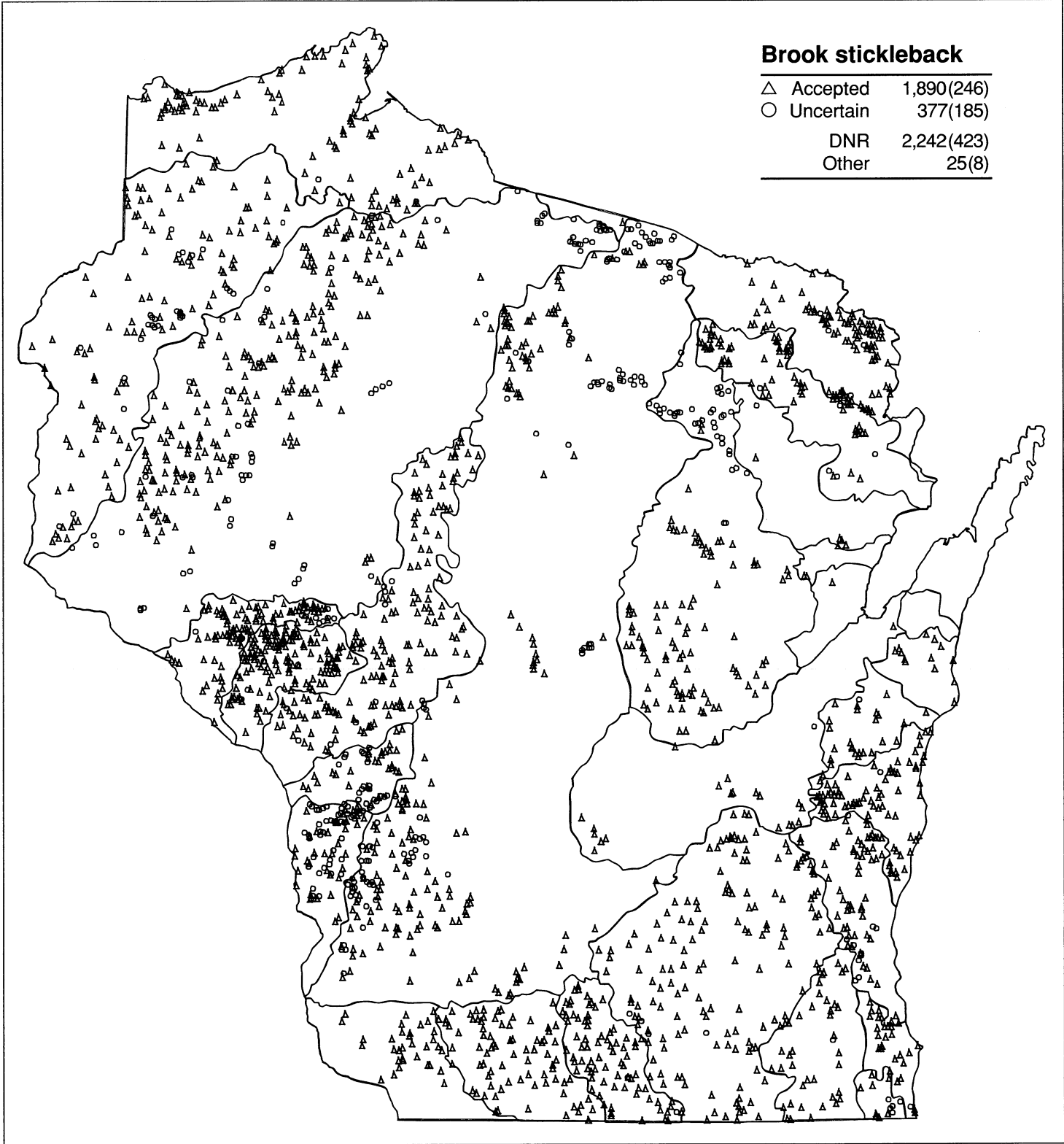
Map 108(E)





Map 109(E)





Map 110(E)

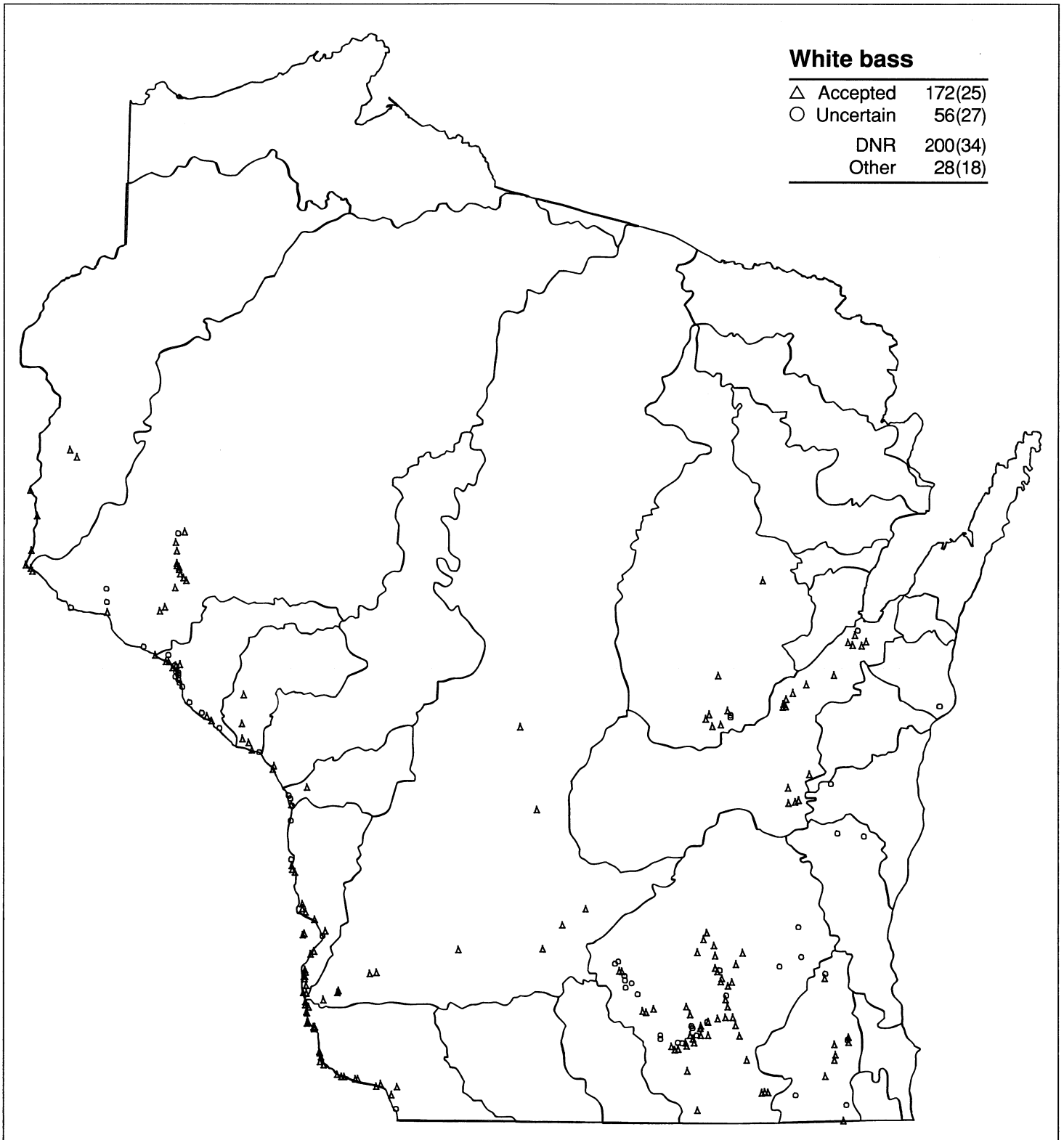




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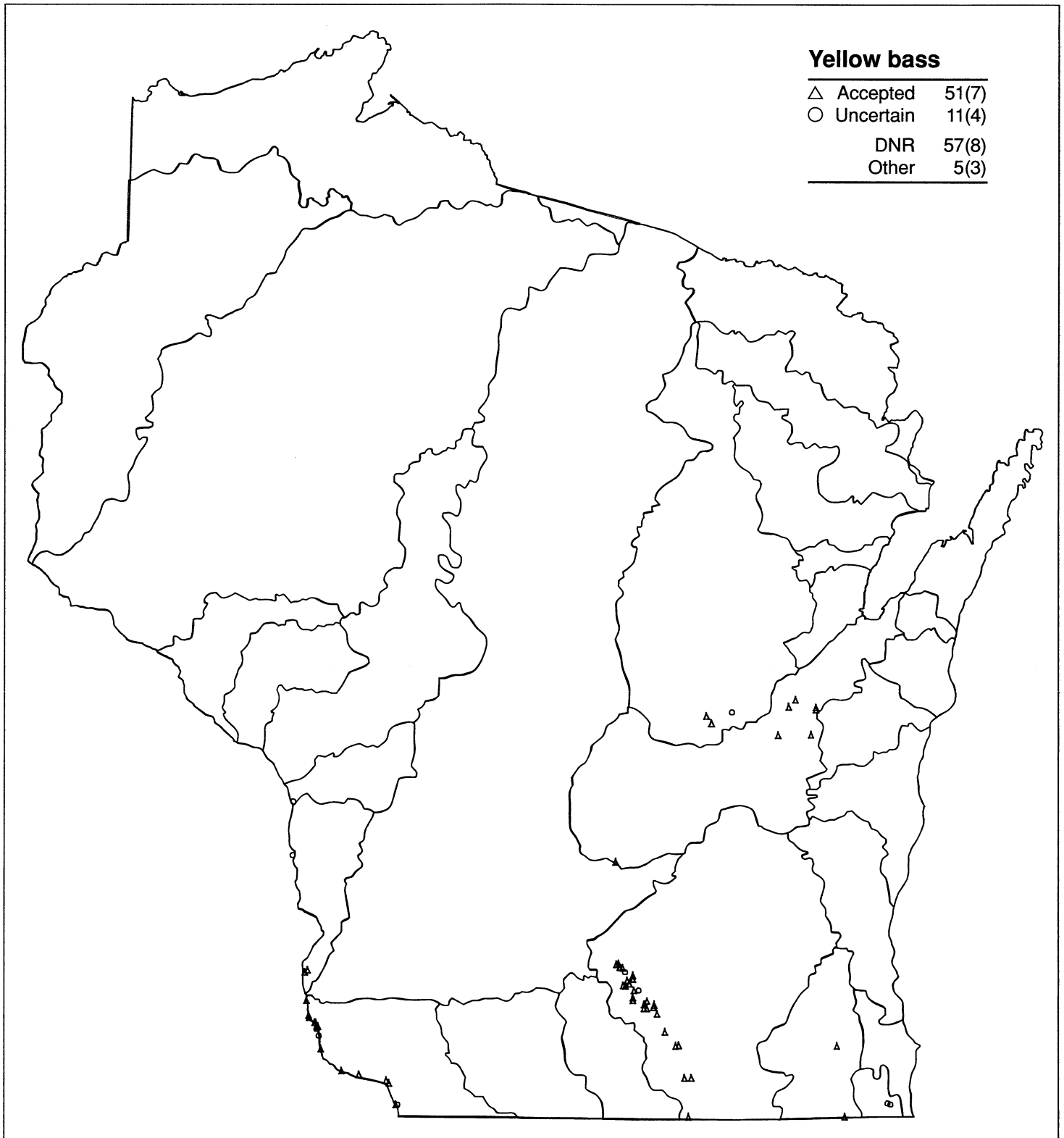
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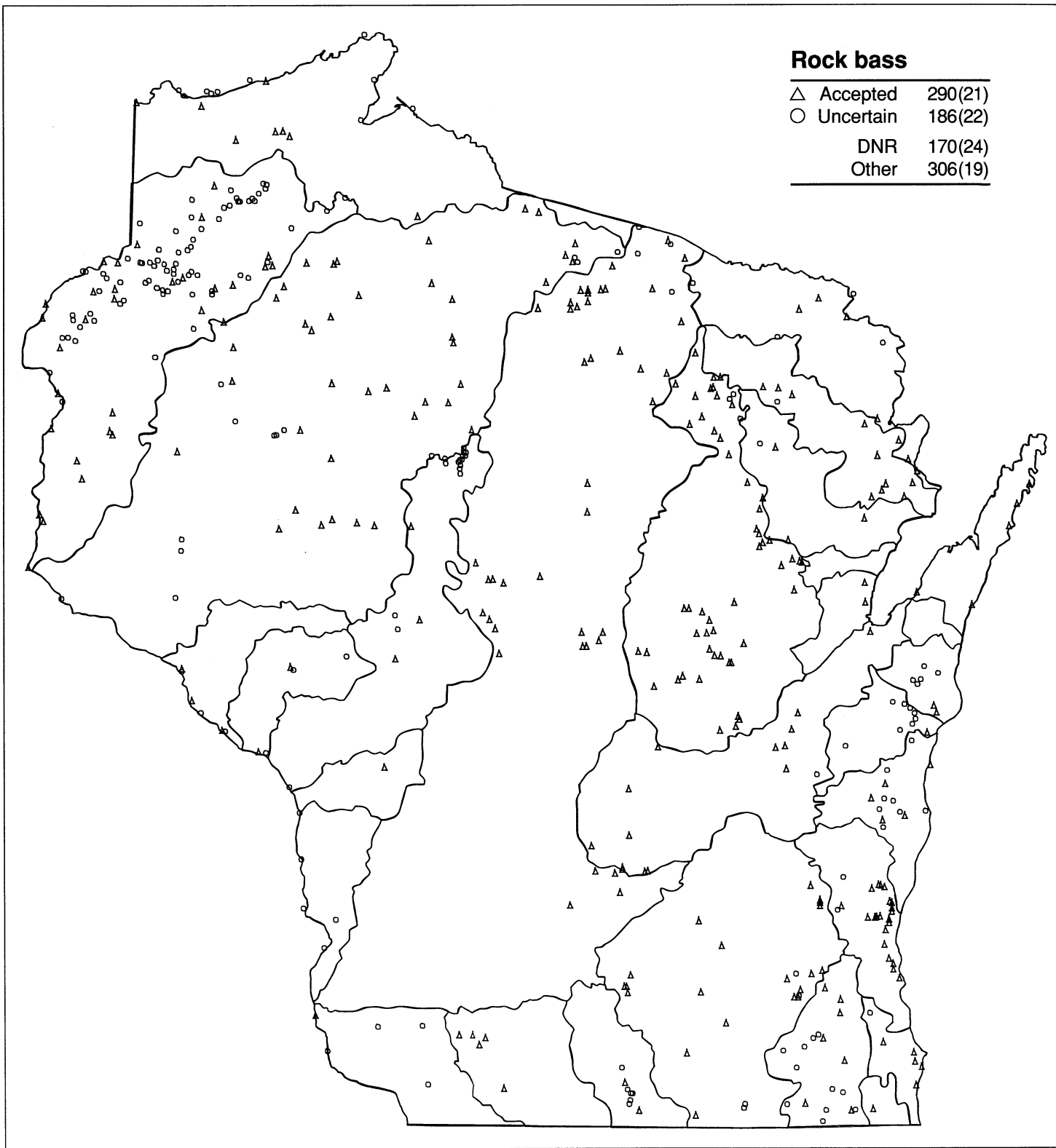
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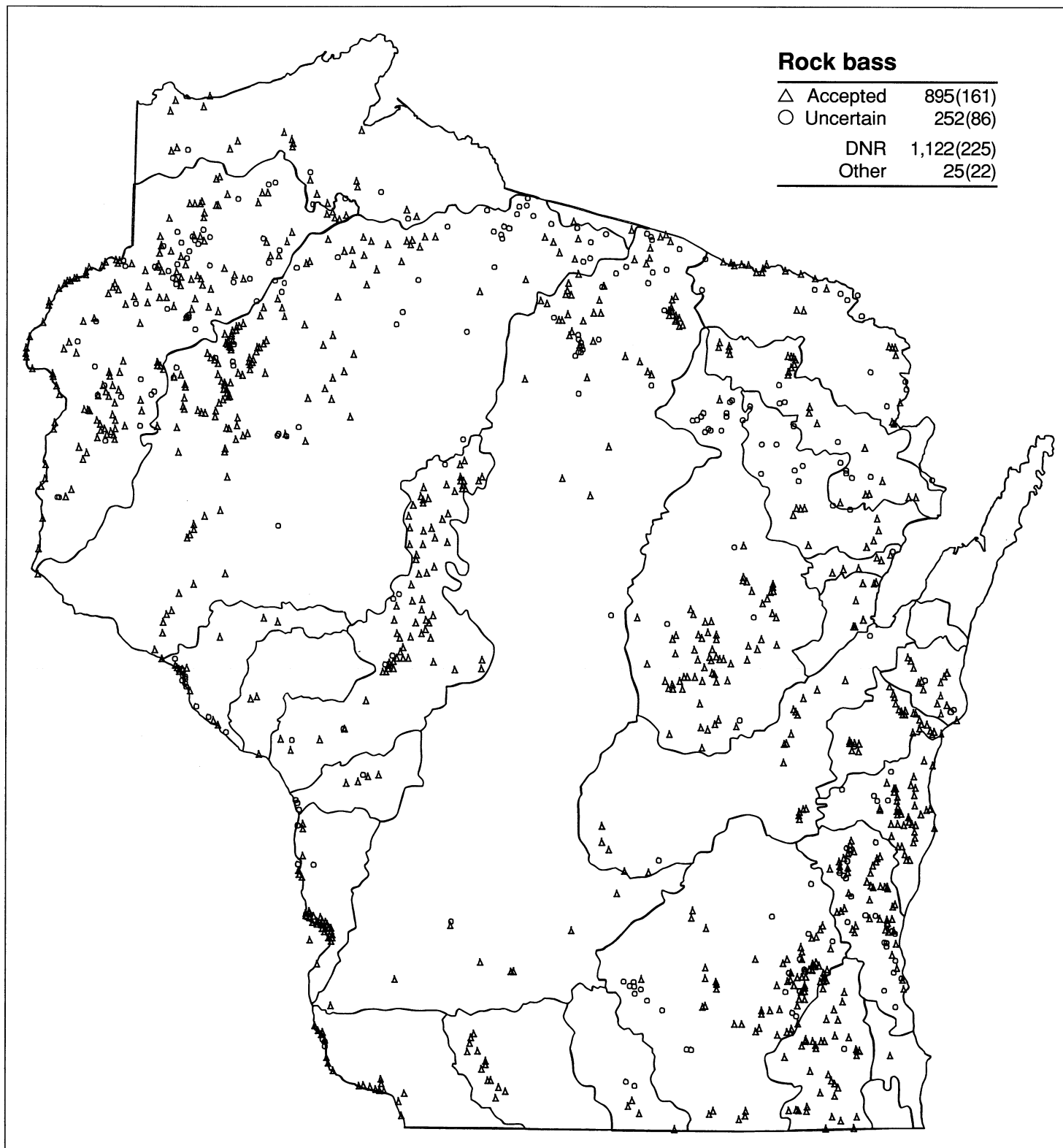


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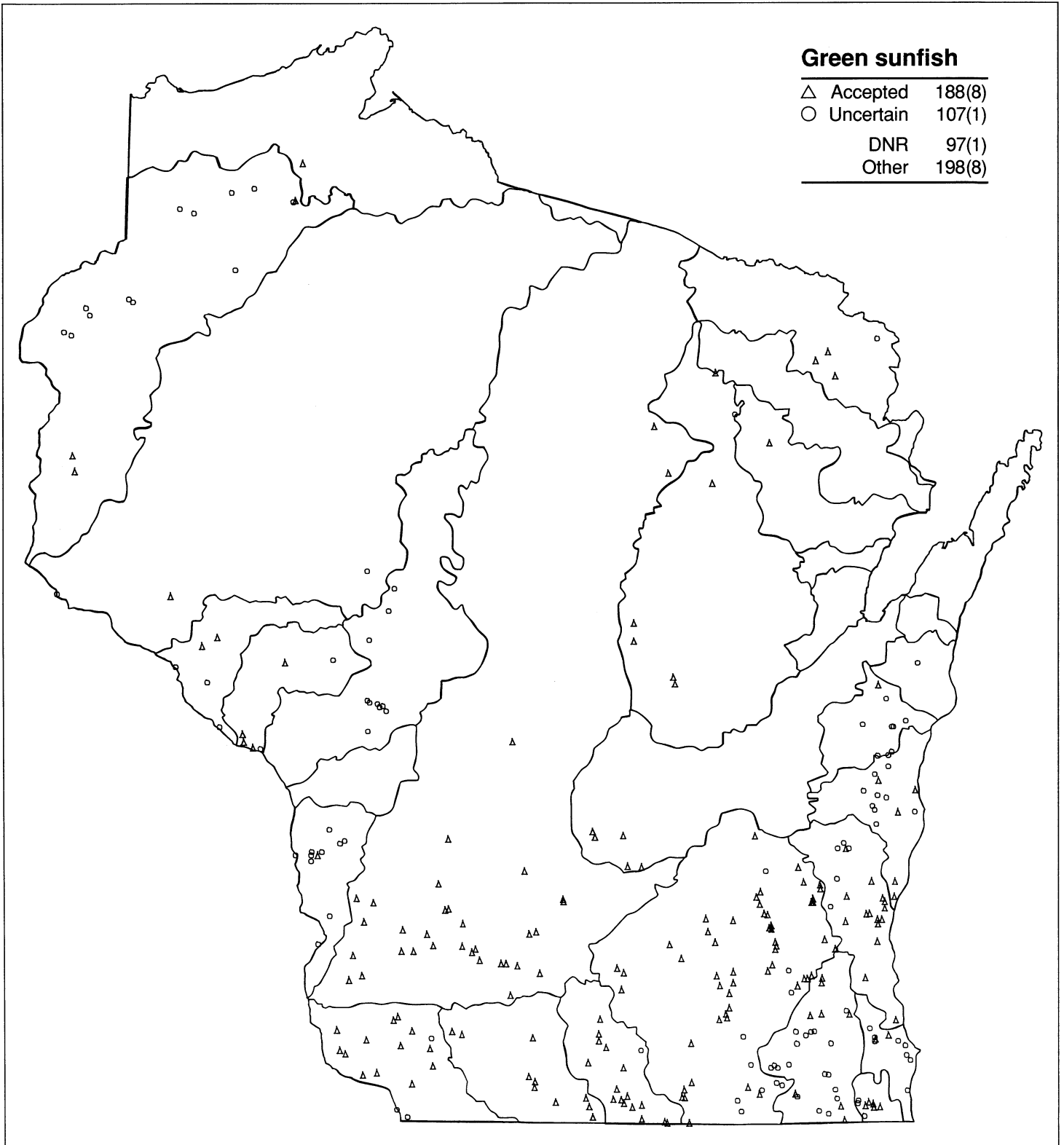


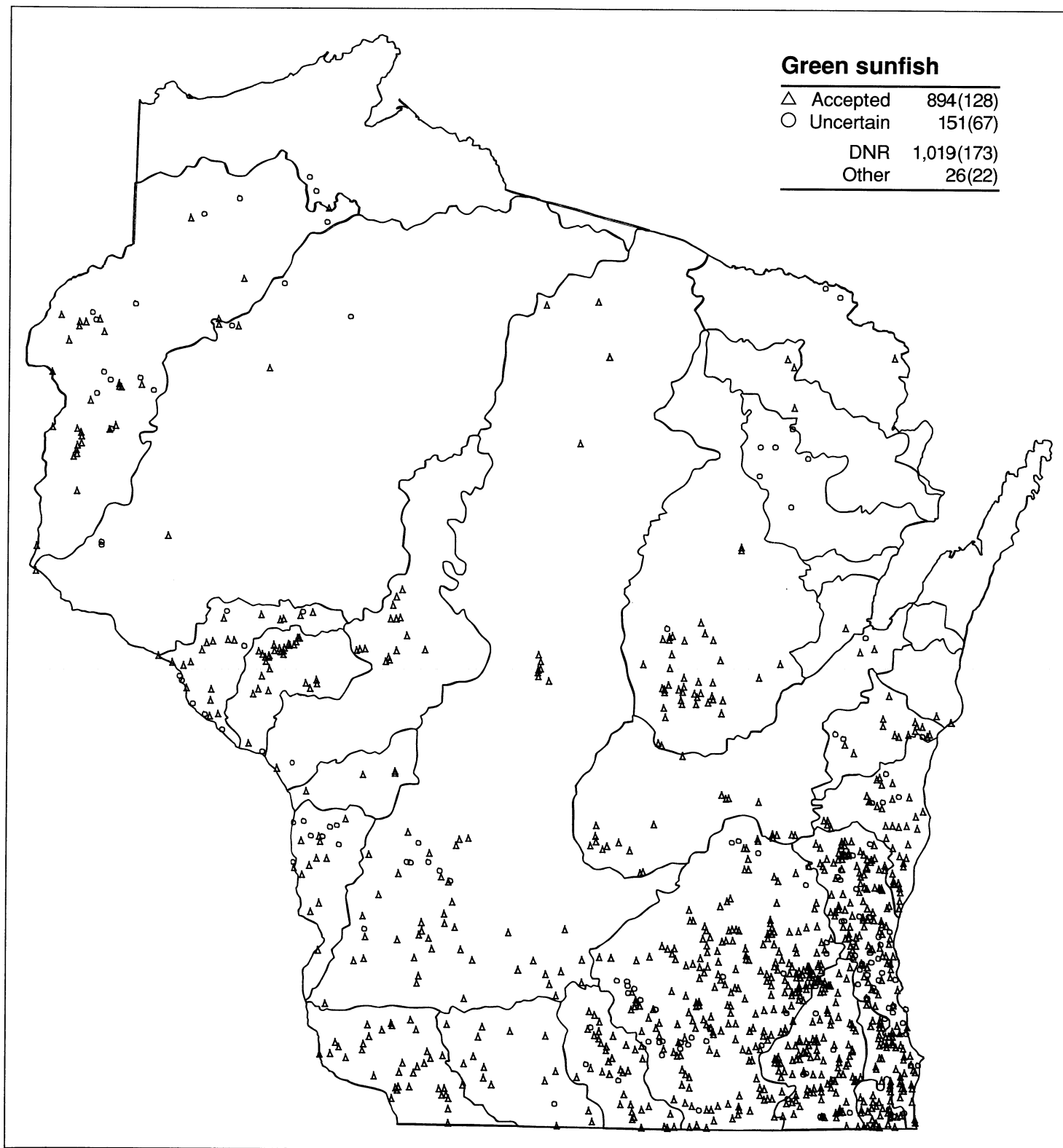
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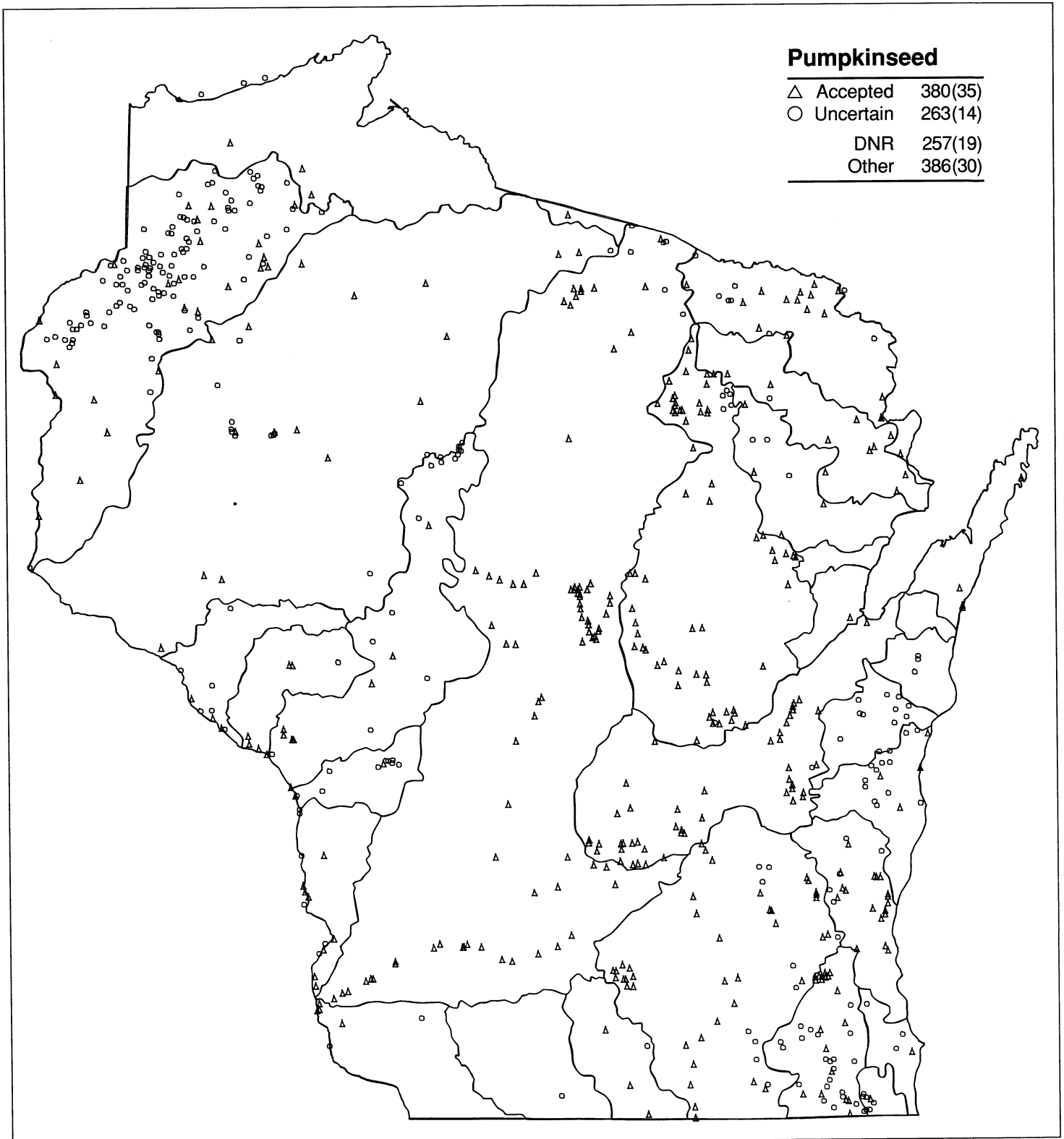


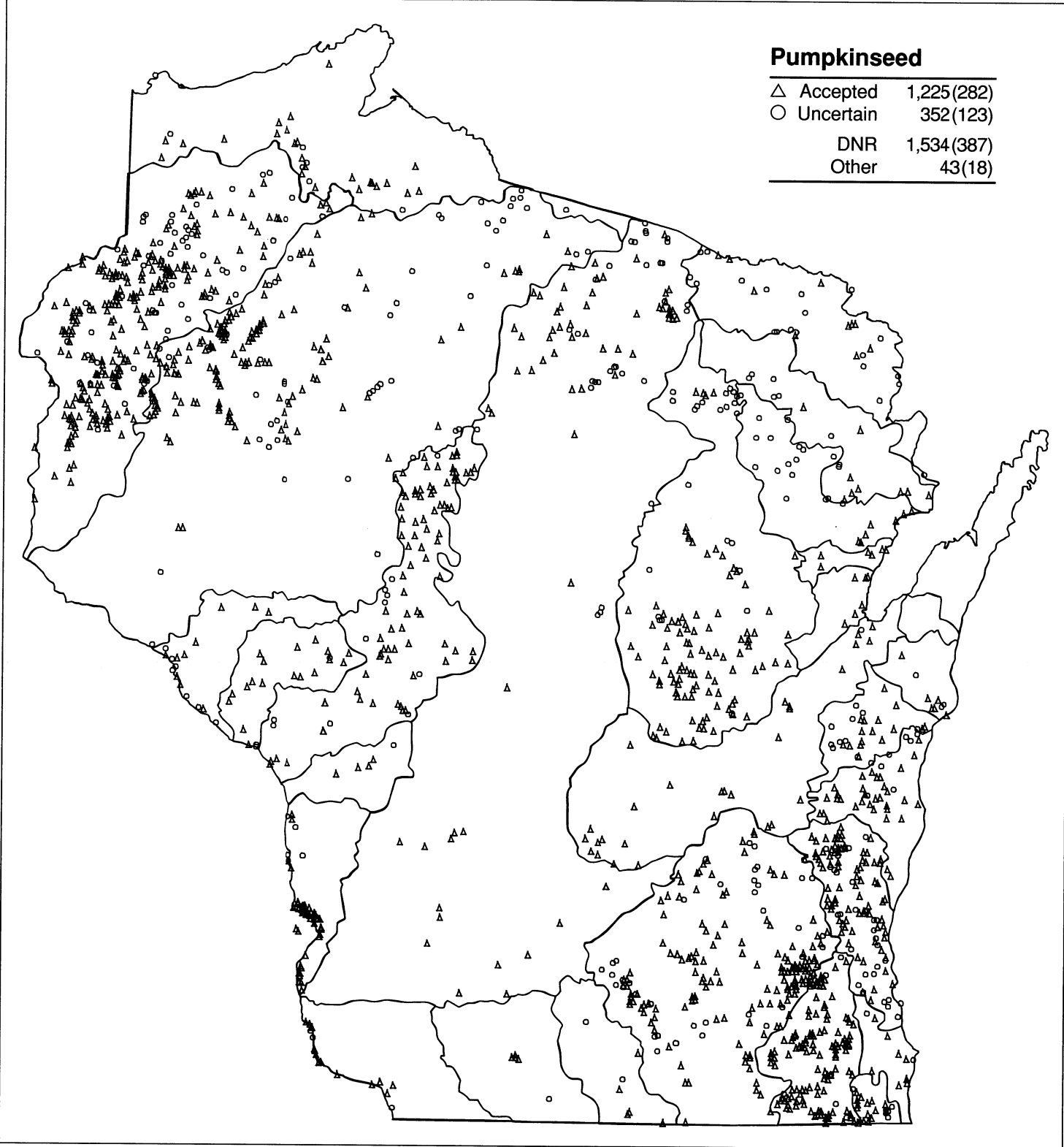
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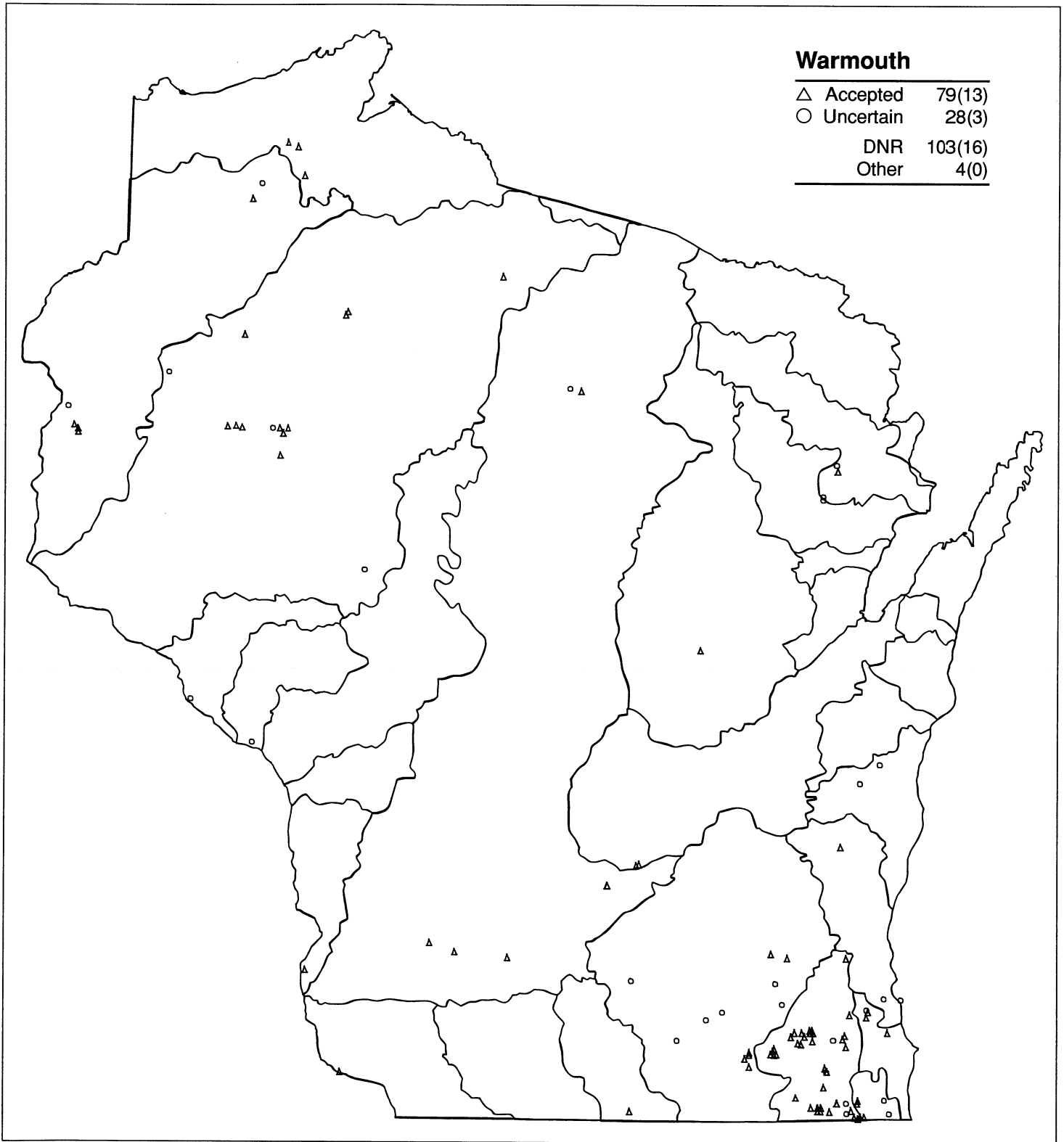
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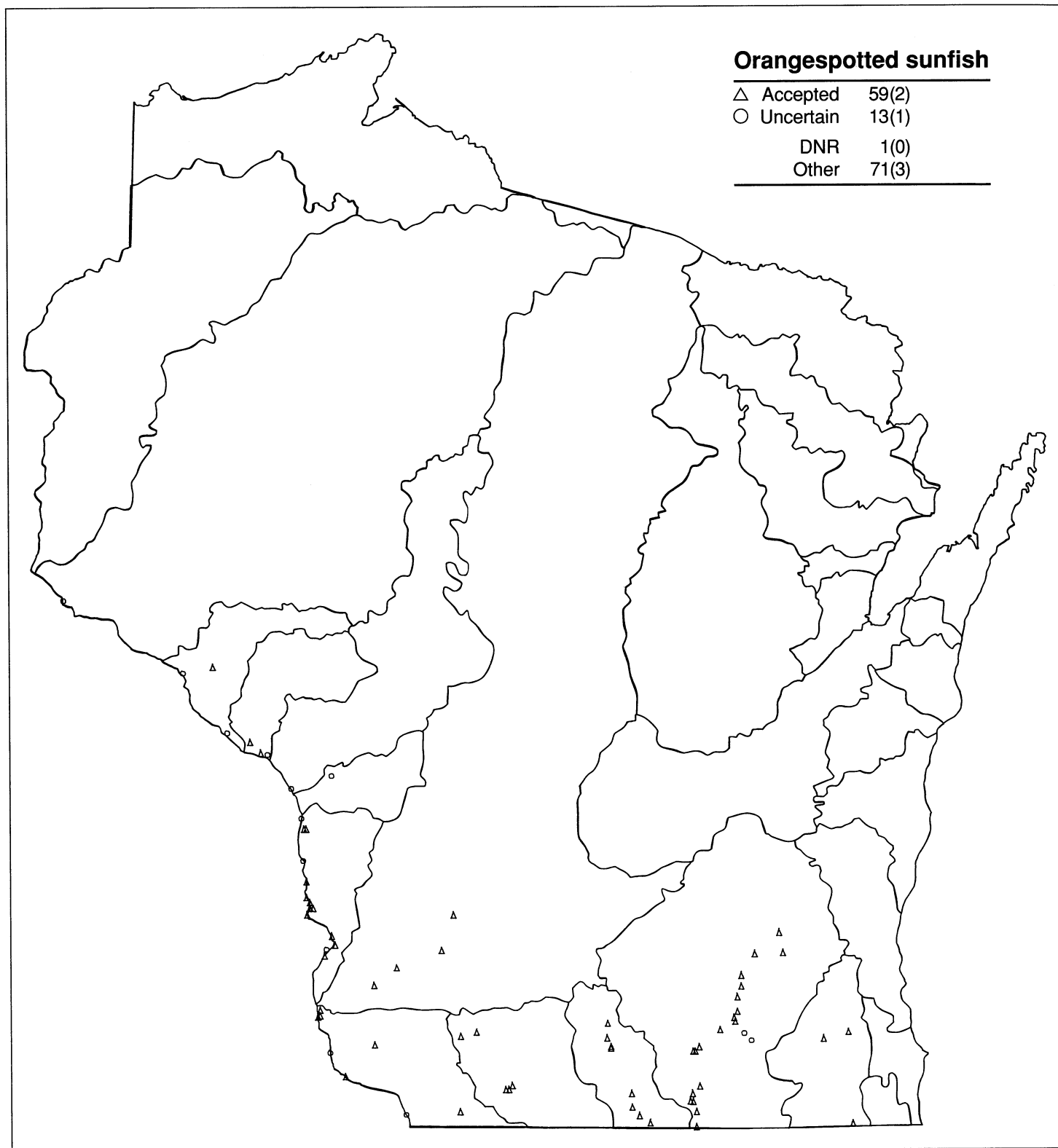


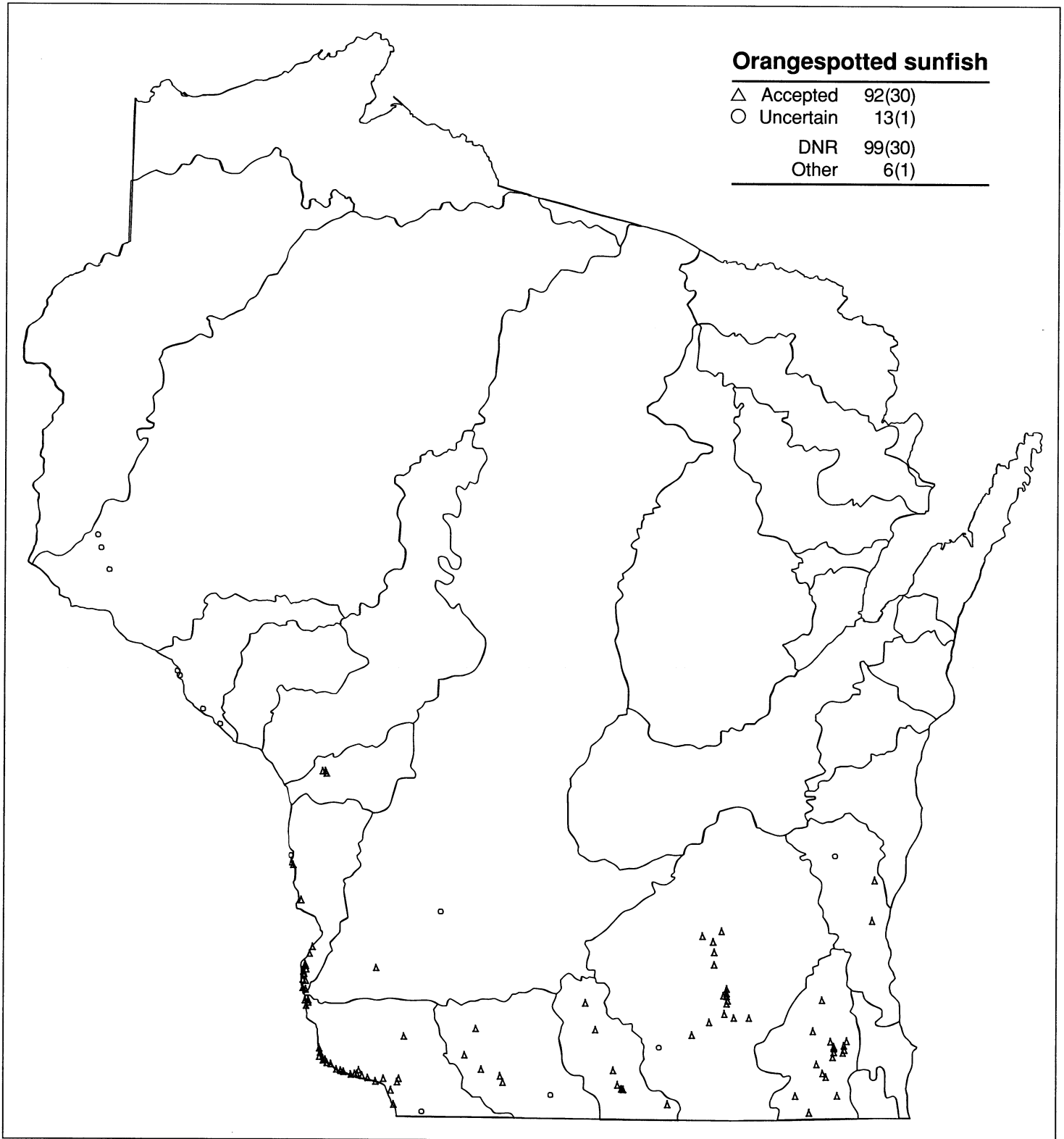
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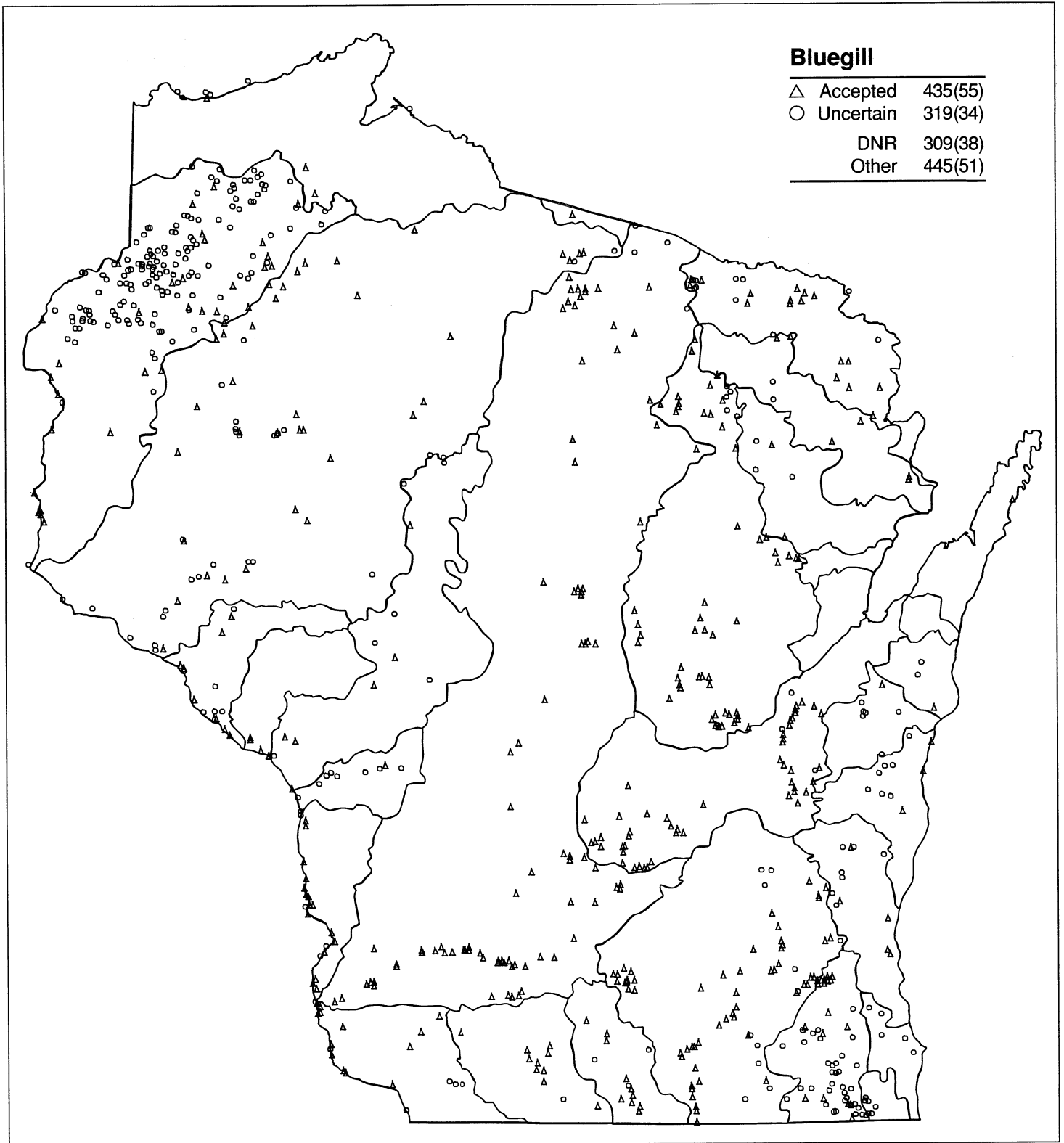


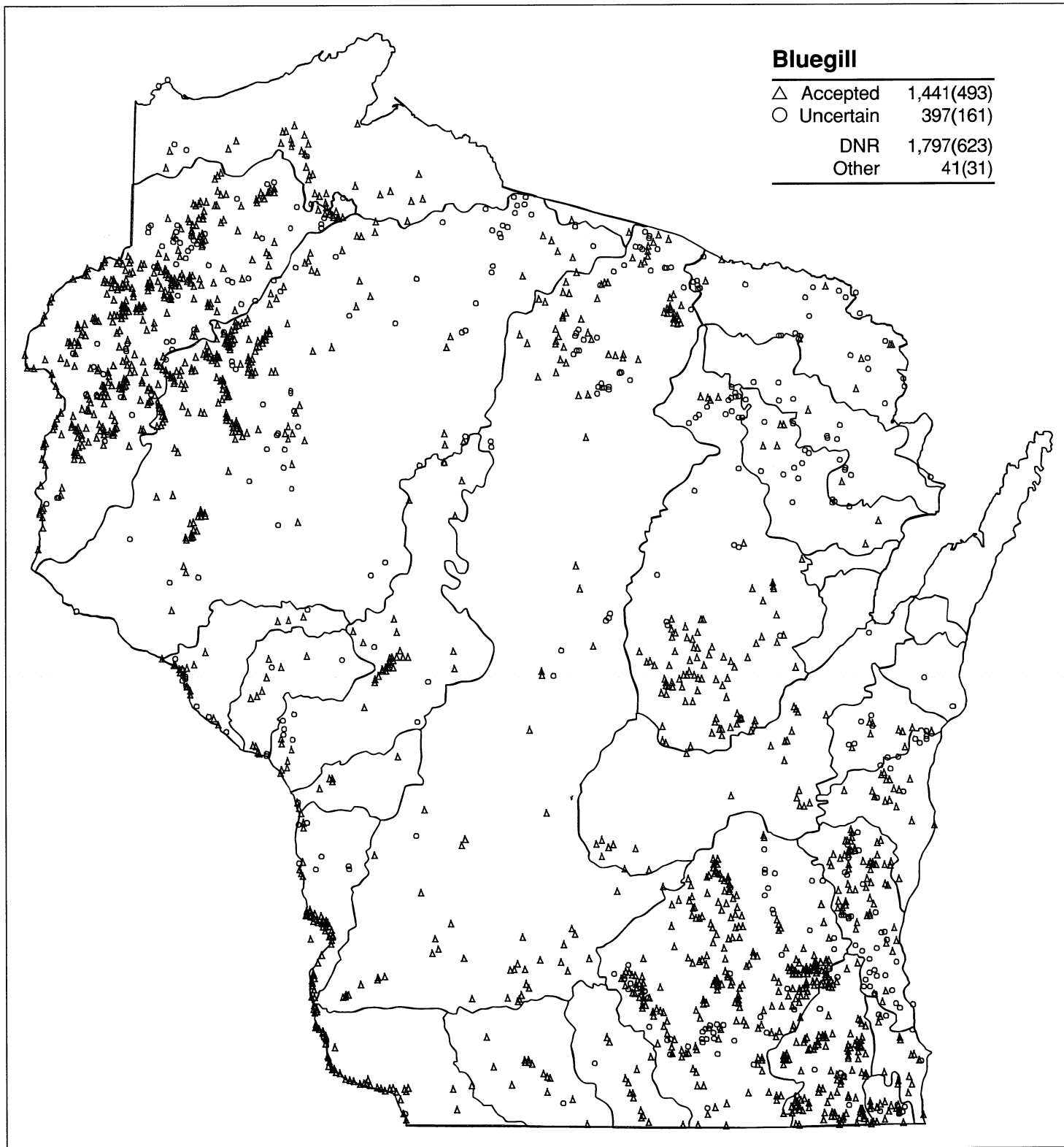
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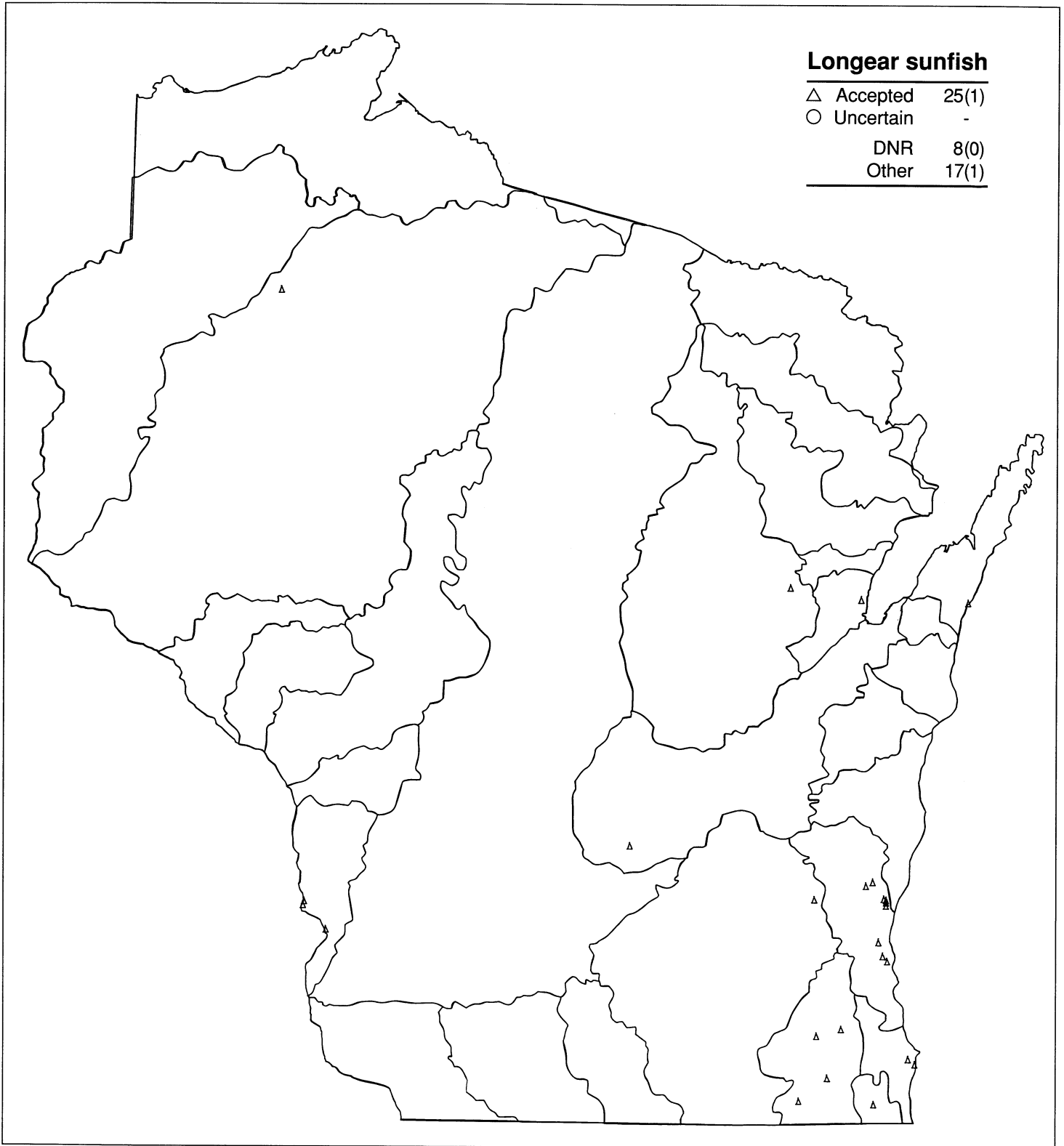


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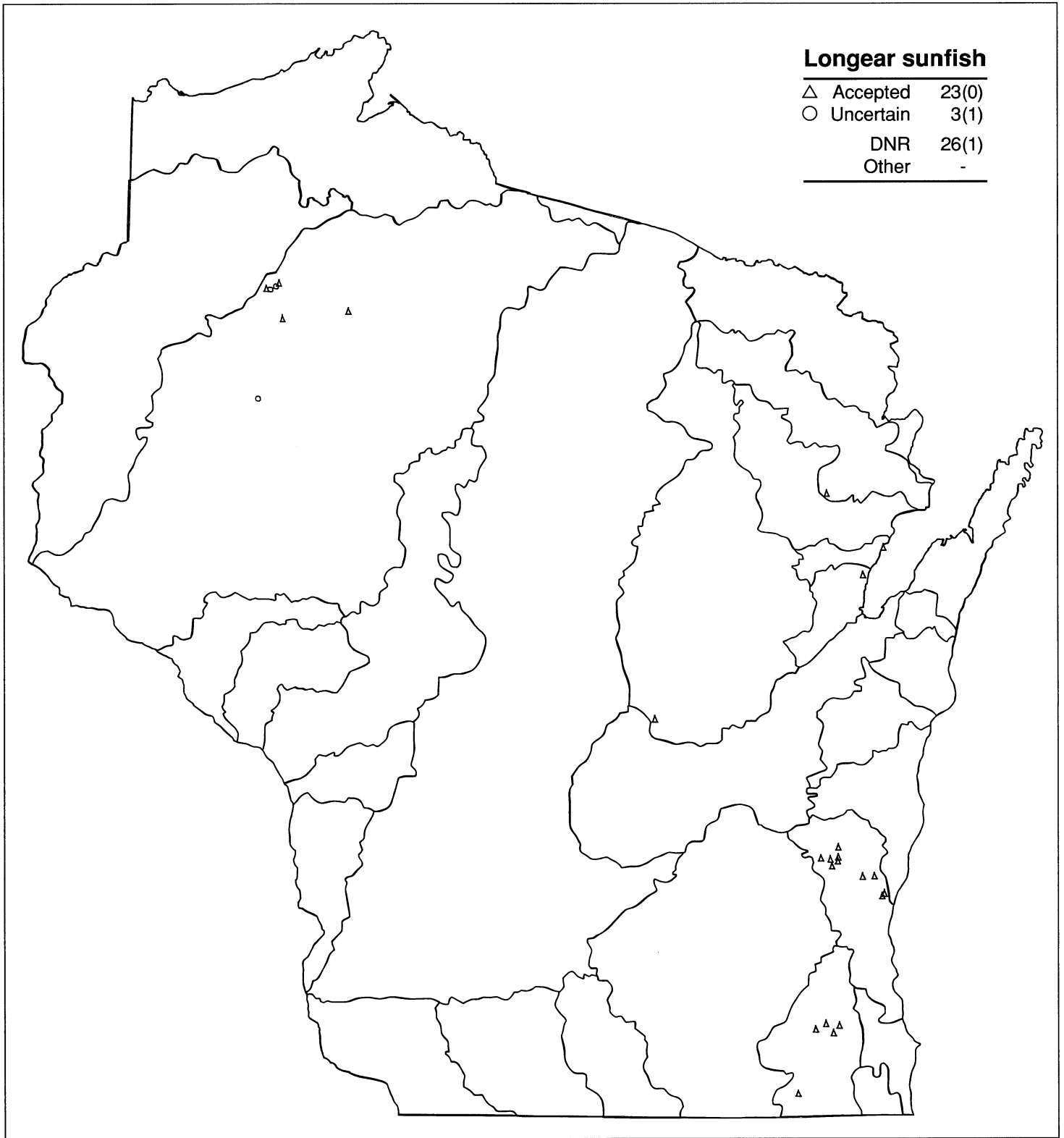




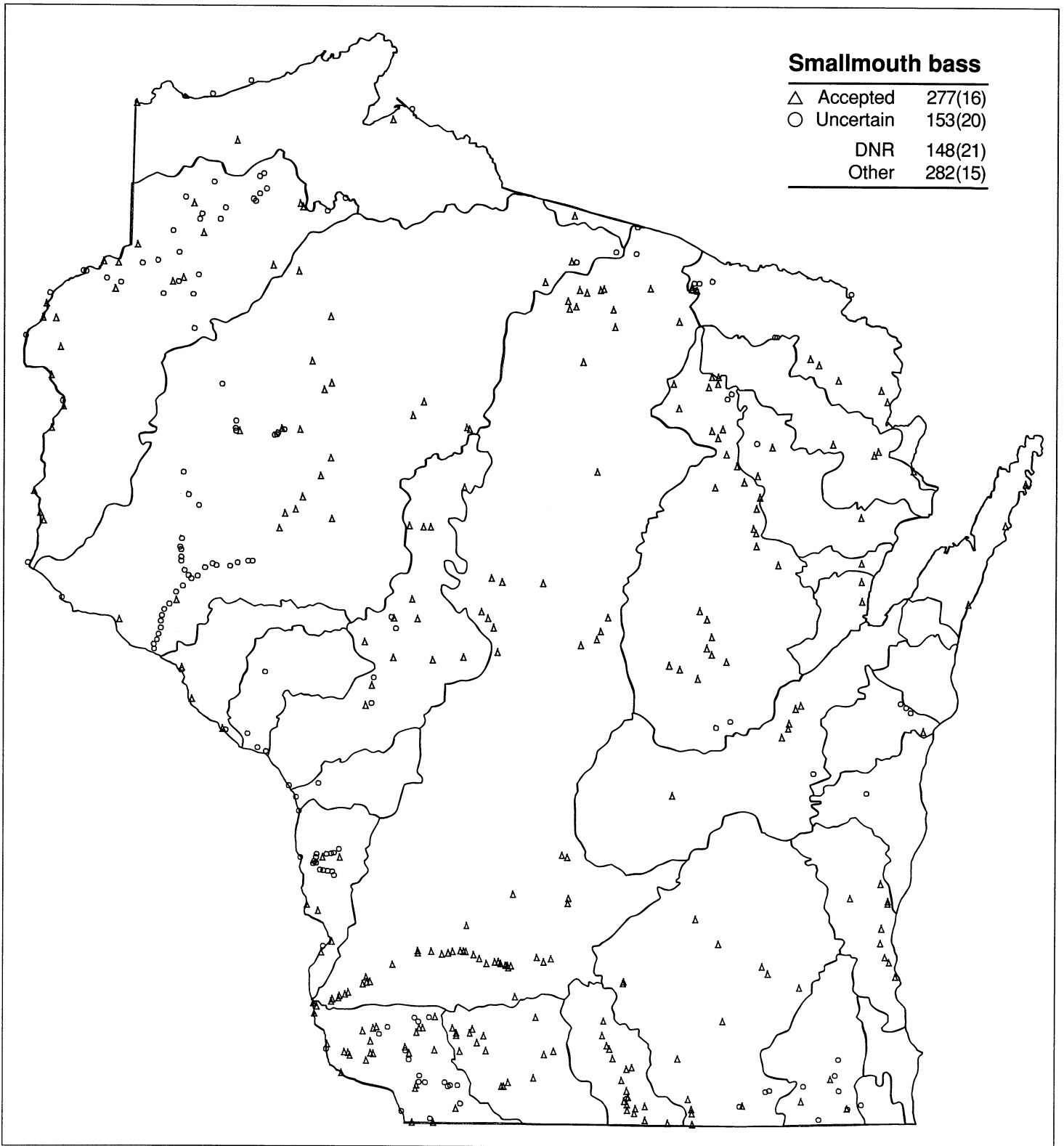
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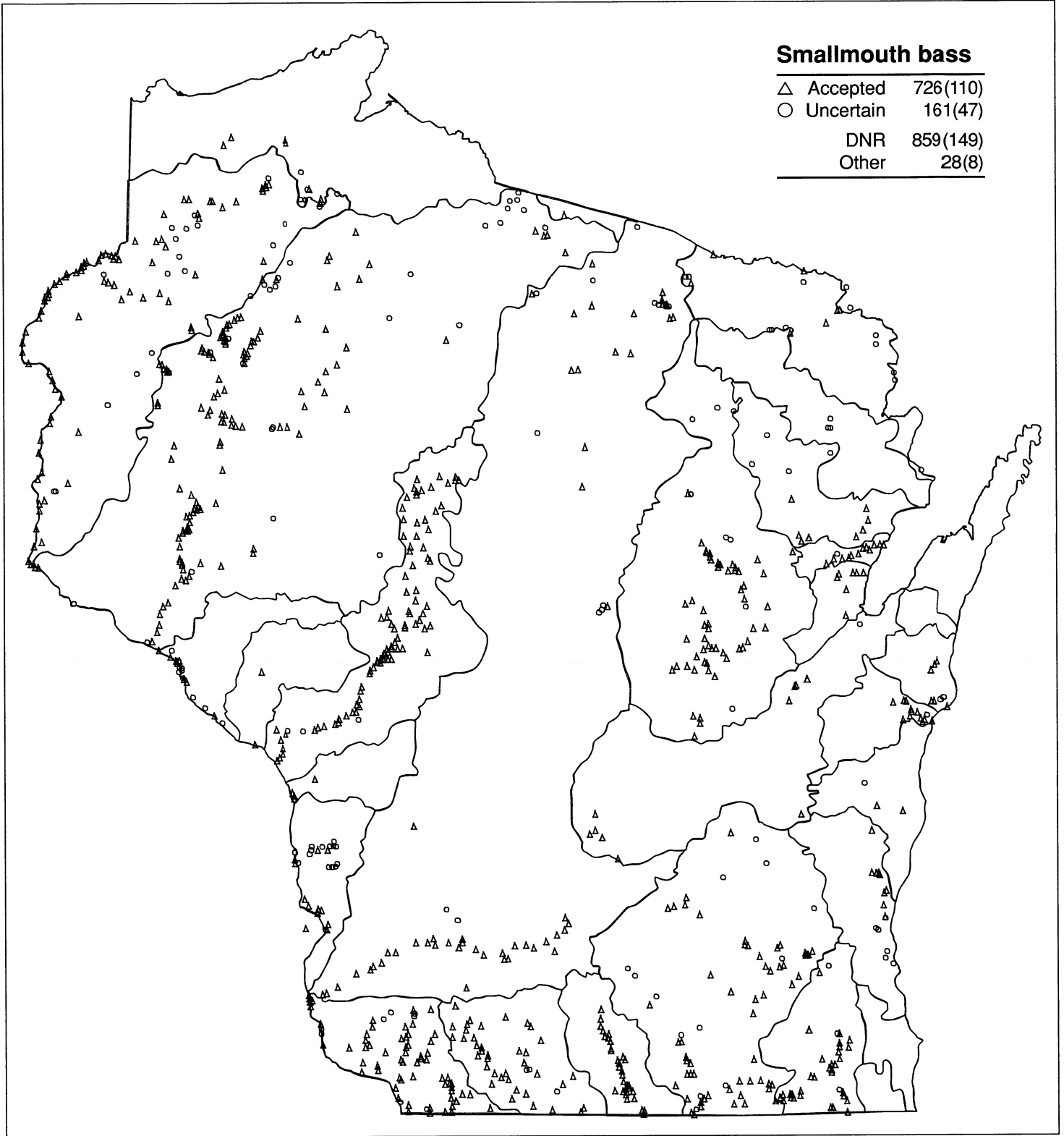


Map 119(L)



Map 120(E)

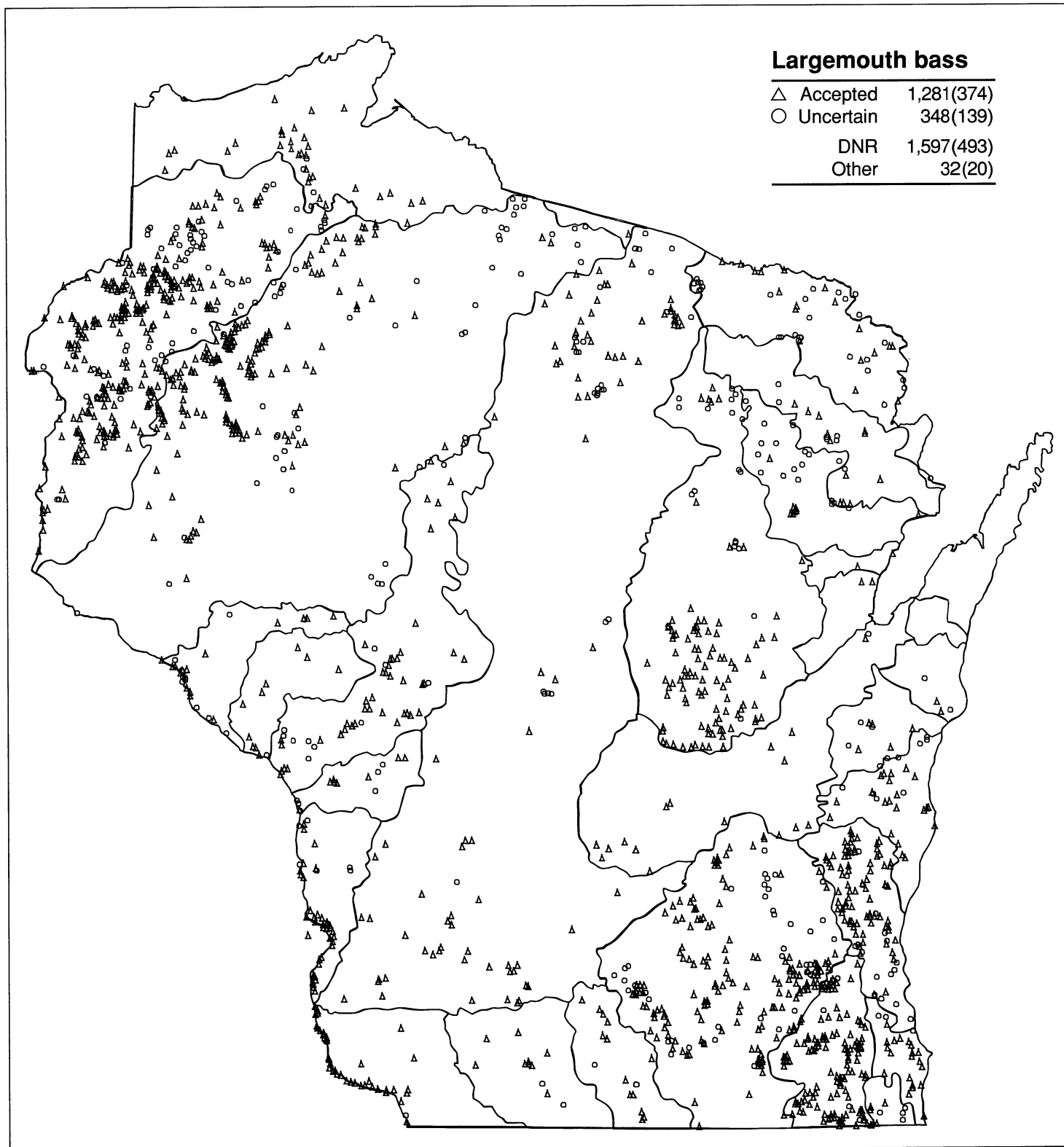




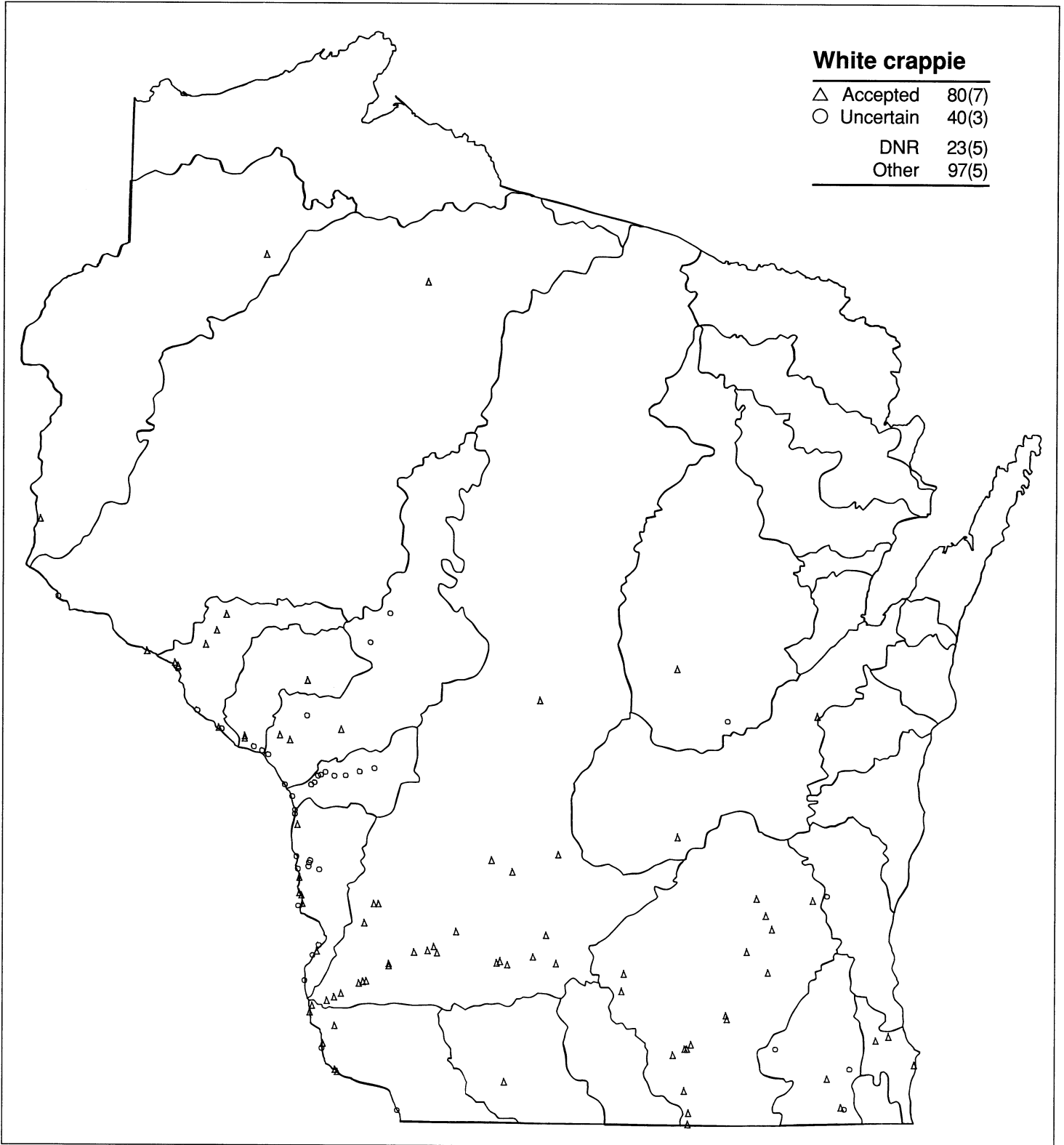
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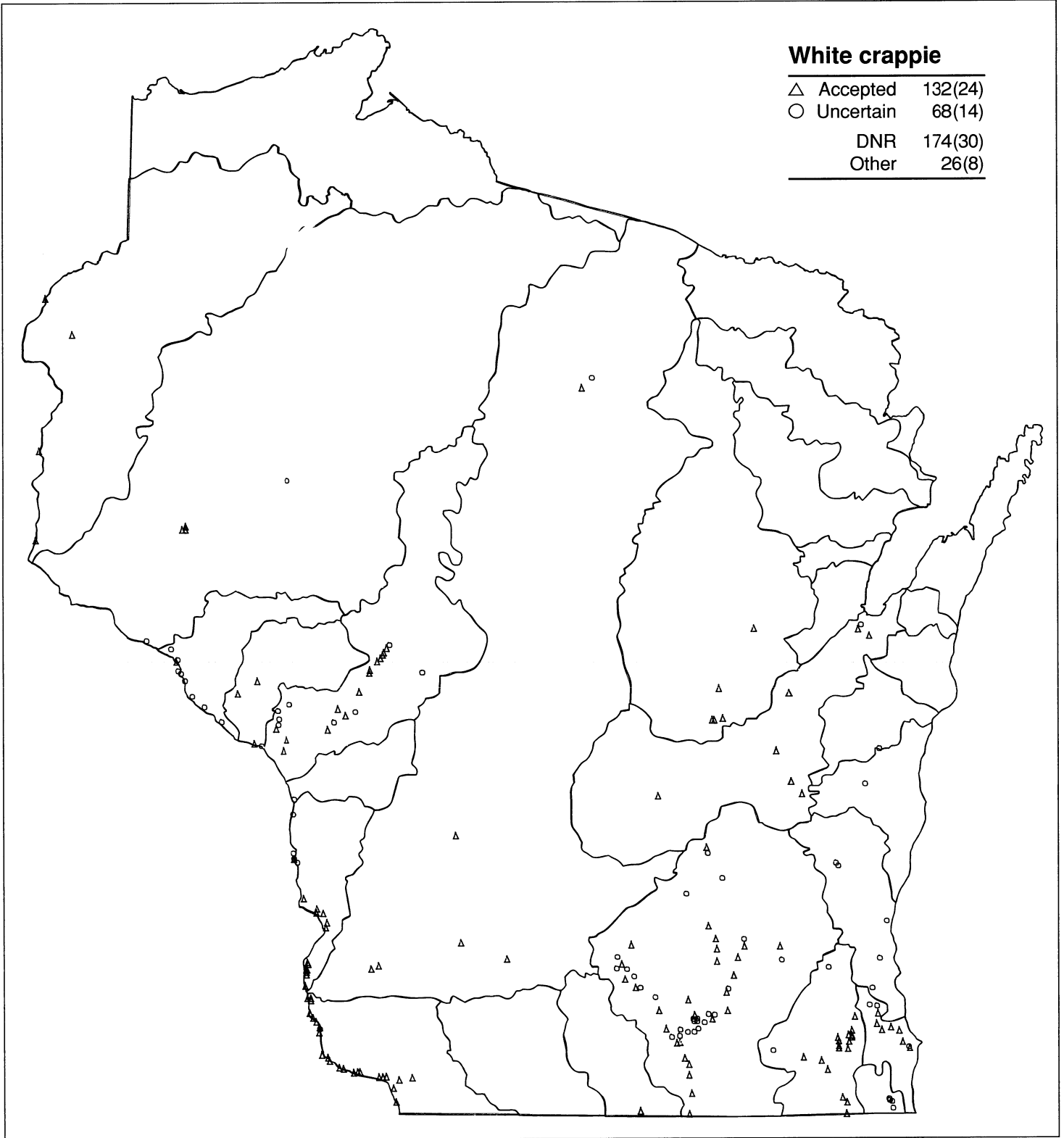


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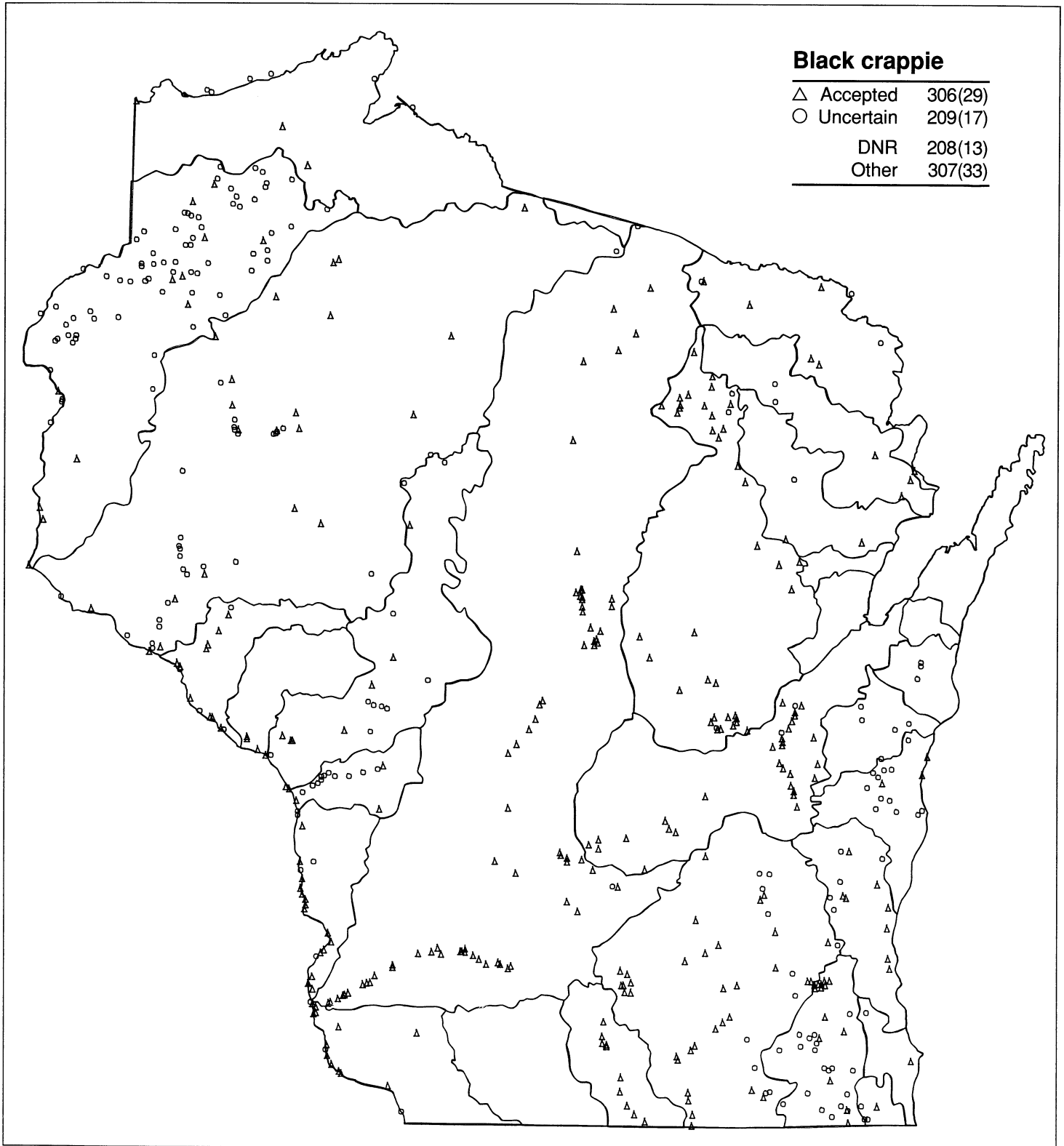


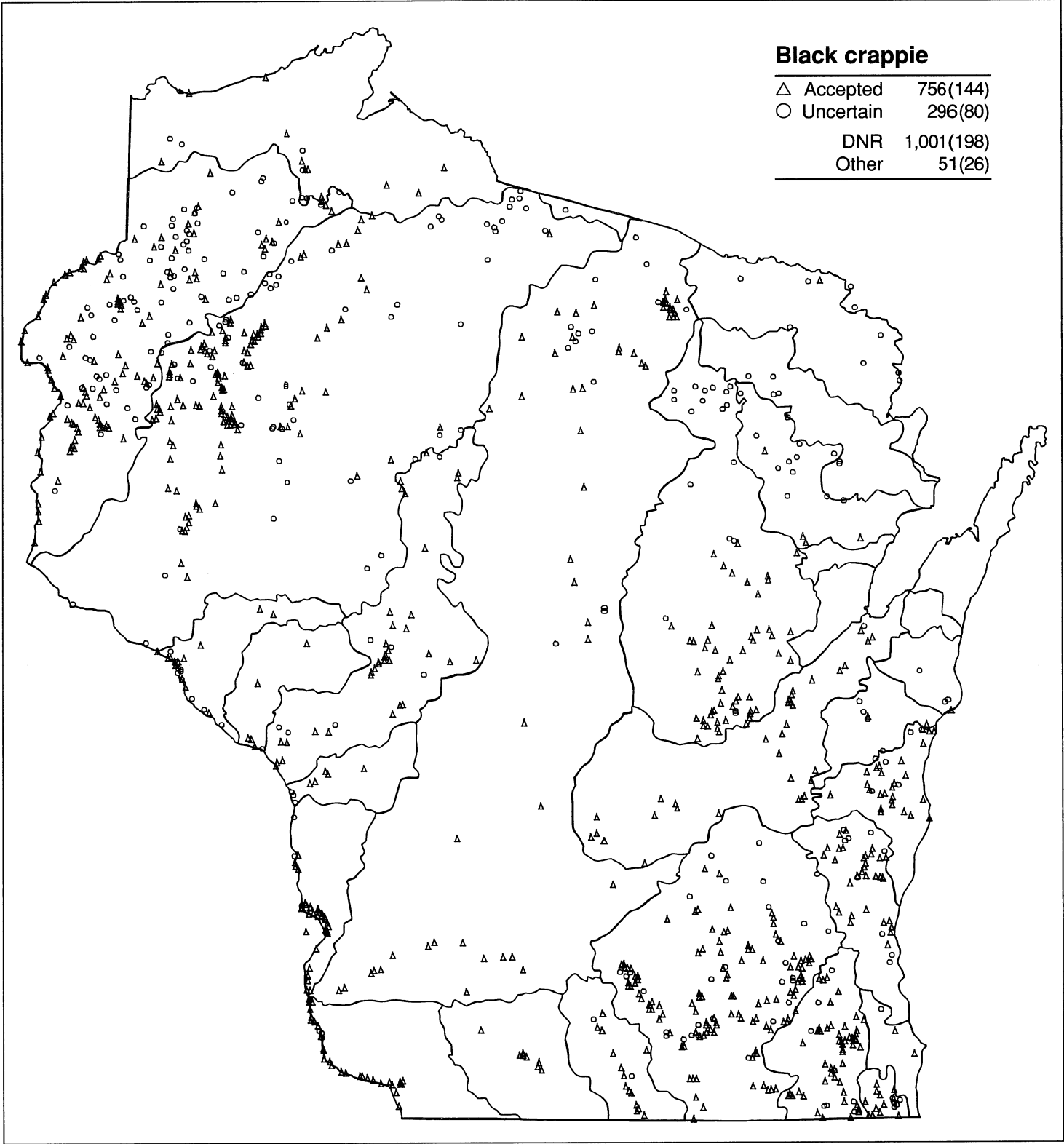
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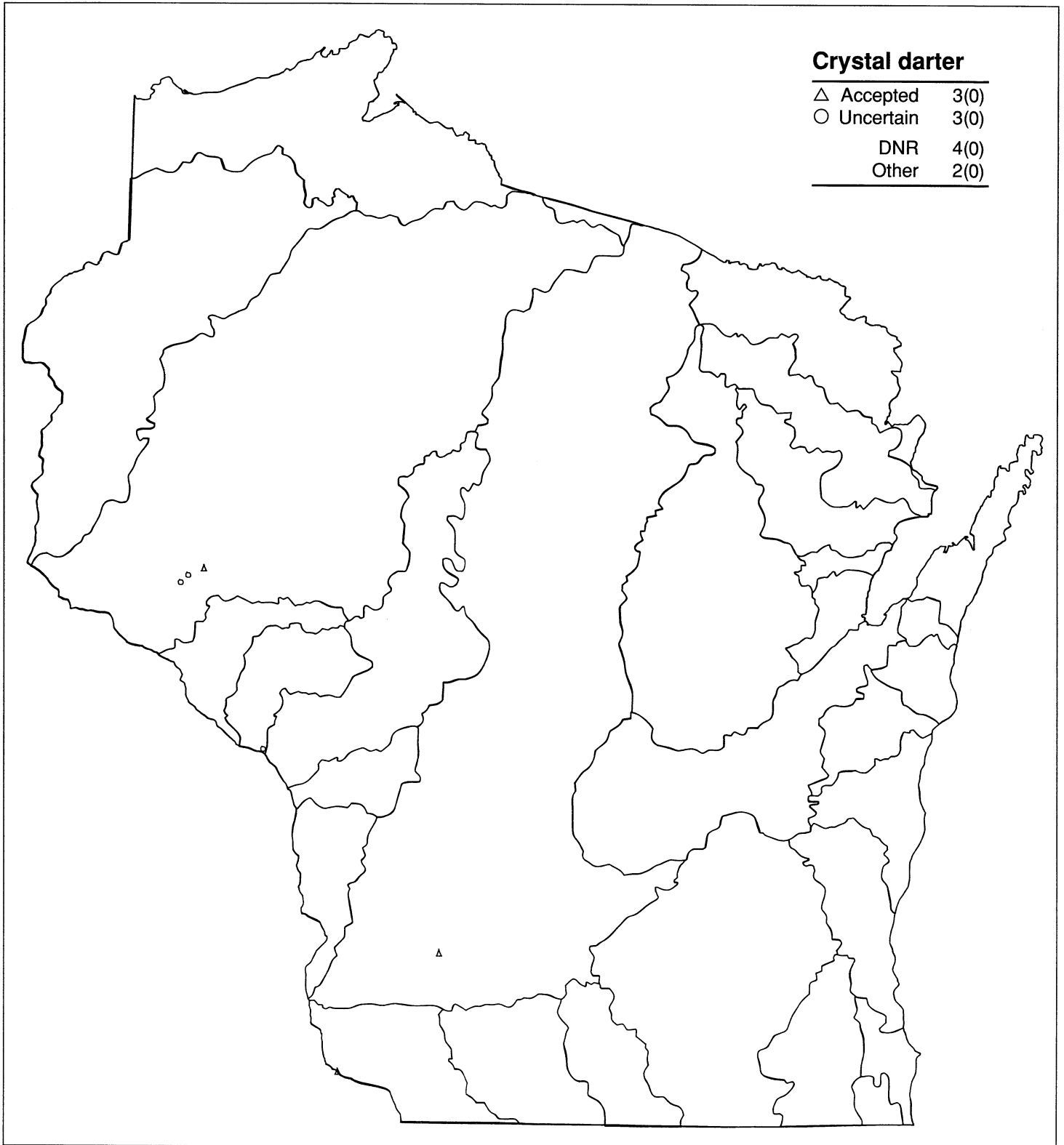


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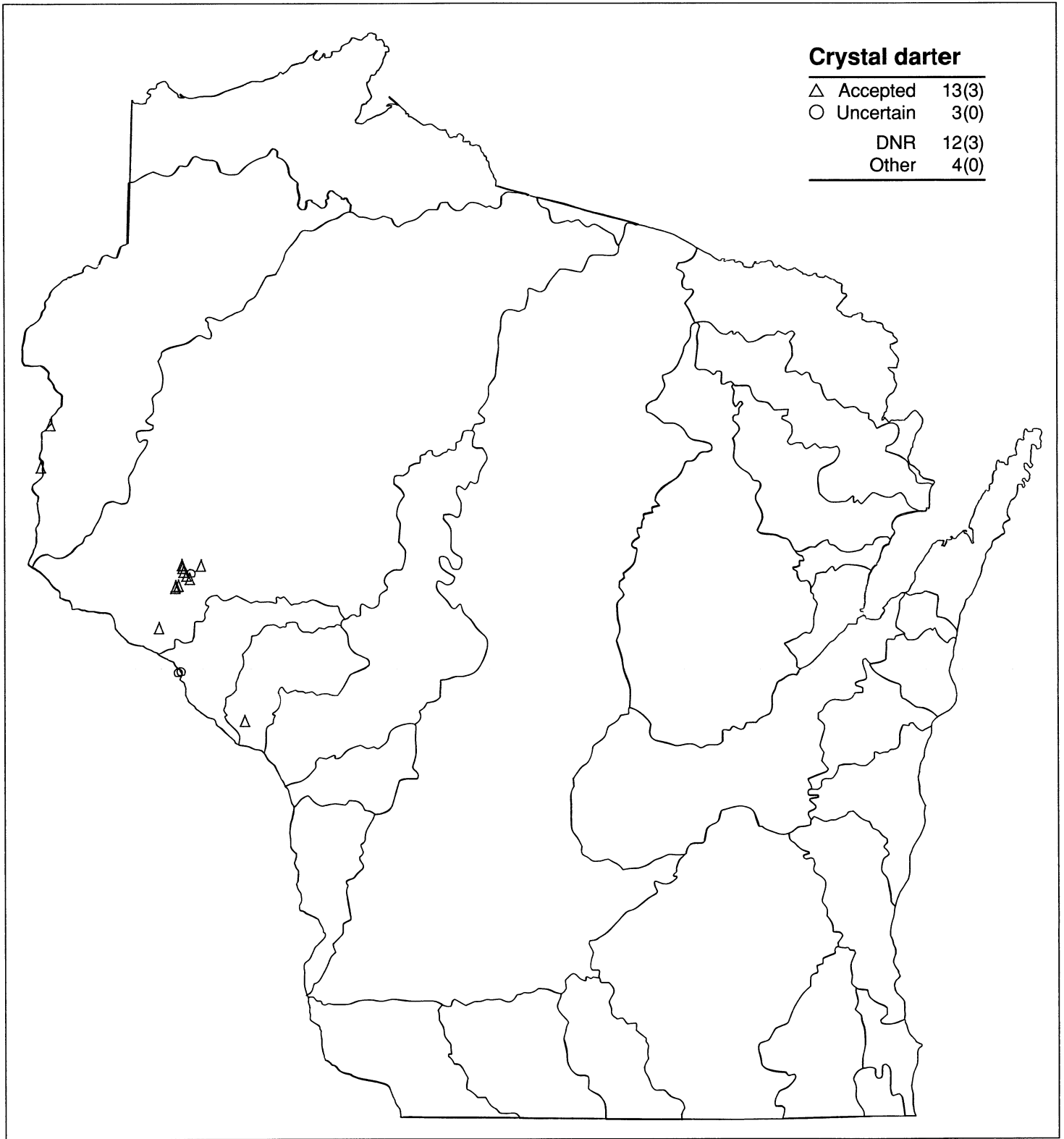




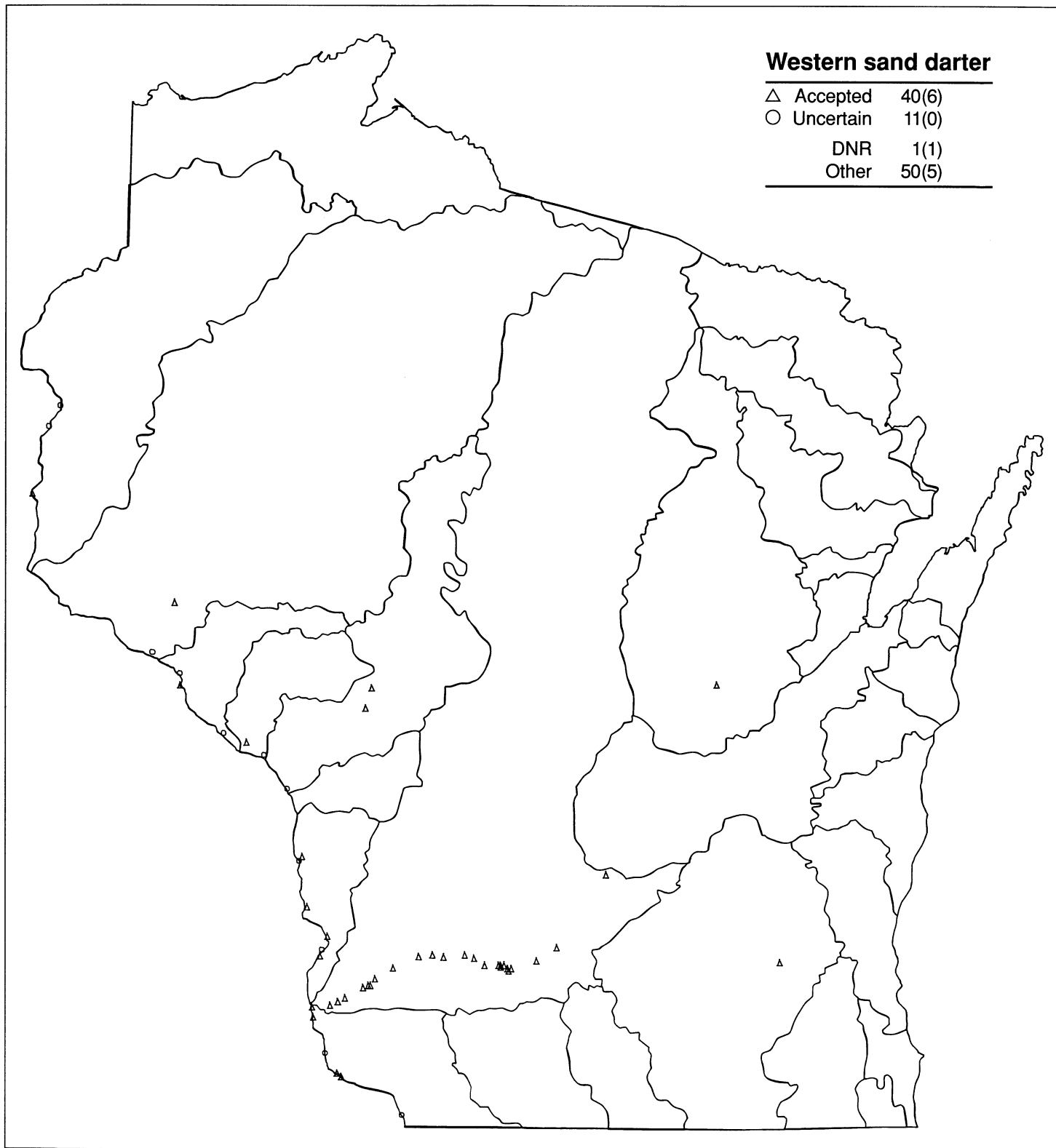
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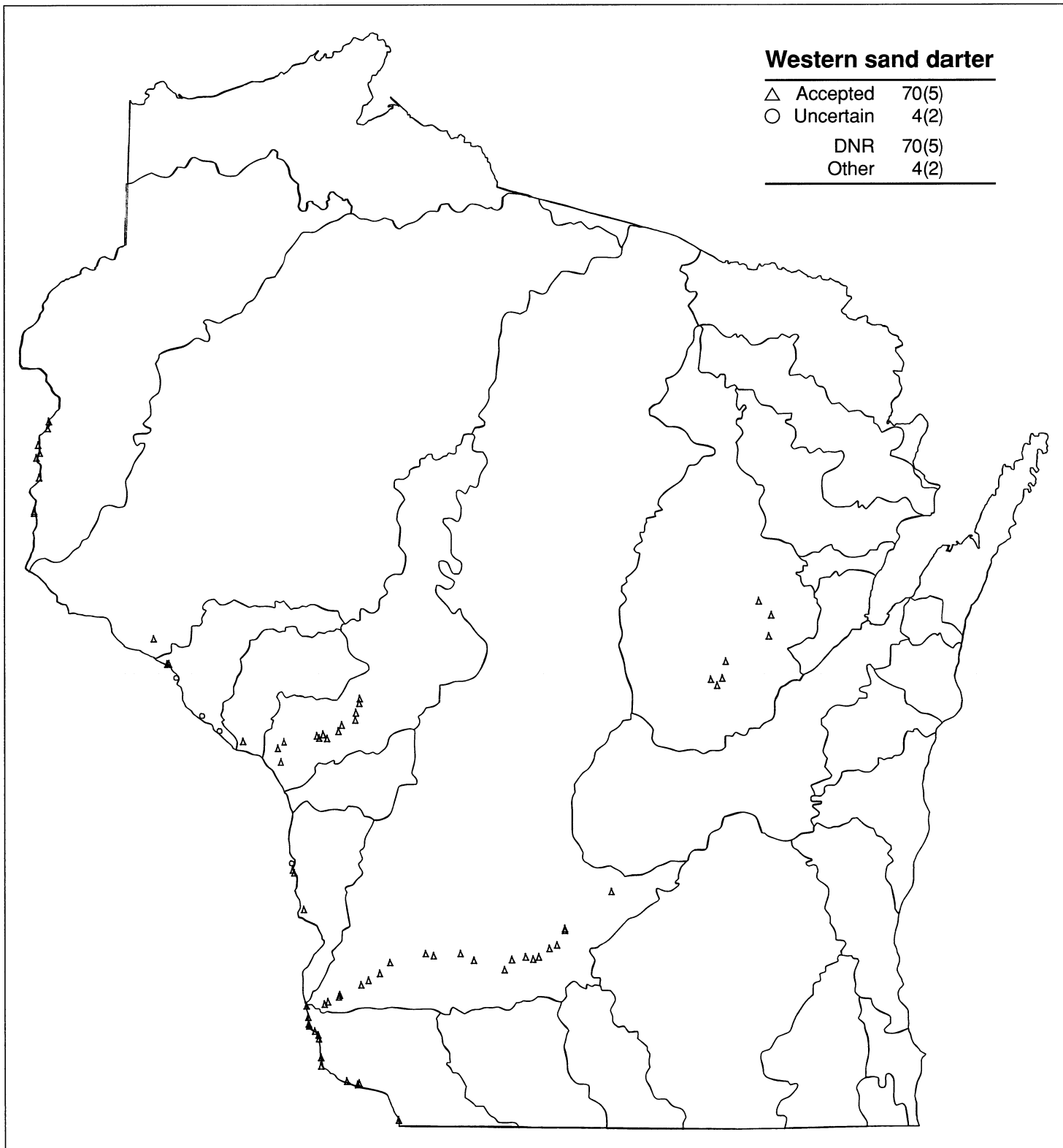


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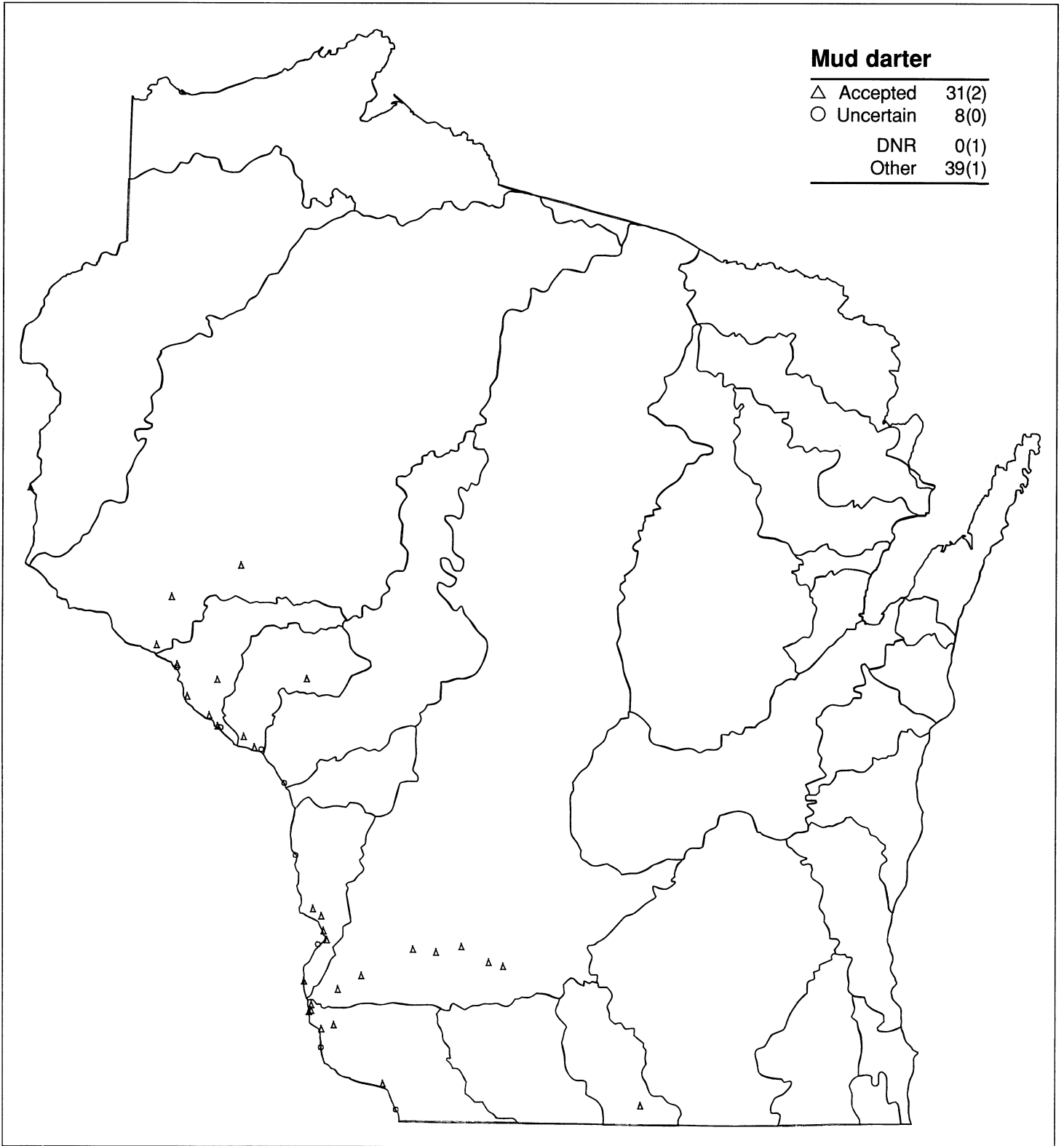


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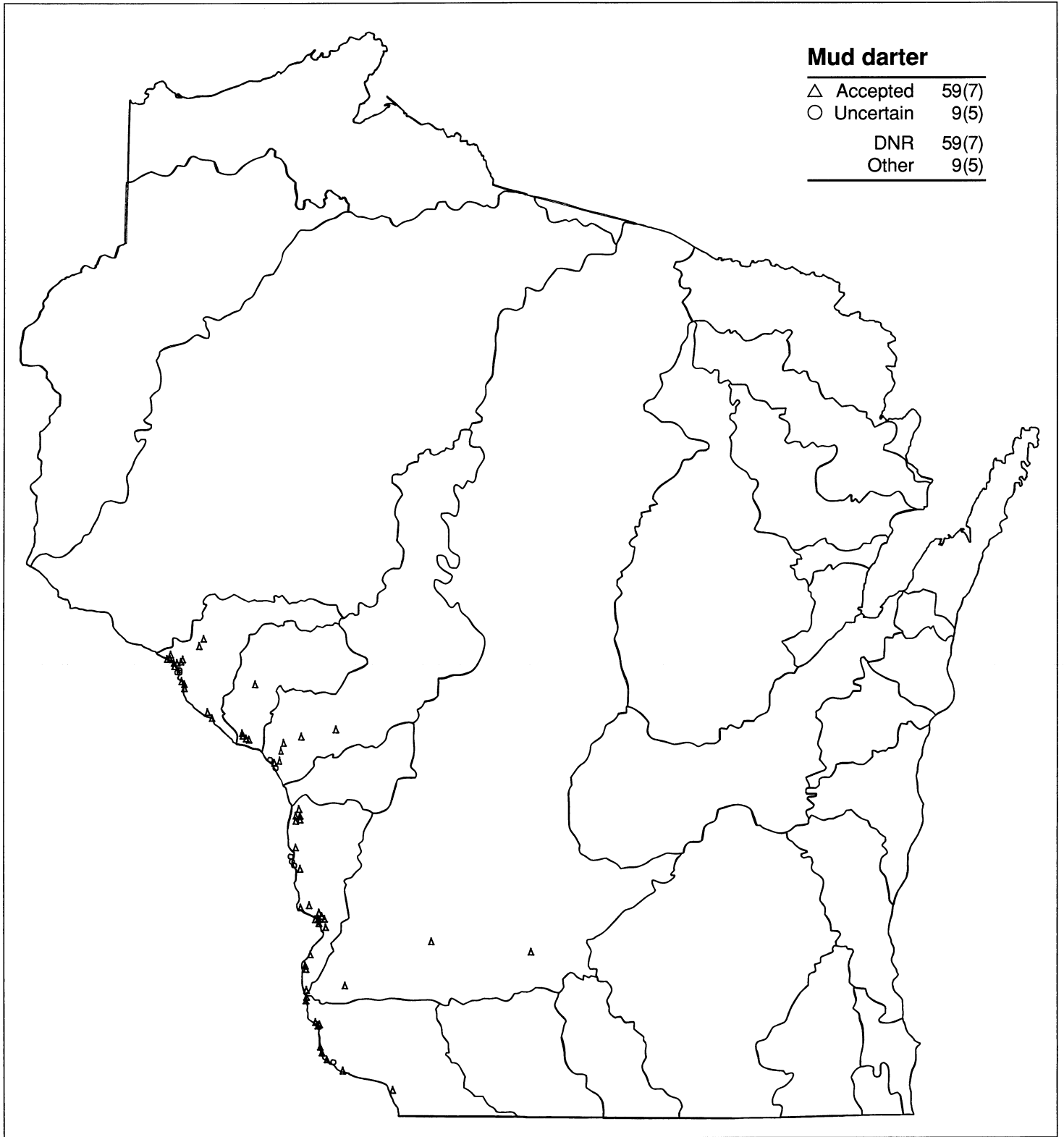




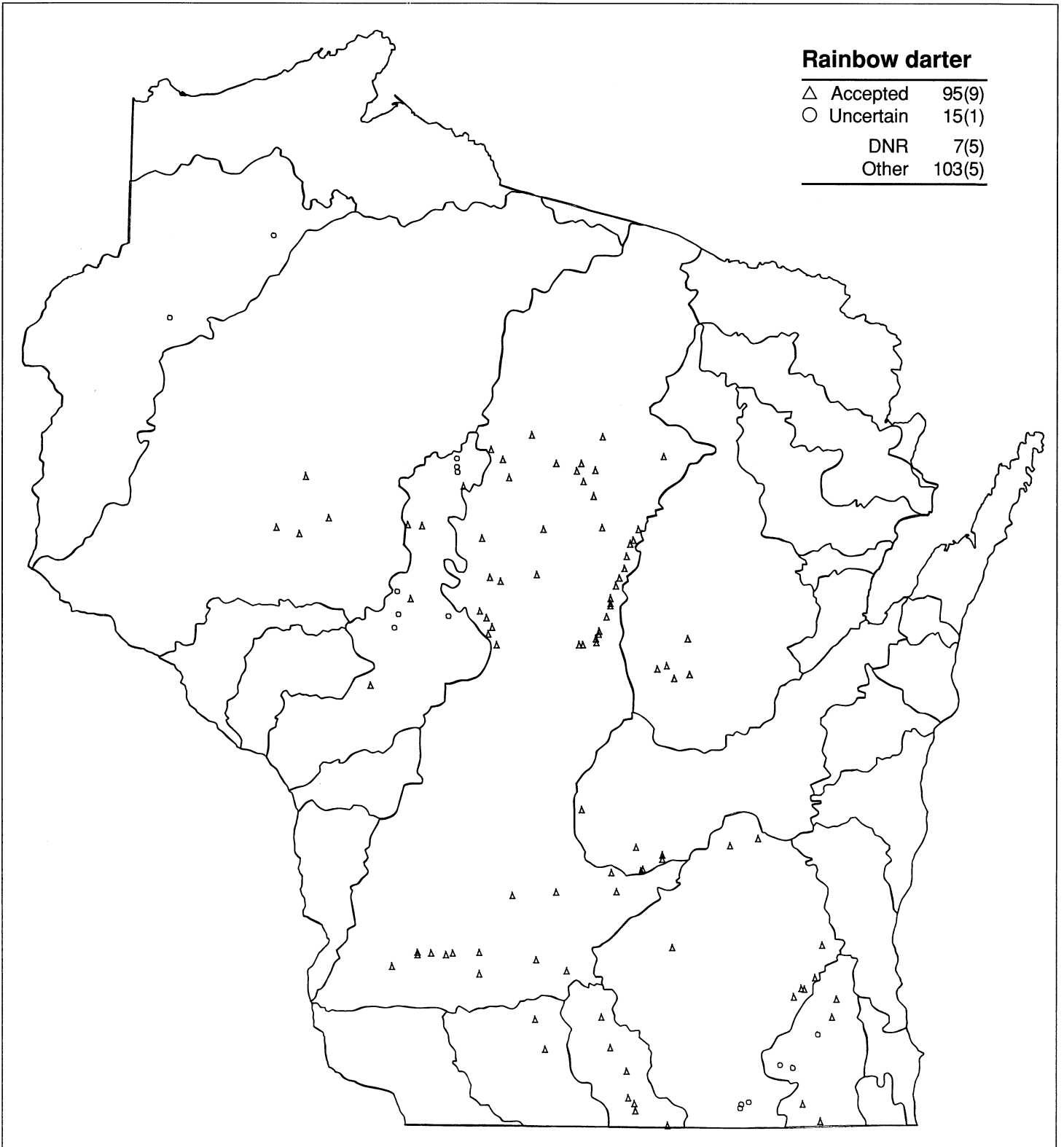
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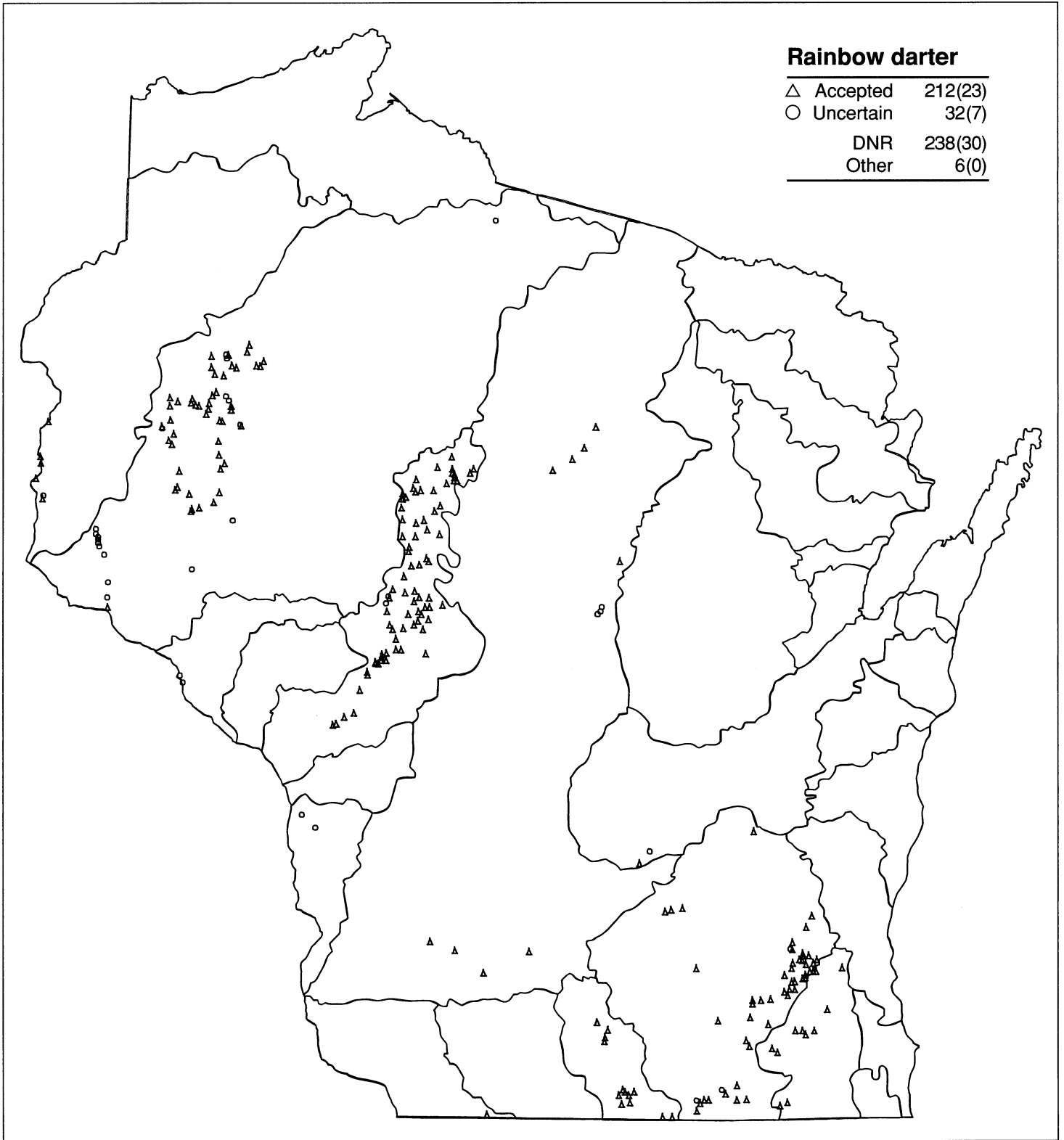


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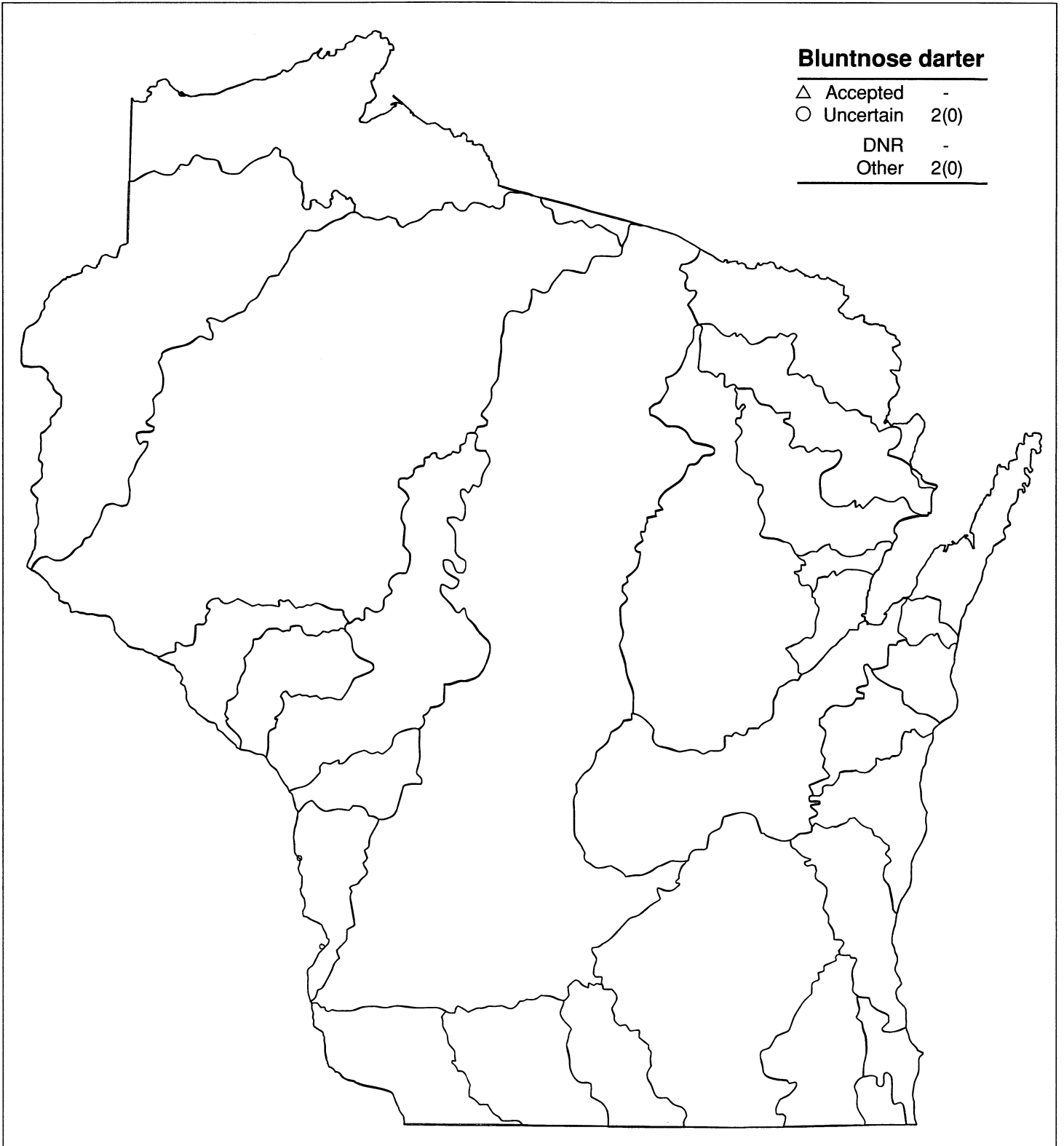


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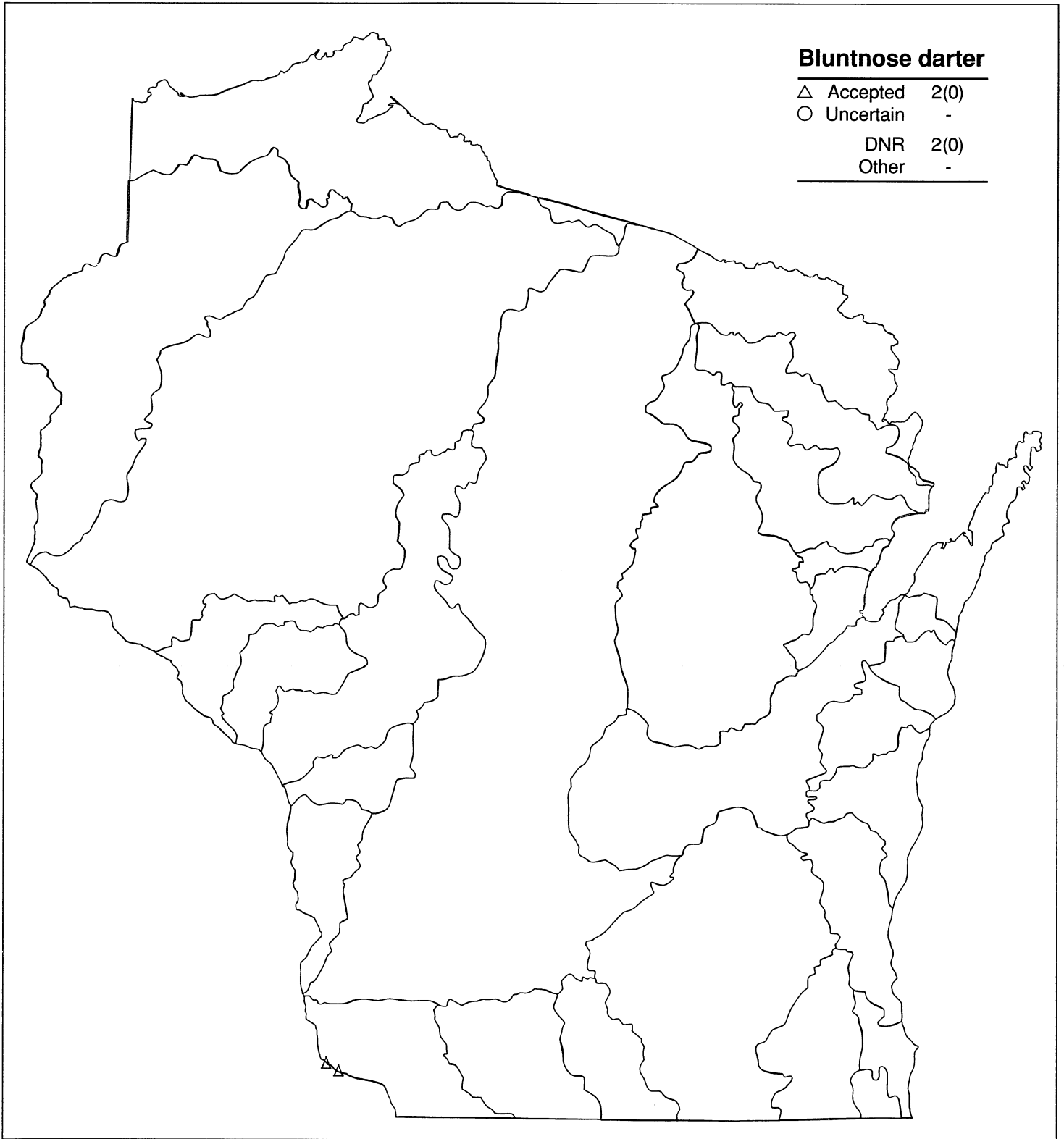




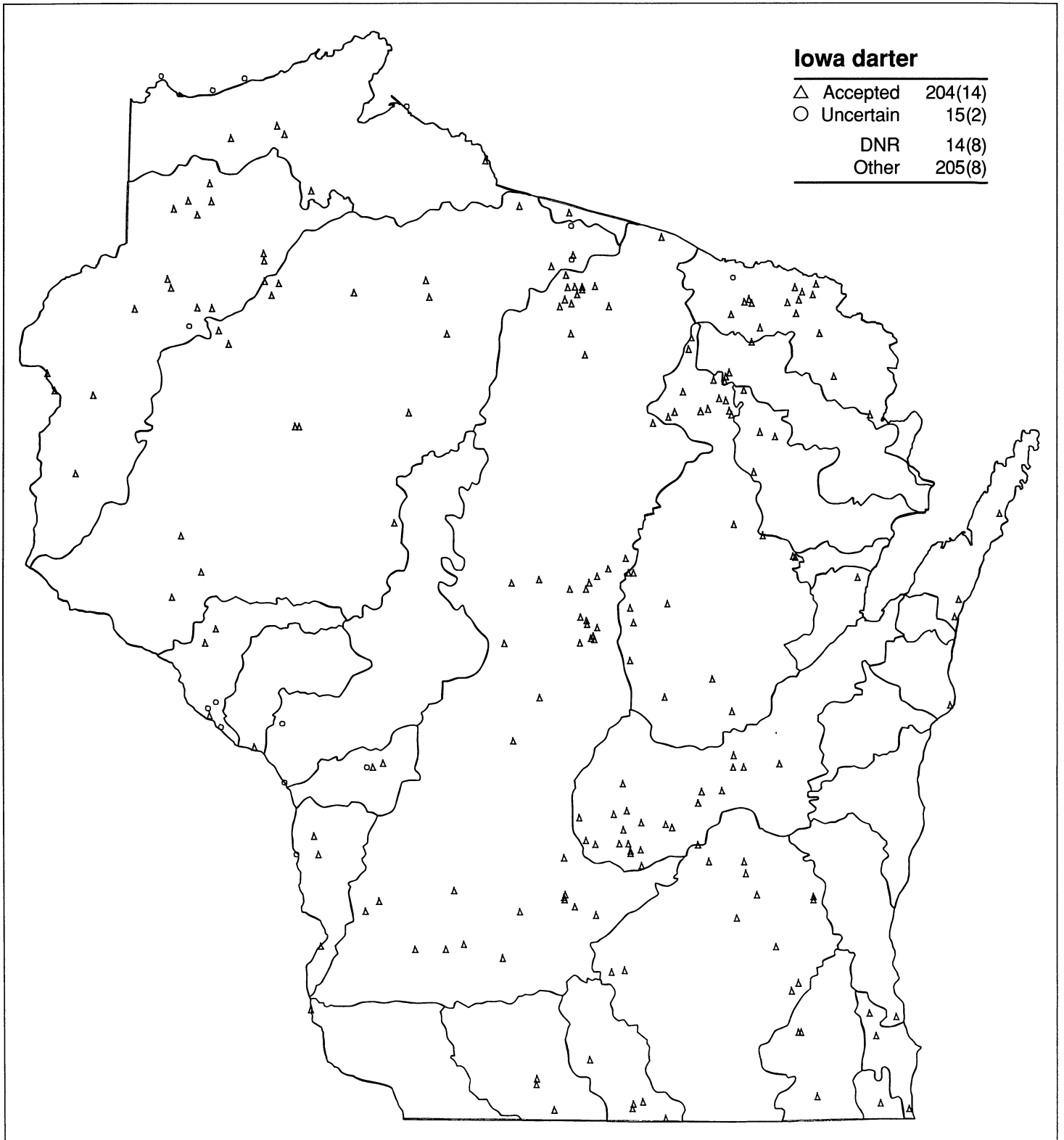
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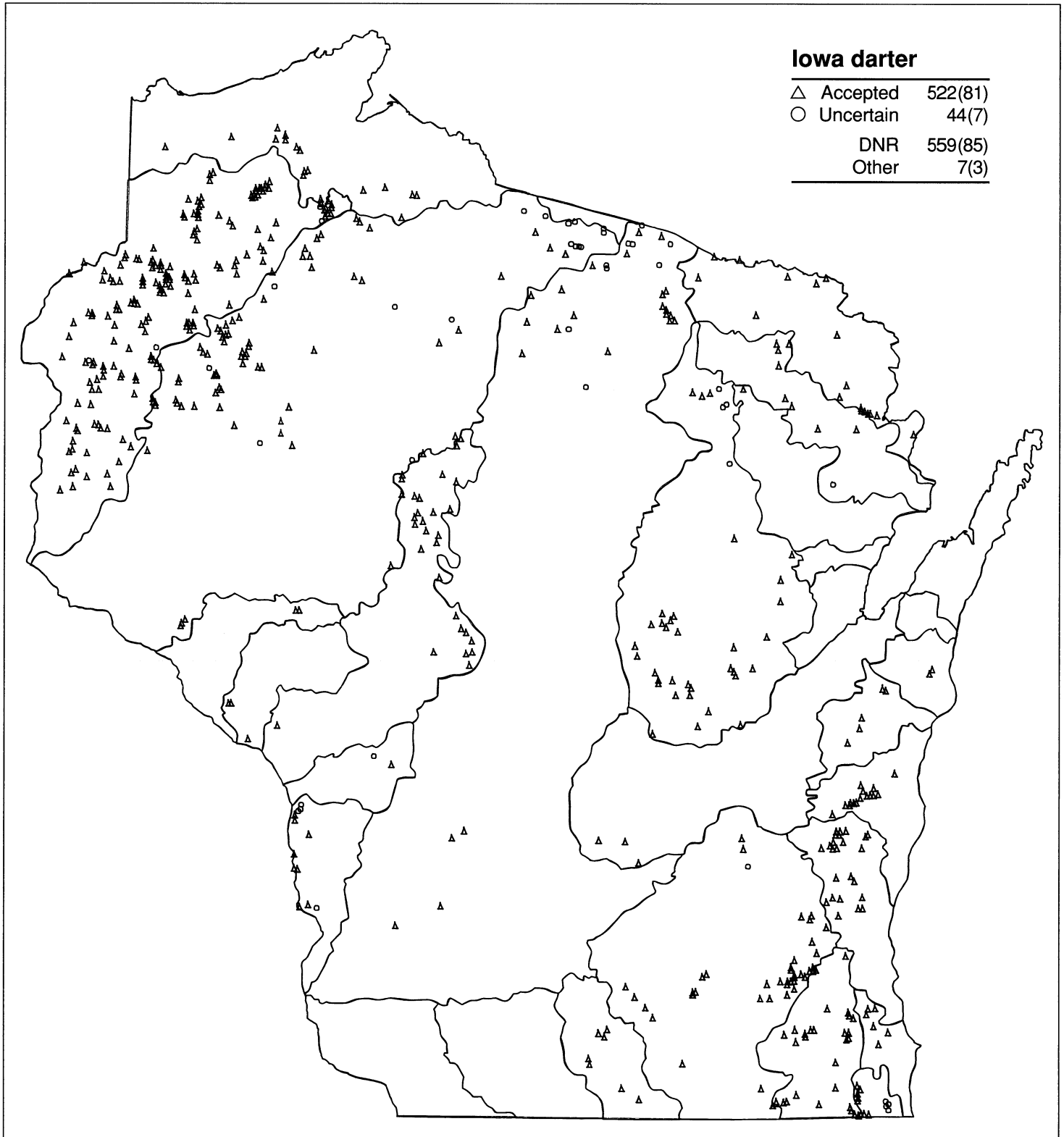


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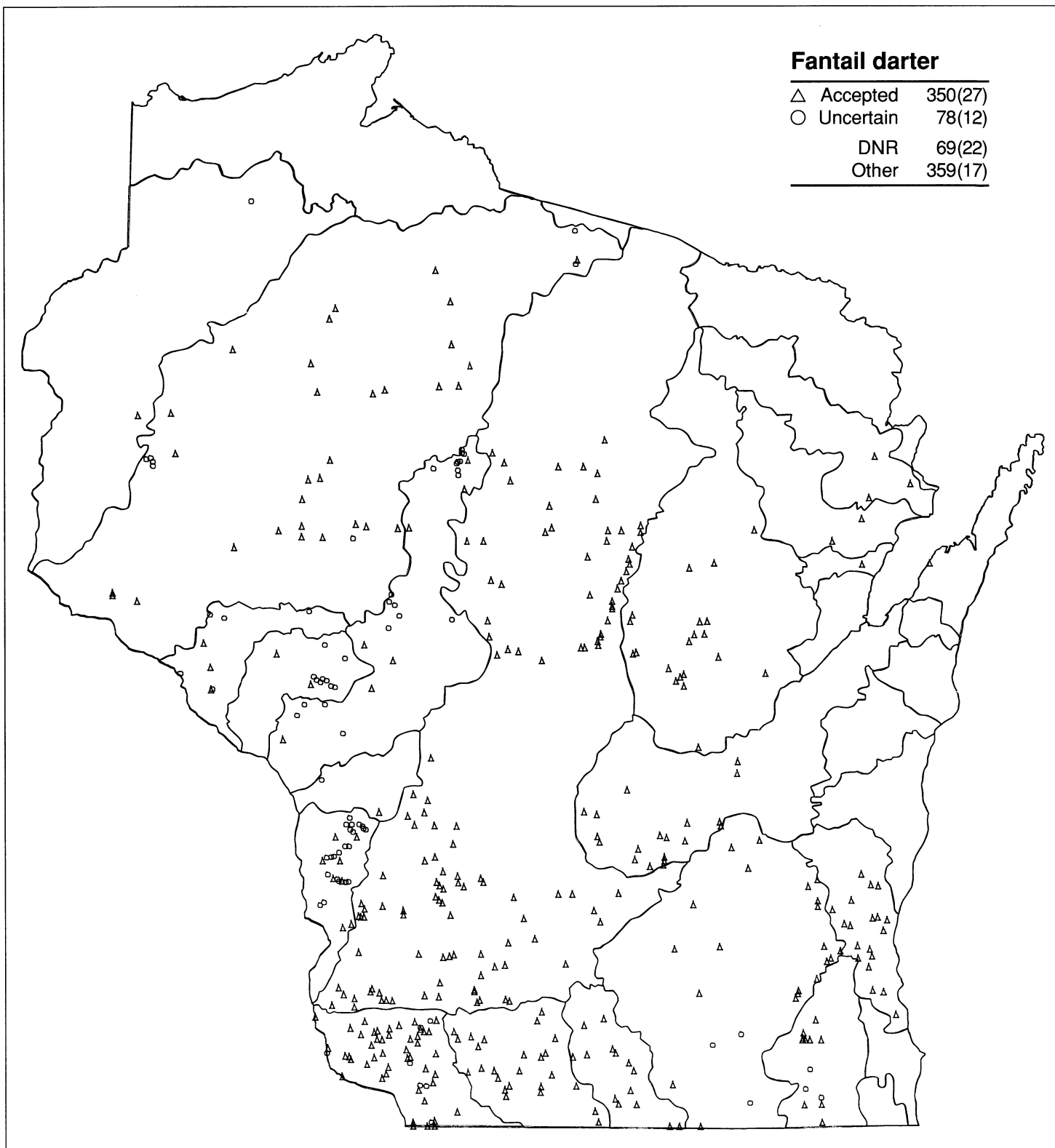


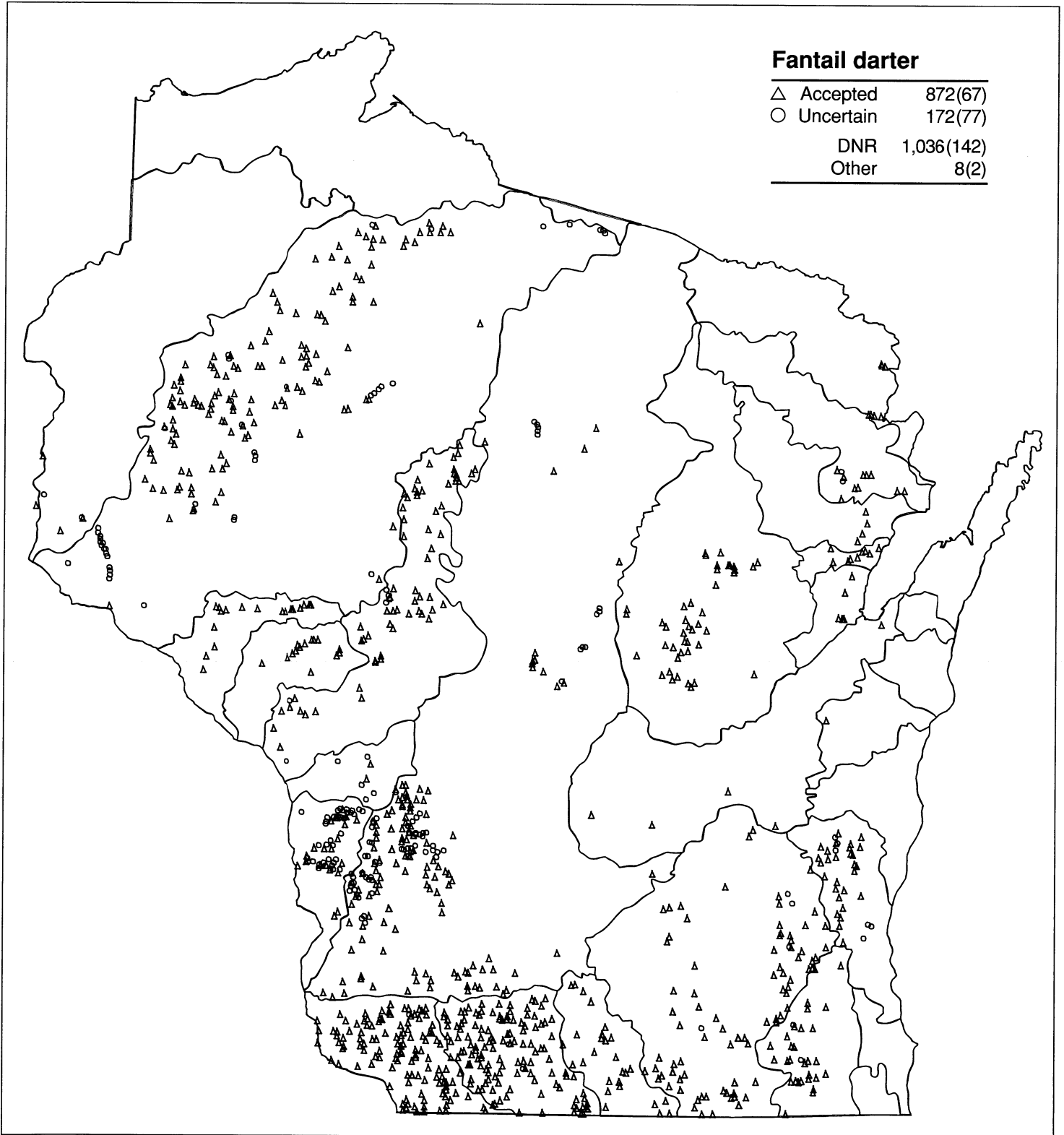
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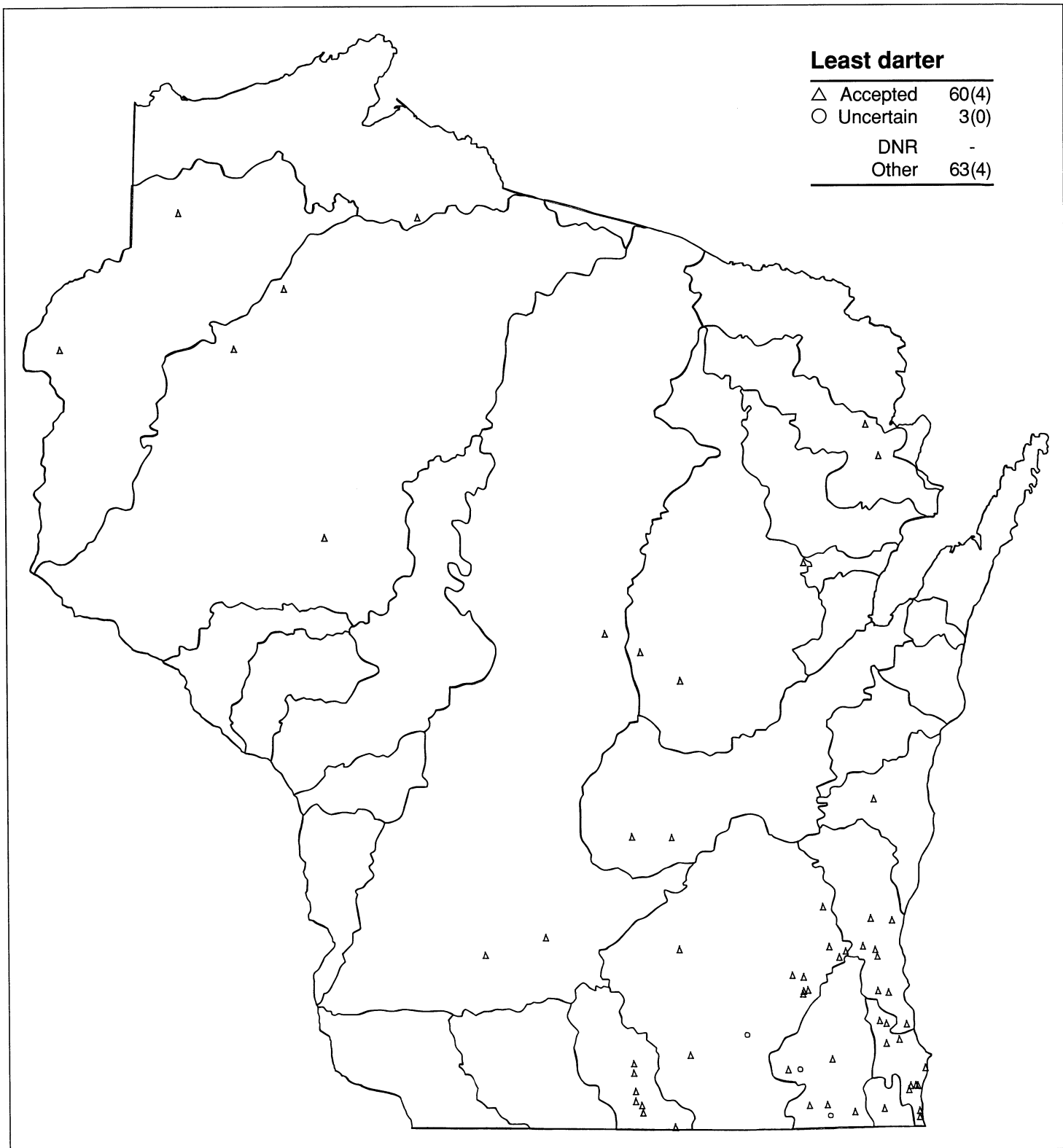


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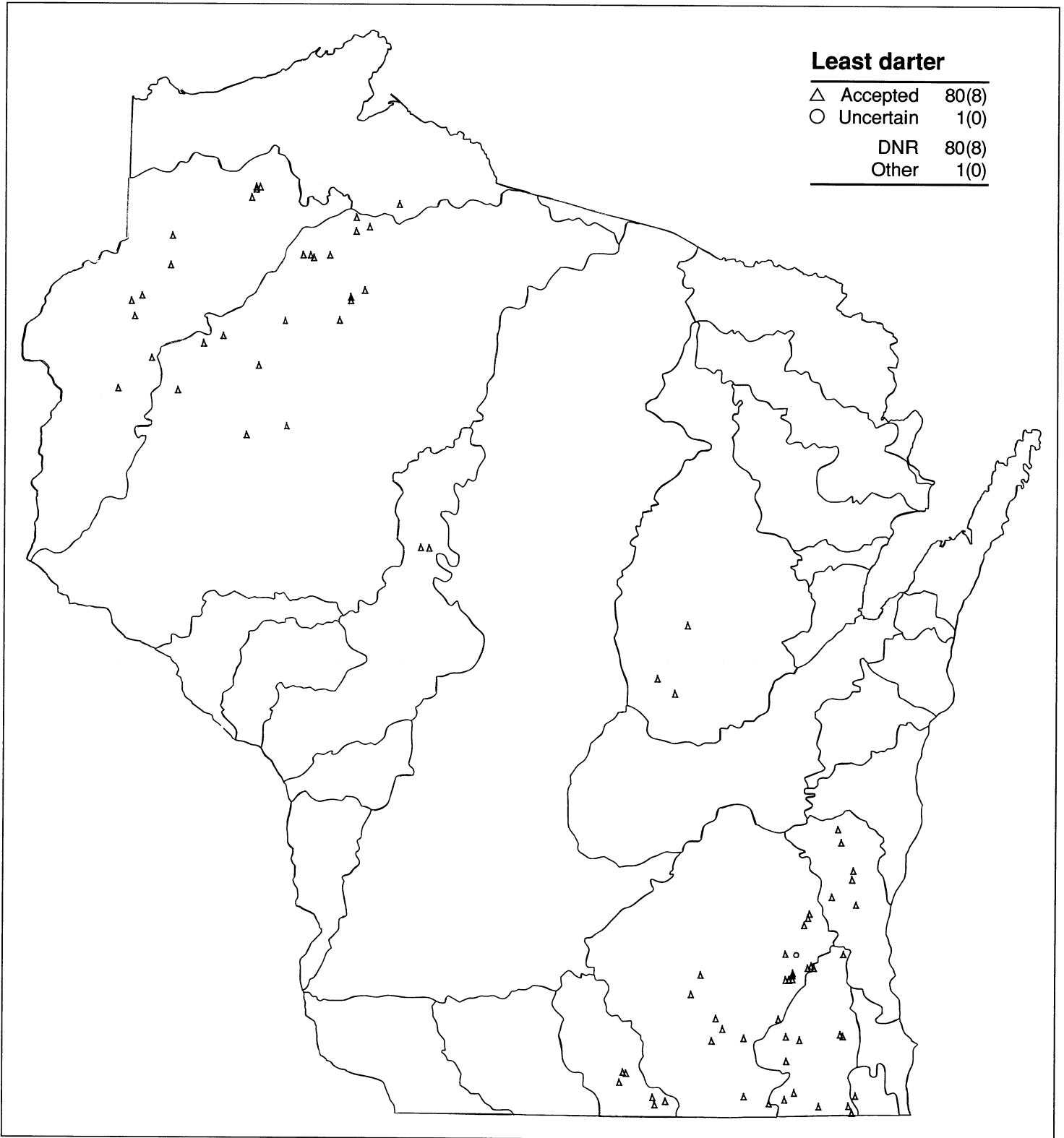




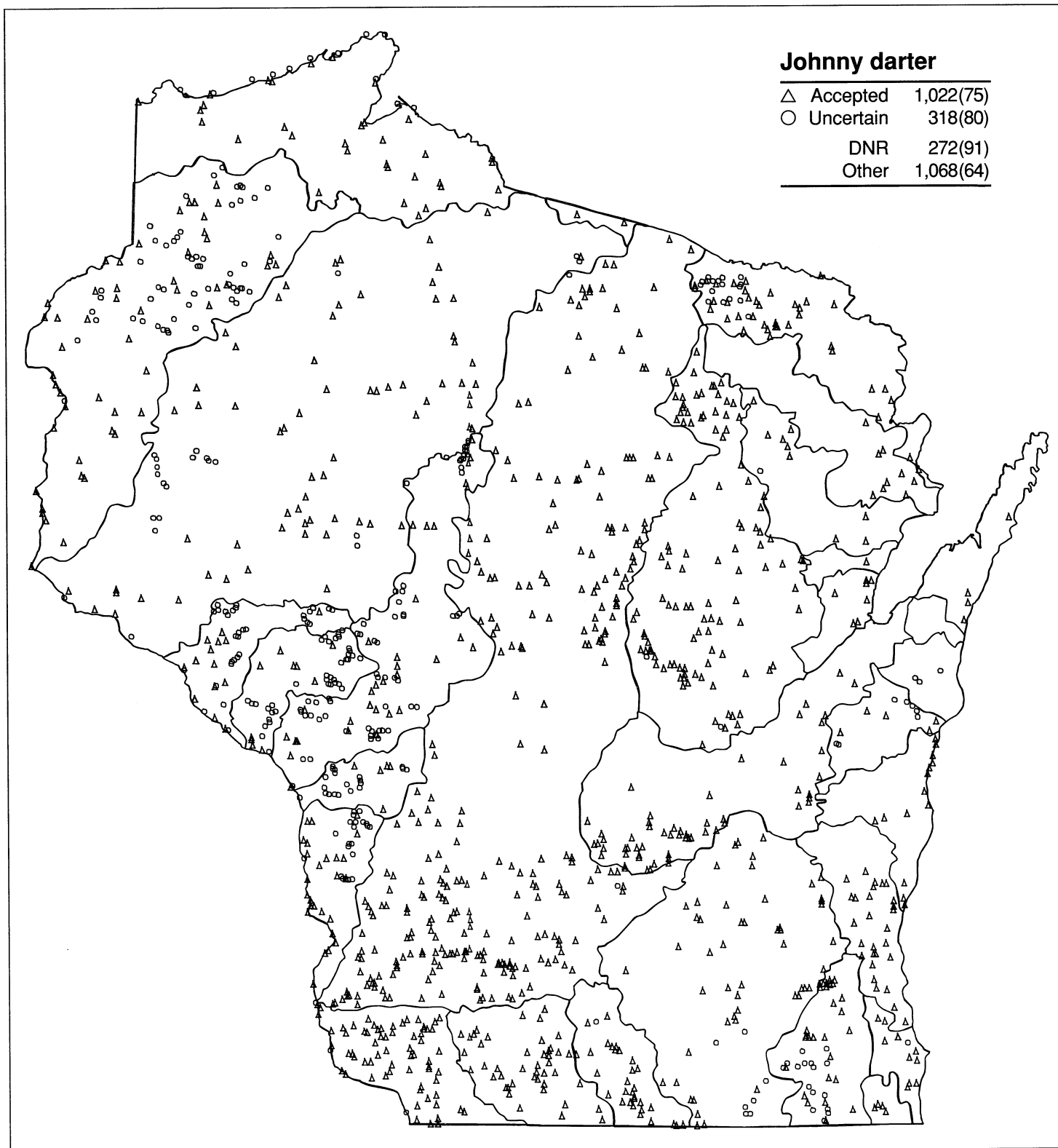
Map 131(E)

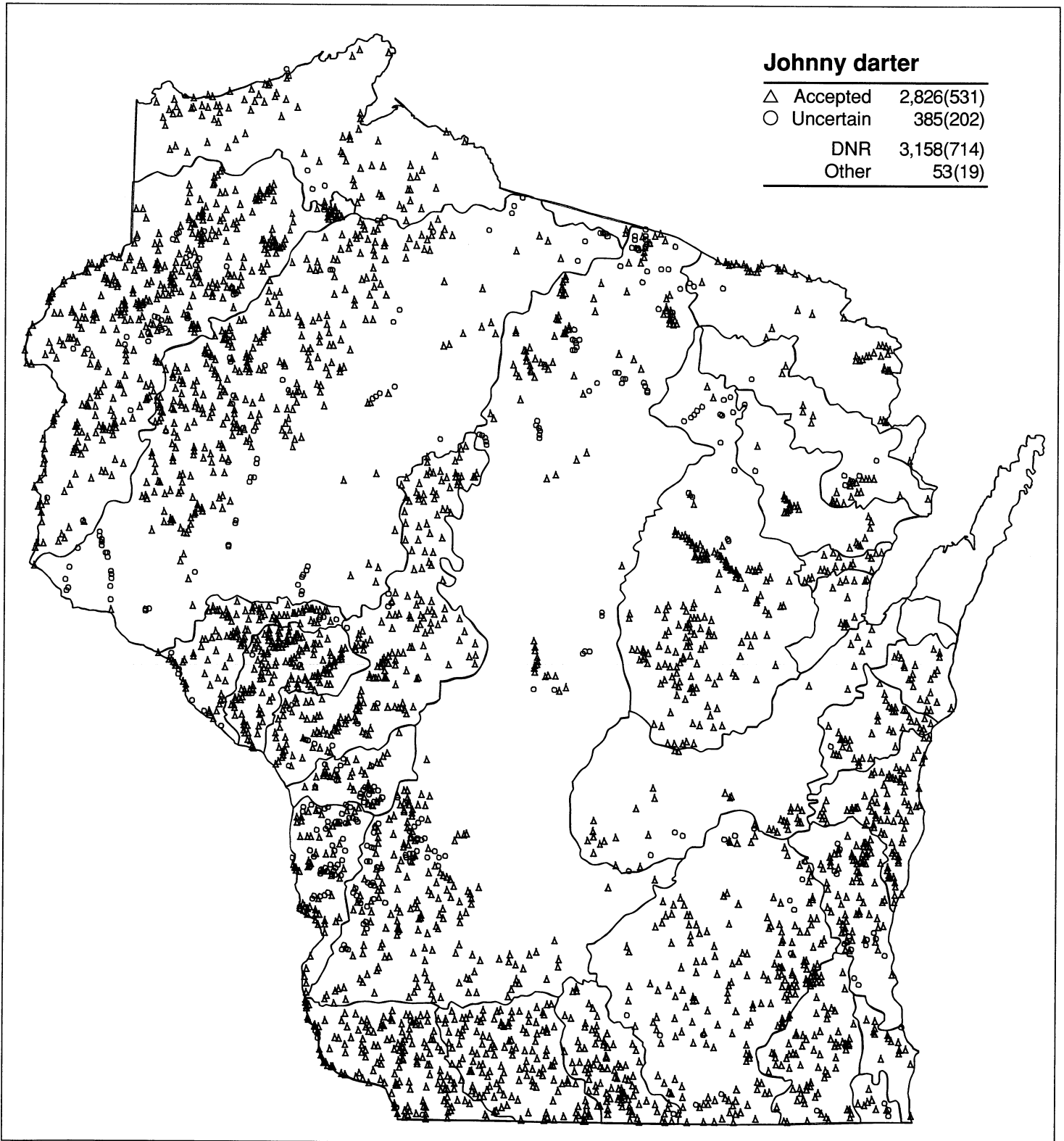


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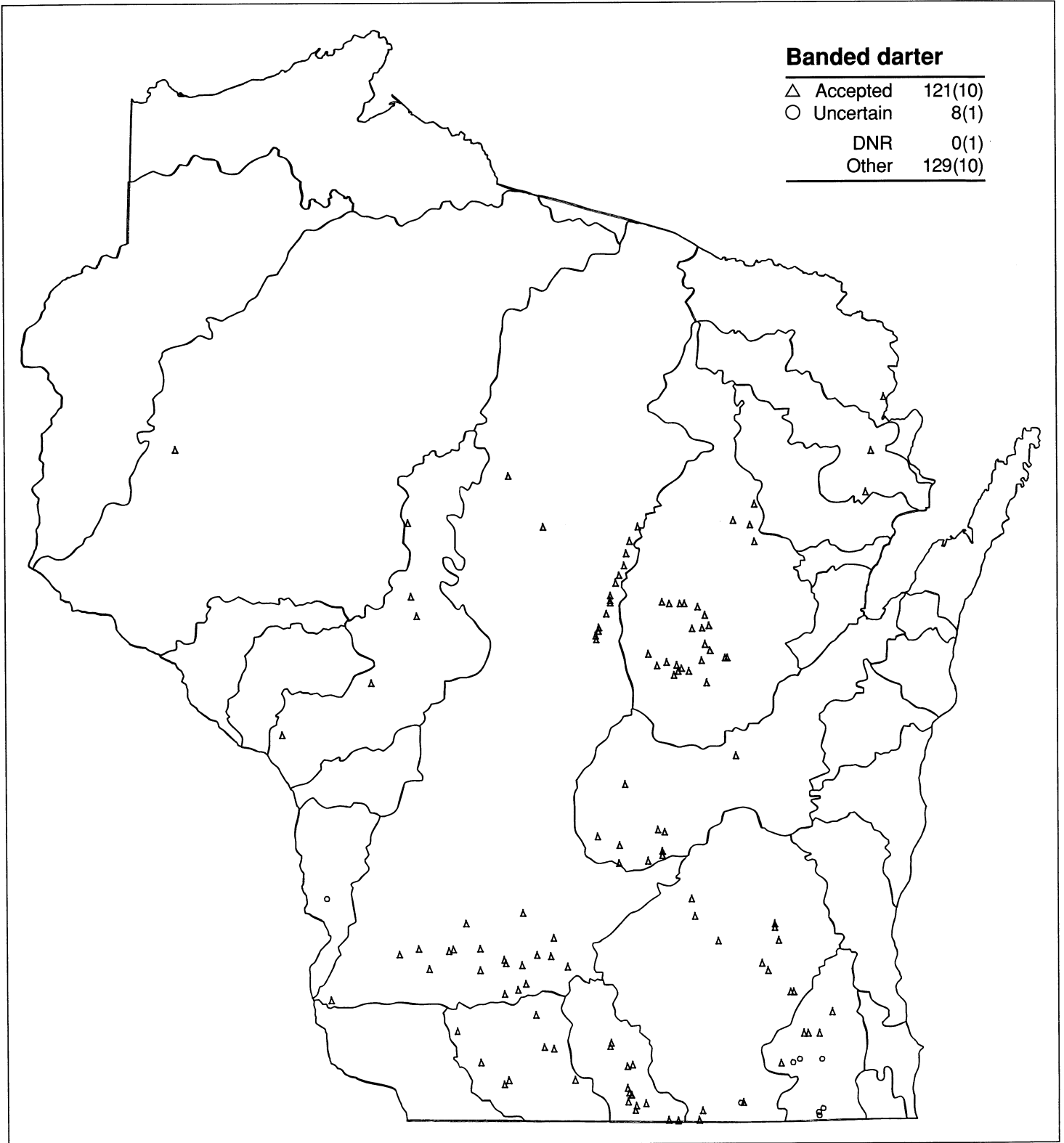


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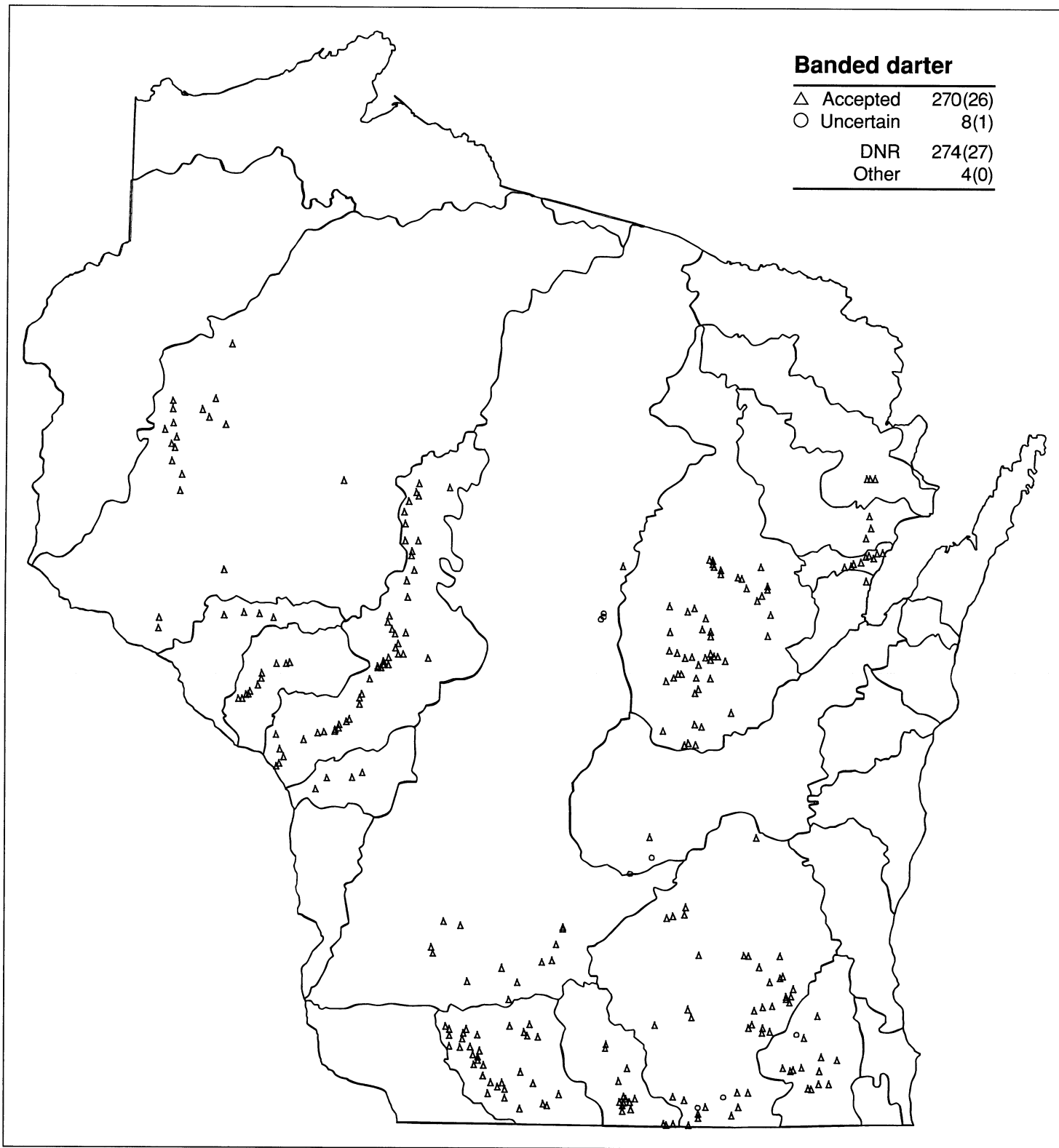




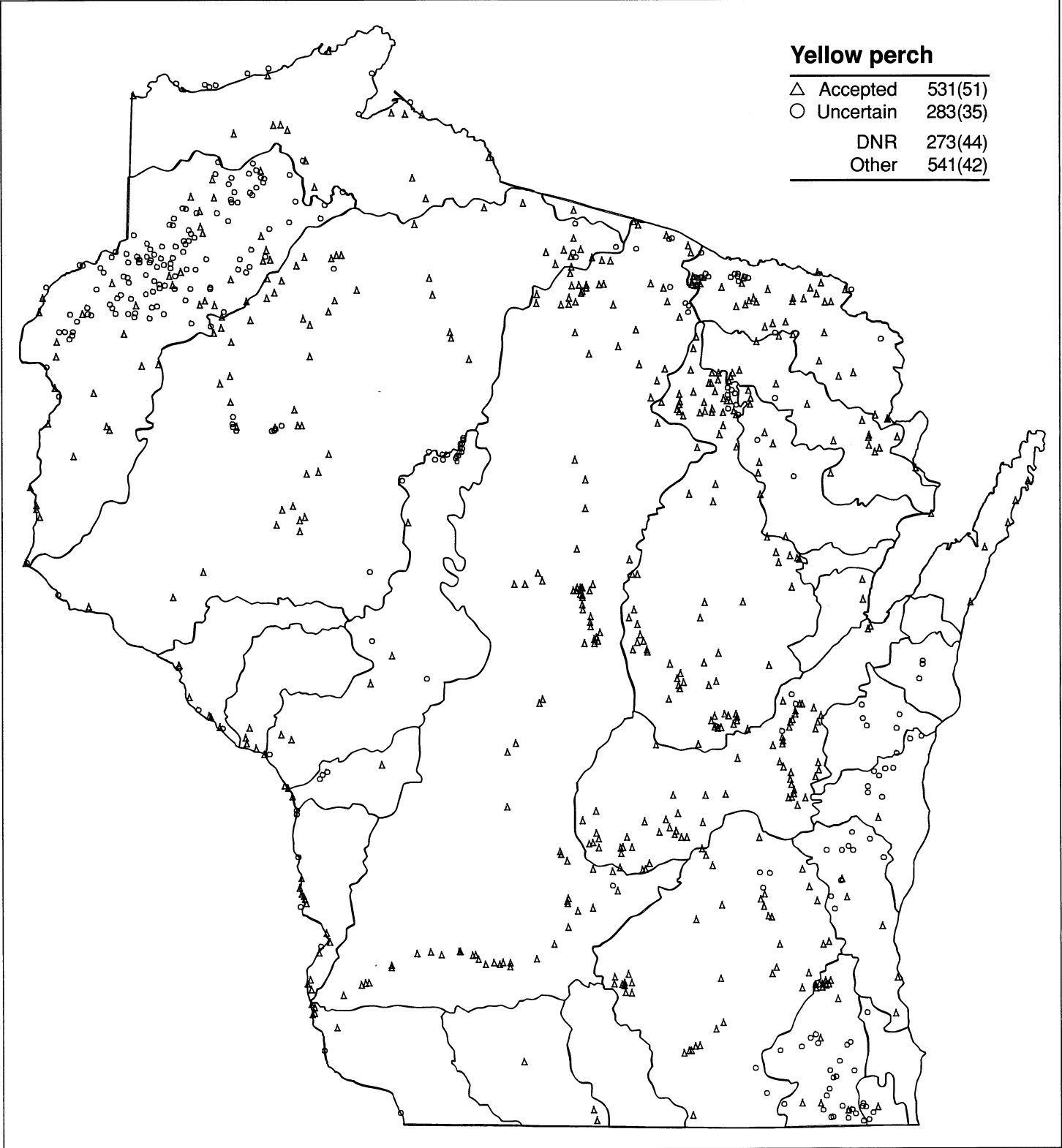
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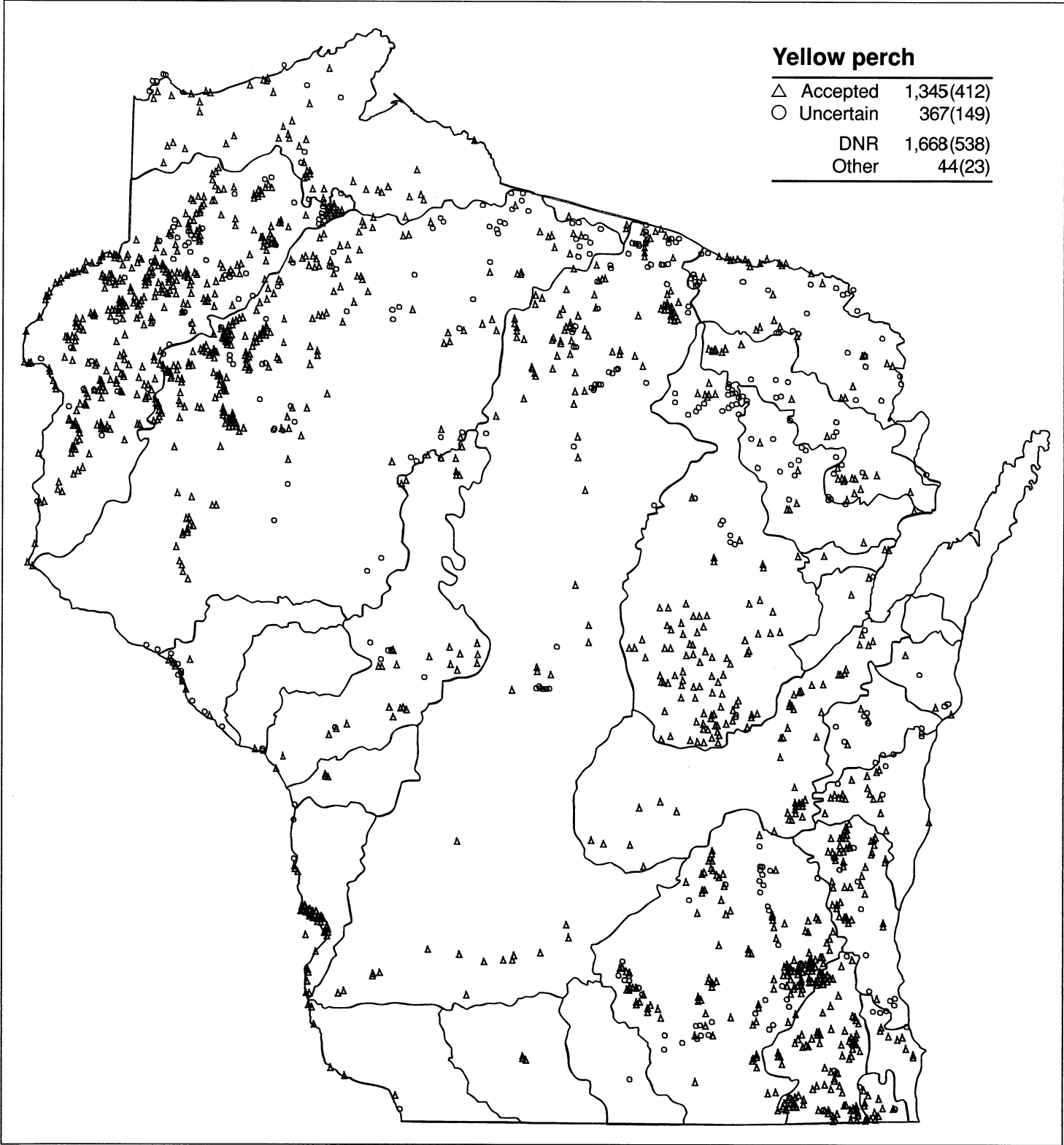


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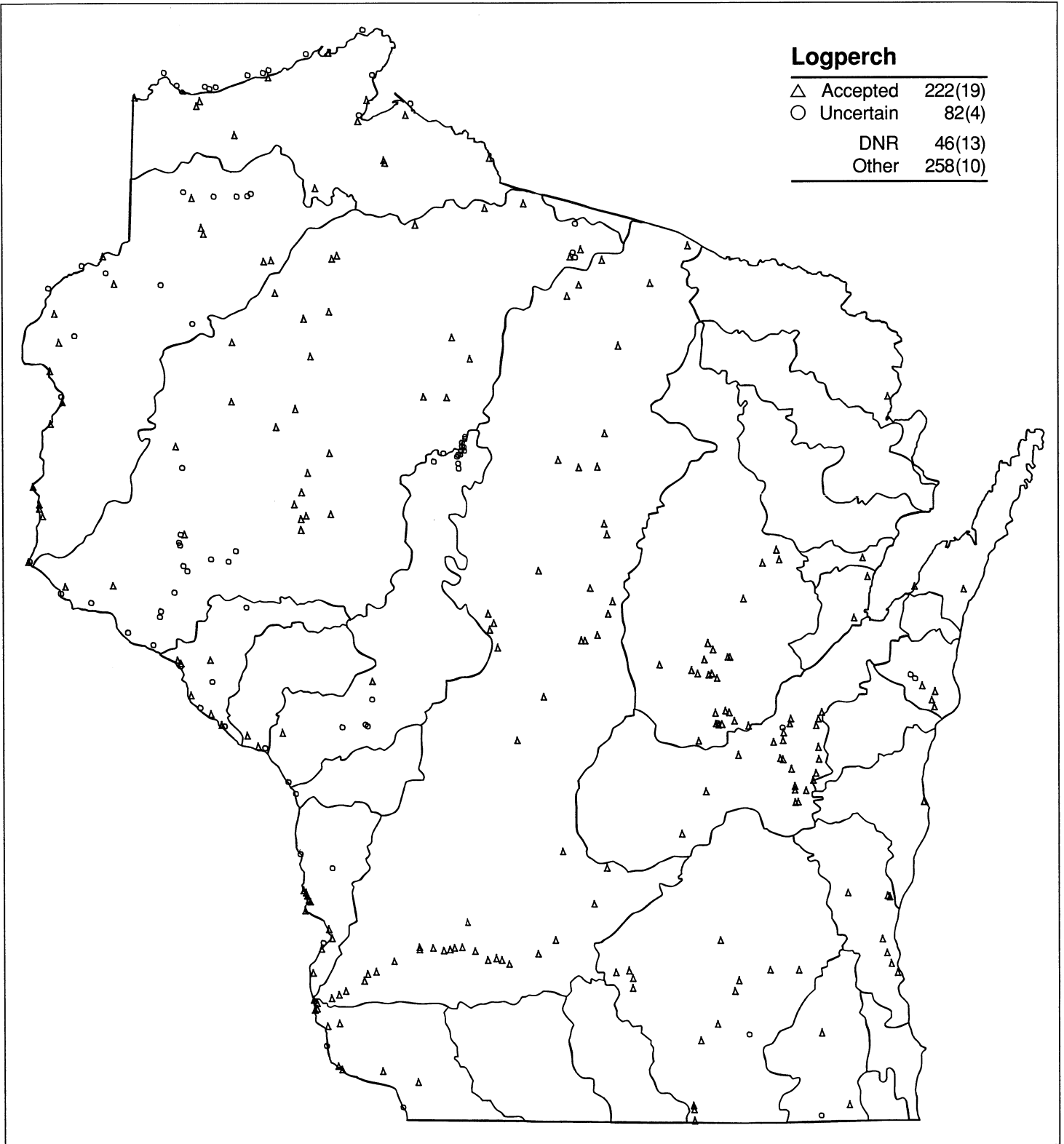


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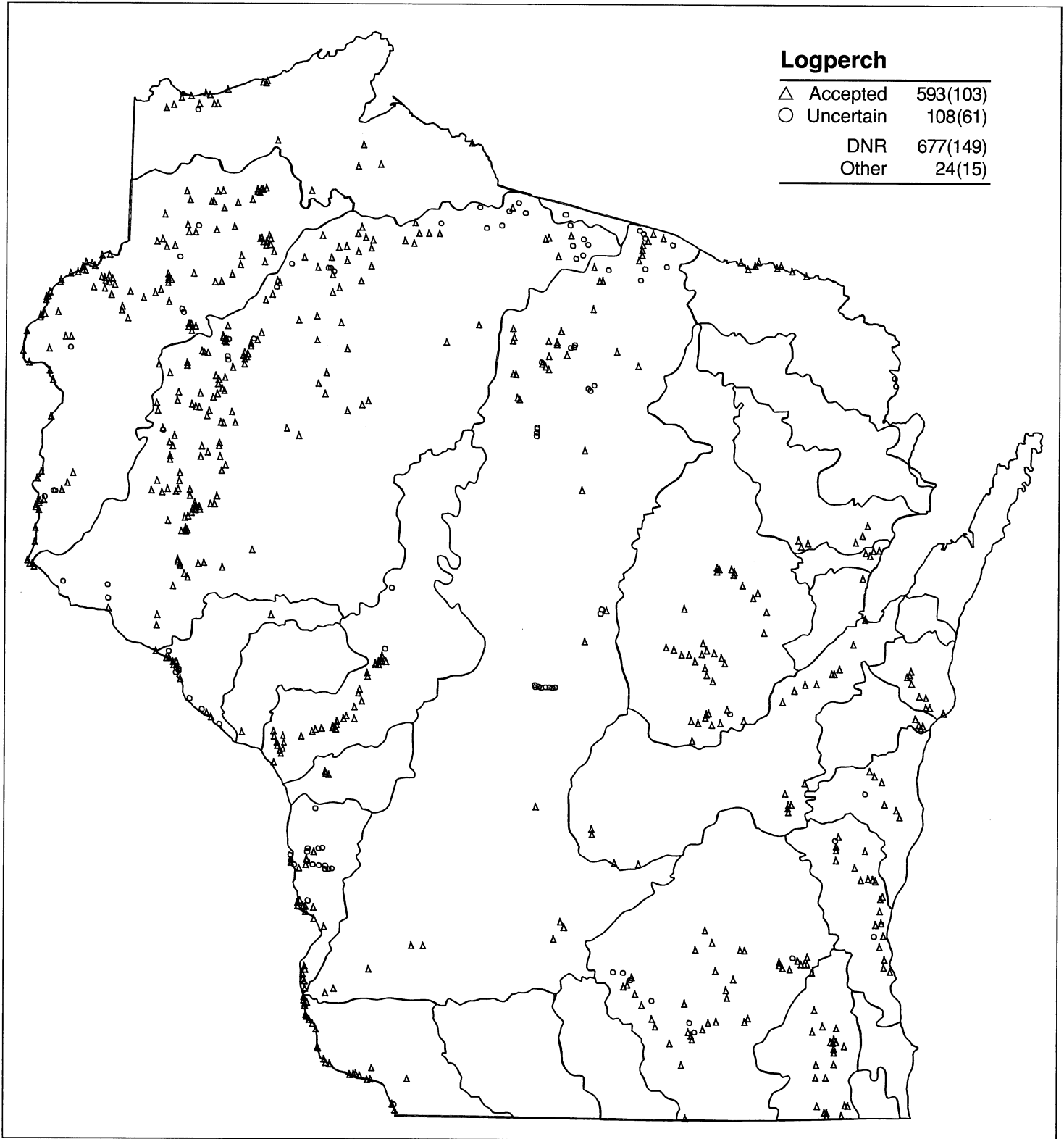




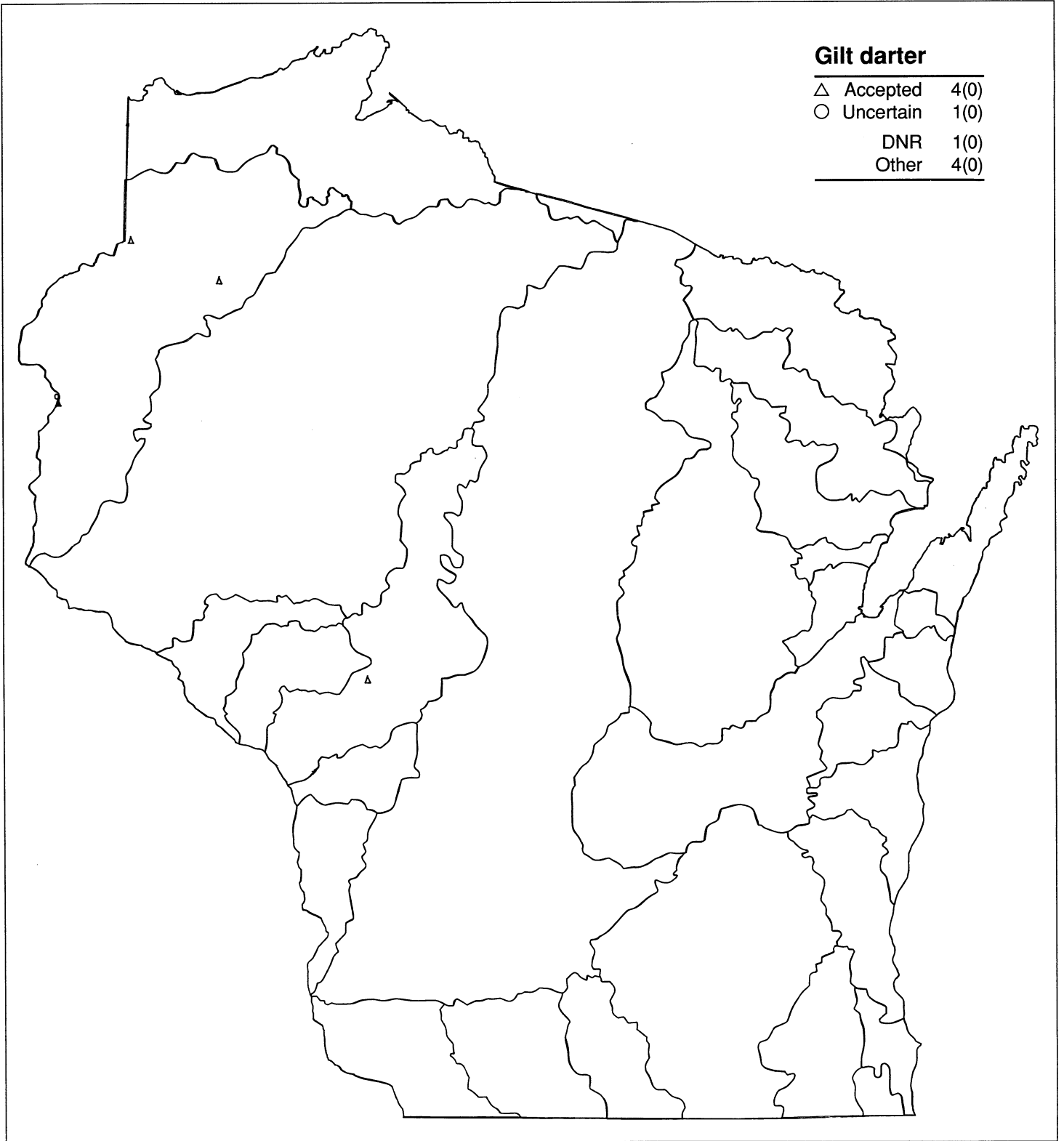
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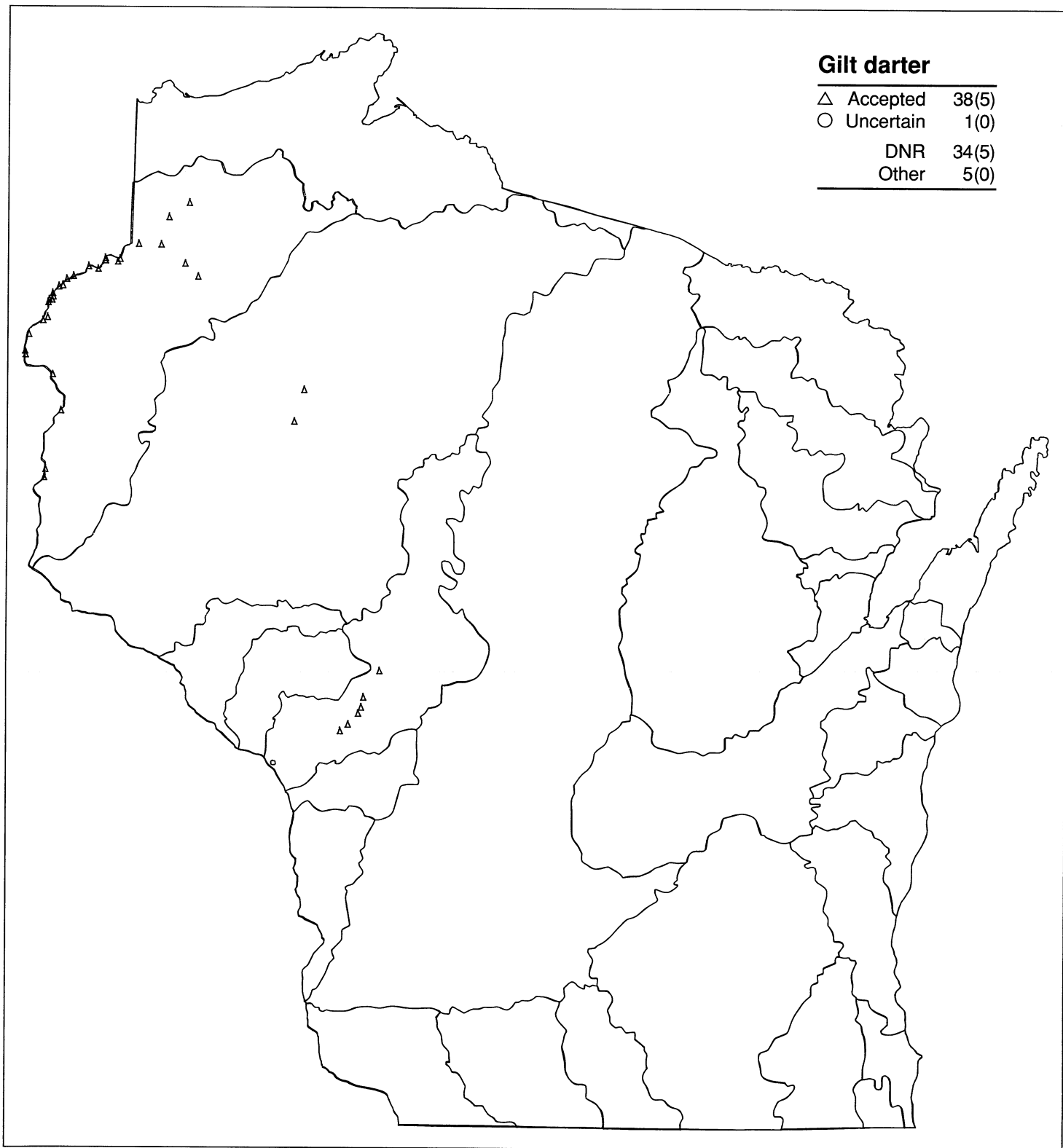
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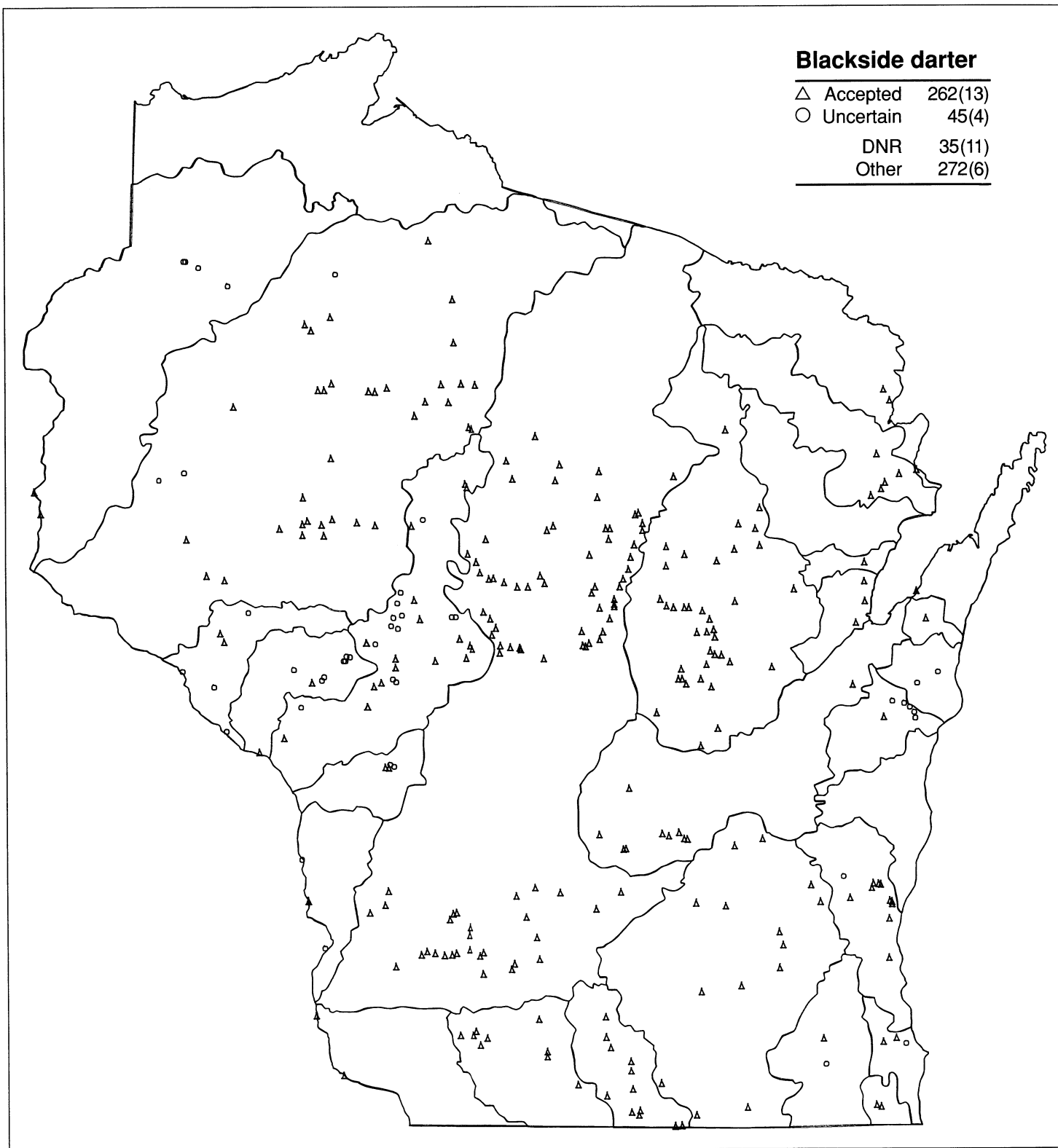
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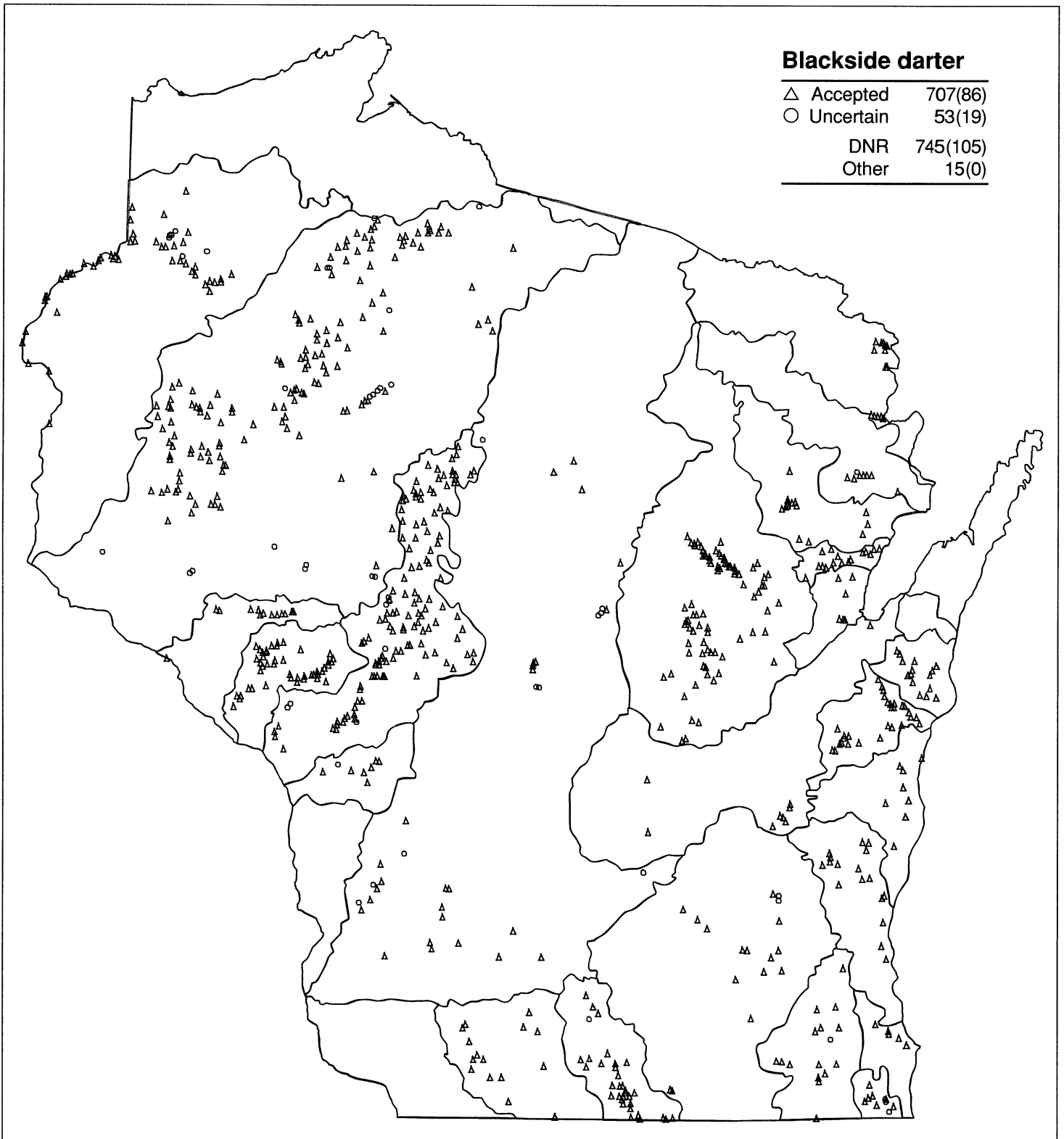


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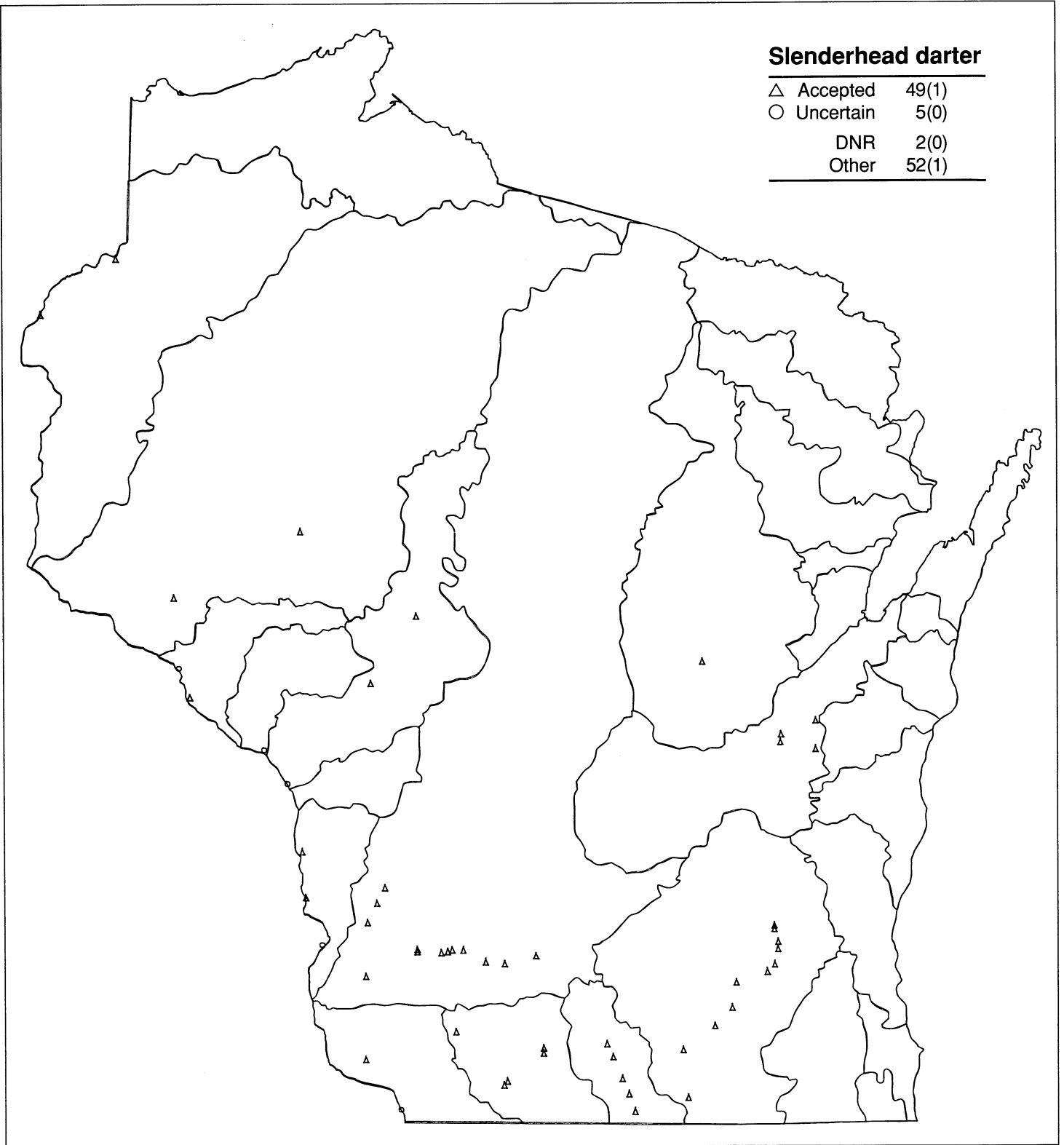


Map 137(E)

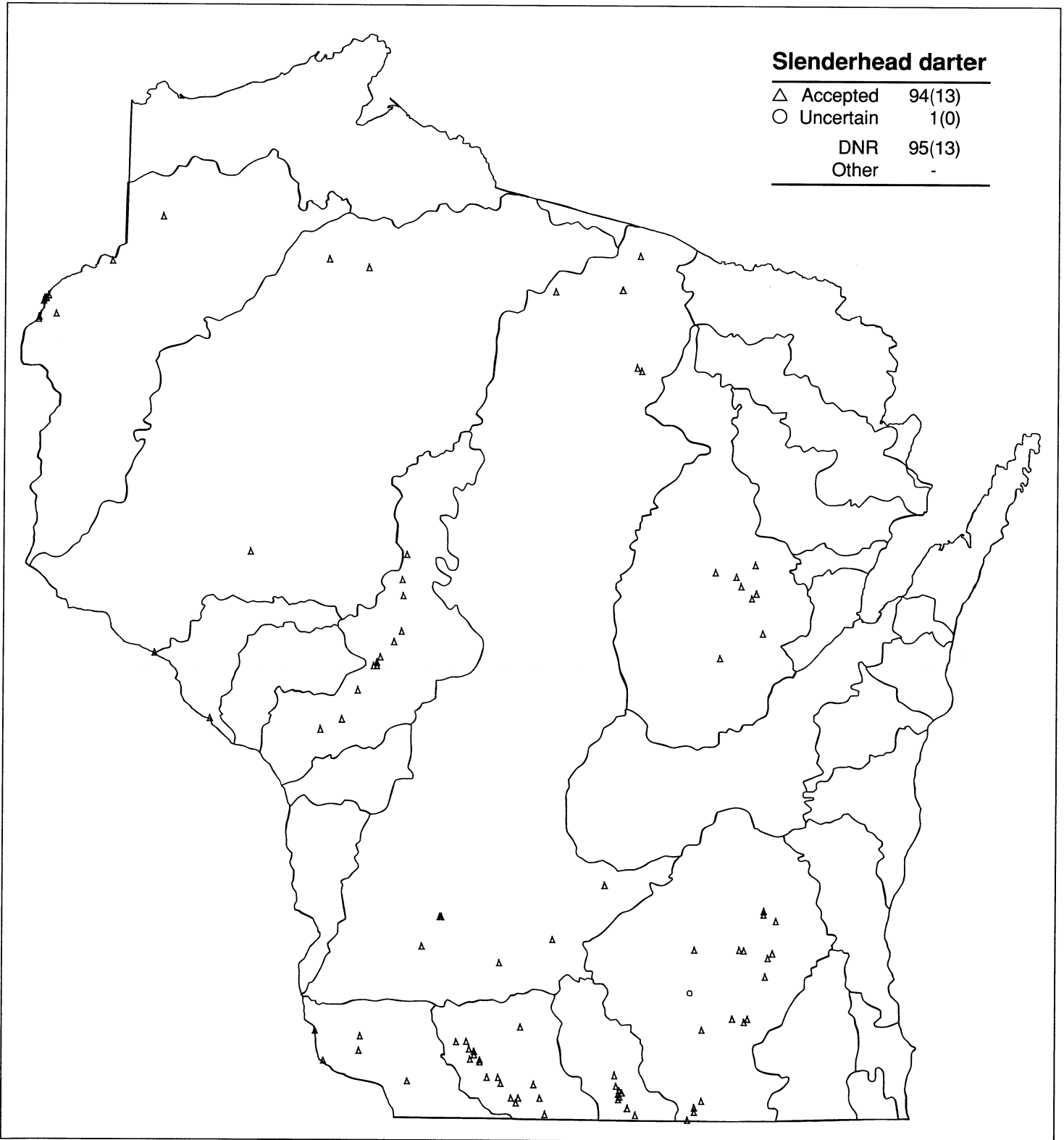




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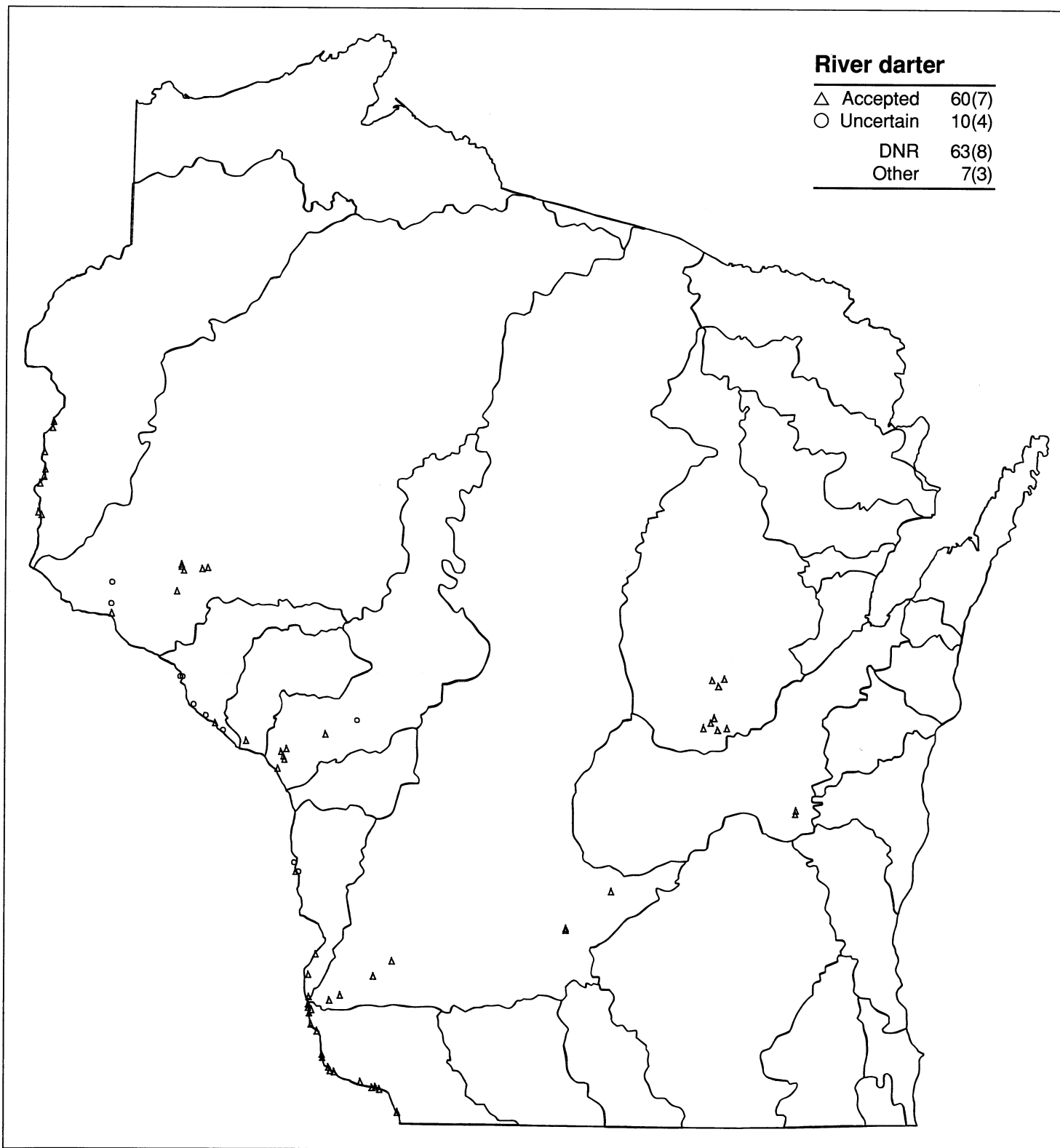
Map 138(L)



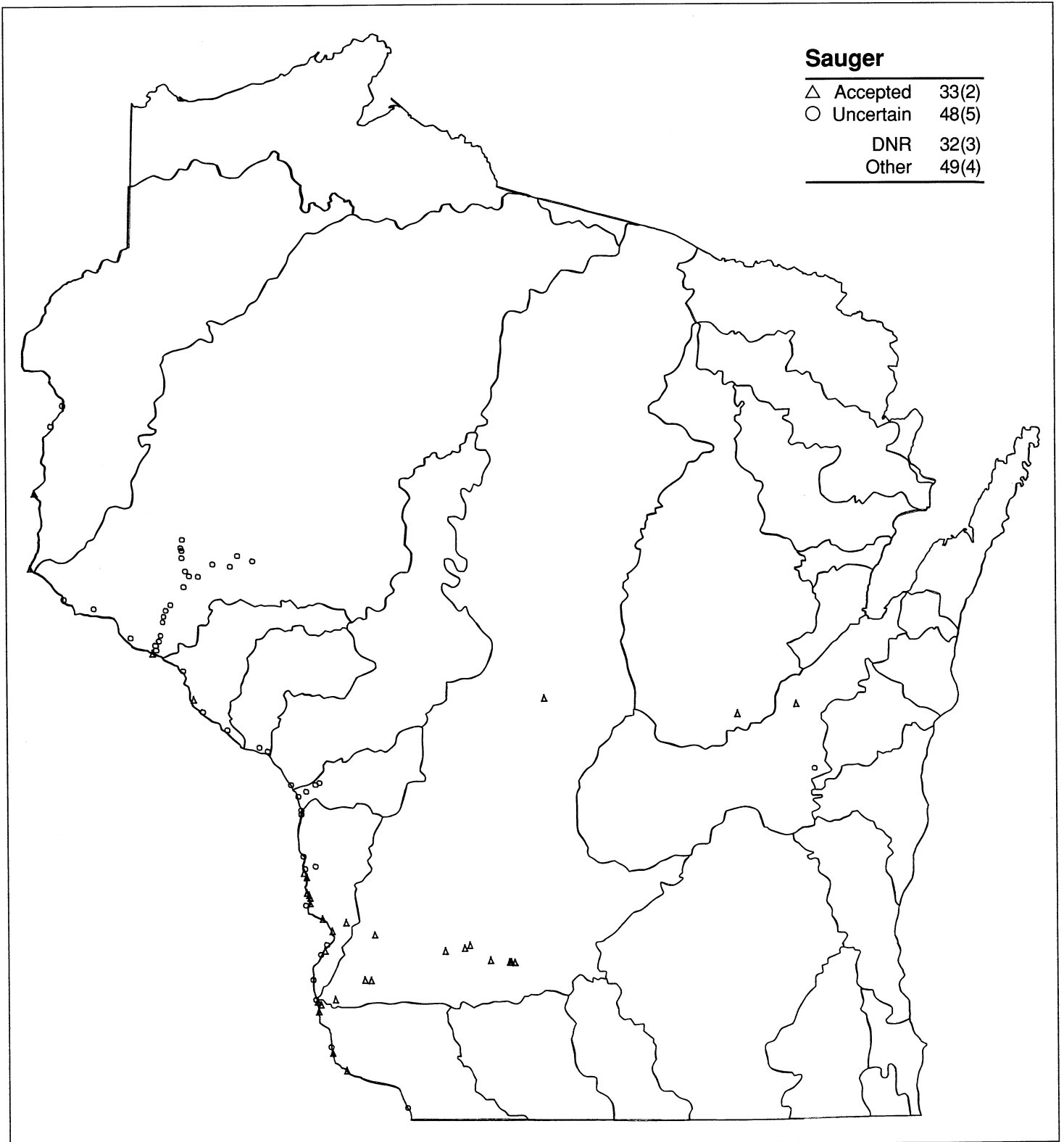
Map 139(E)



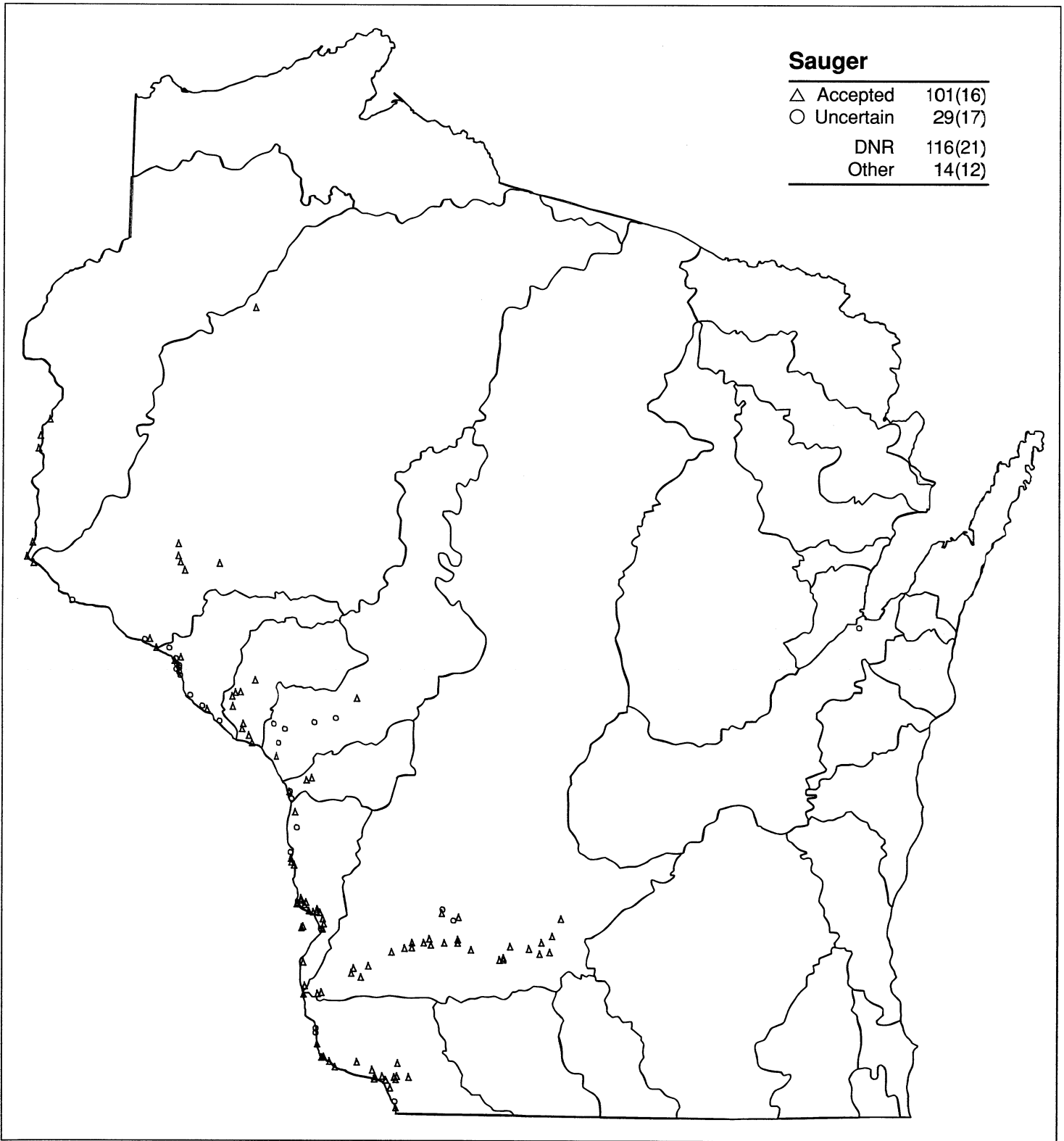
Map 139(L)



Map 140(E)

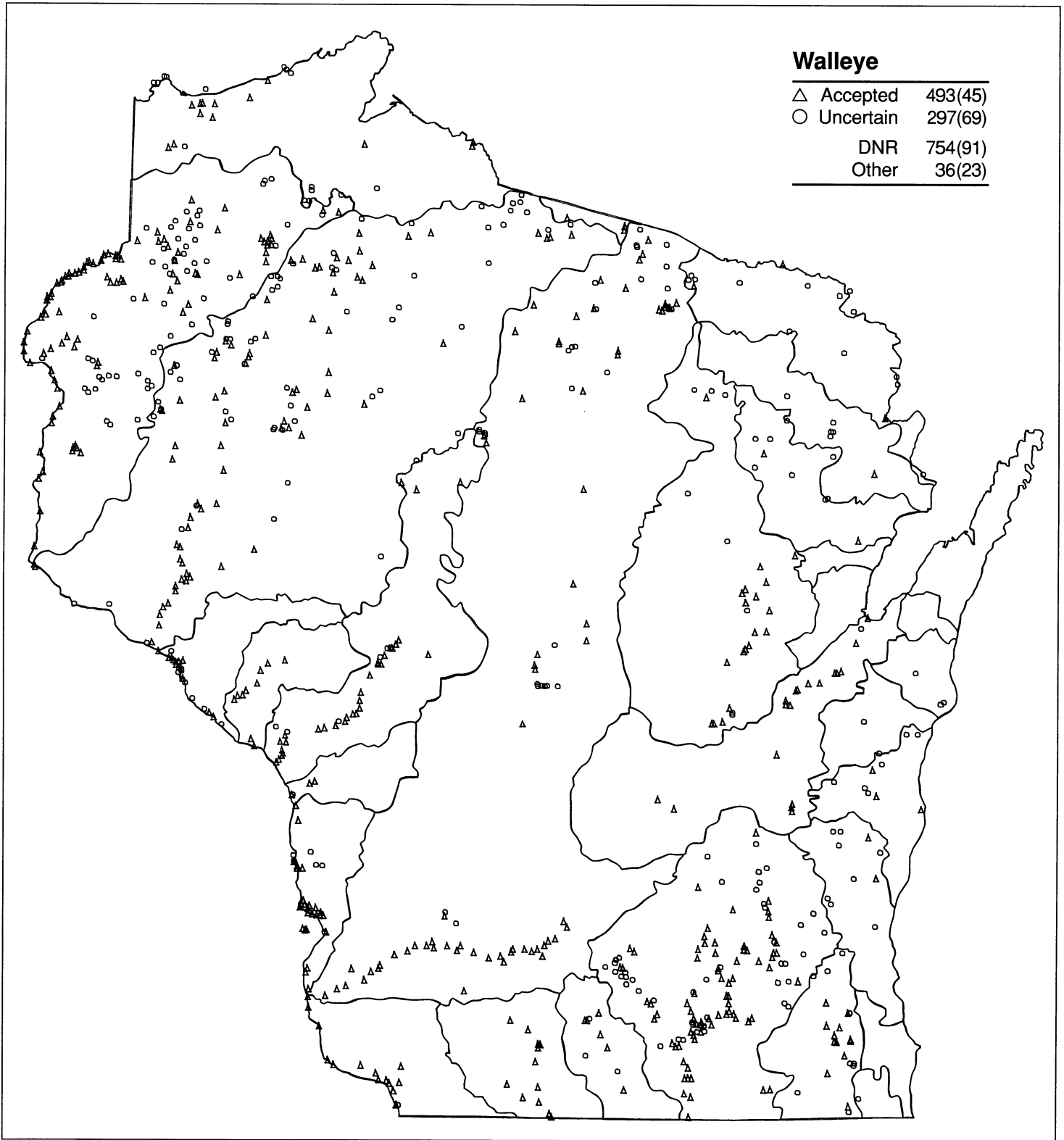


Map 140(L)

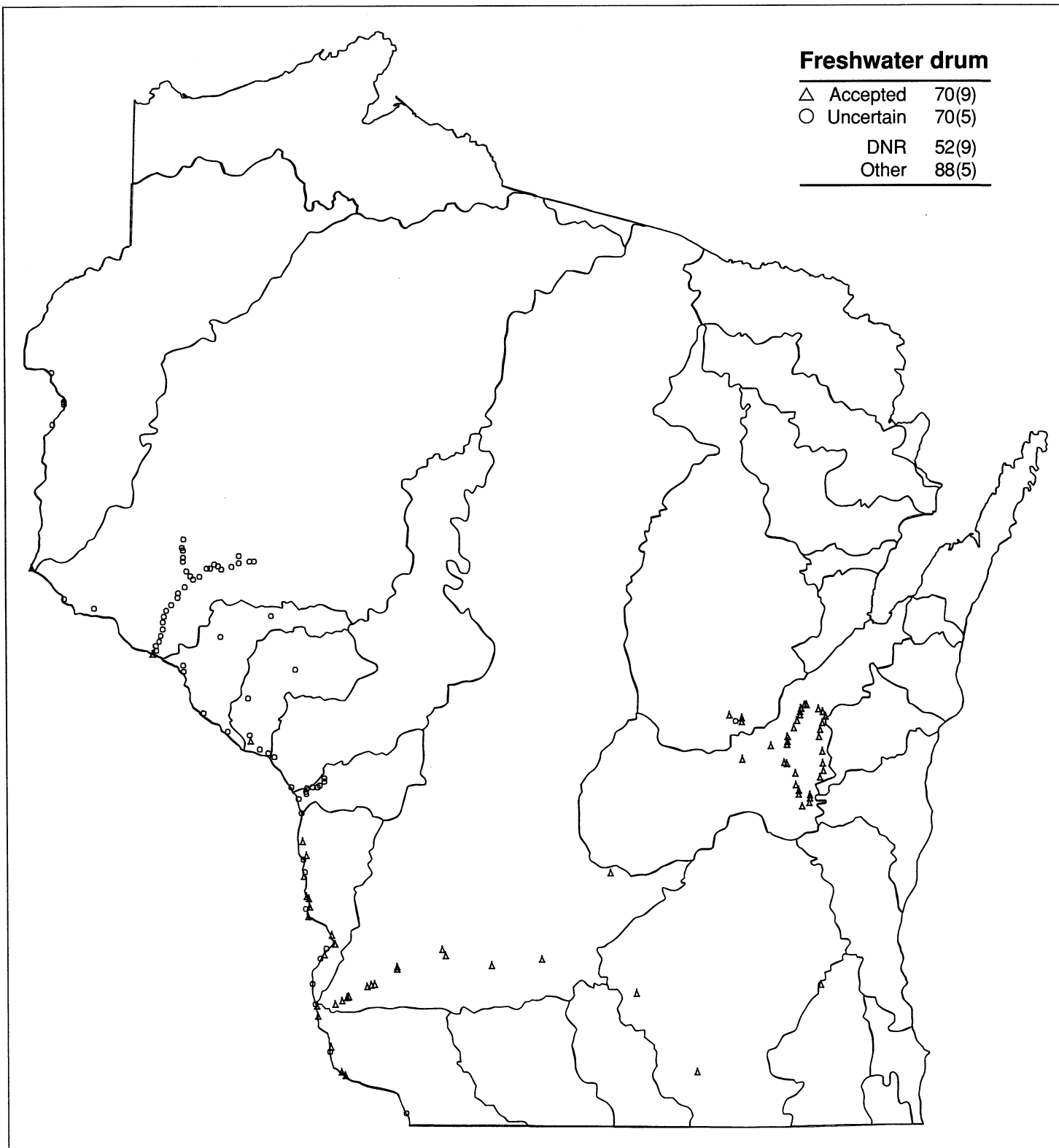


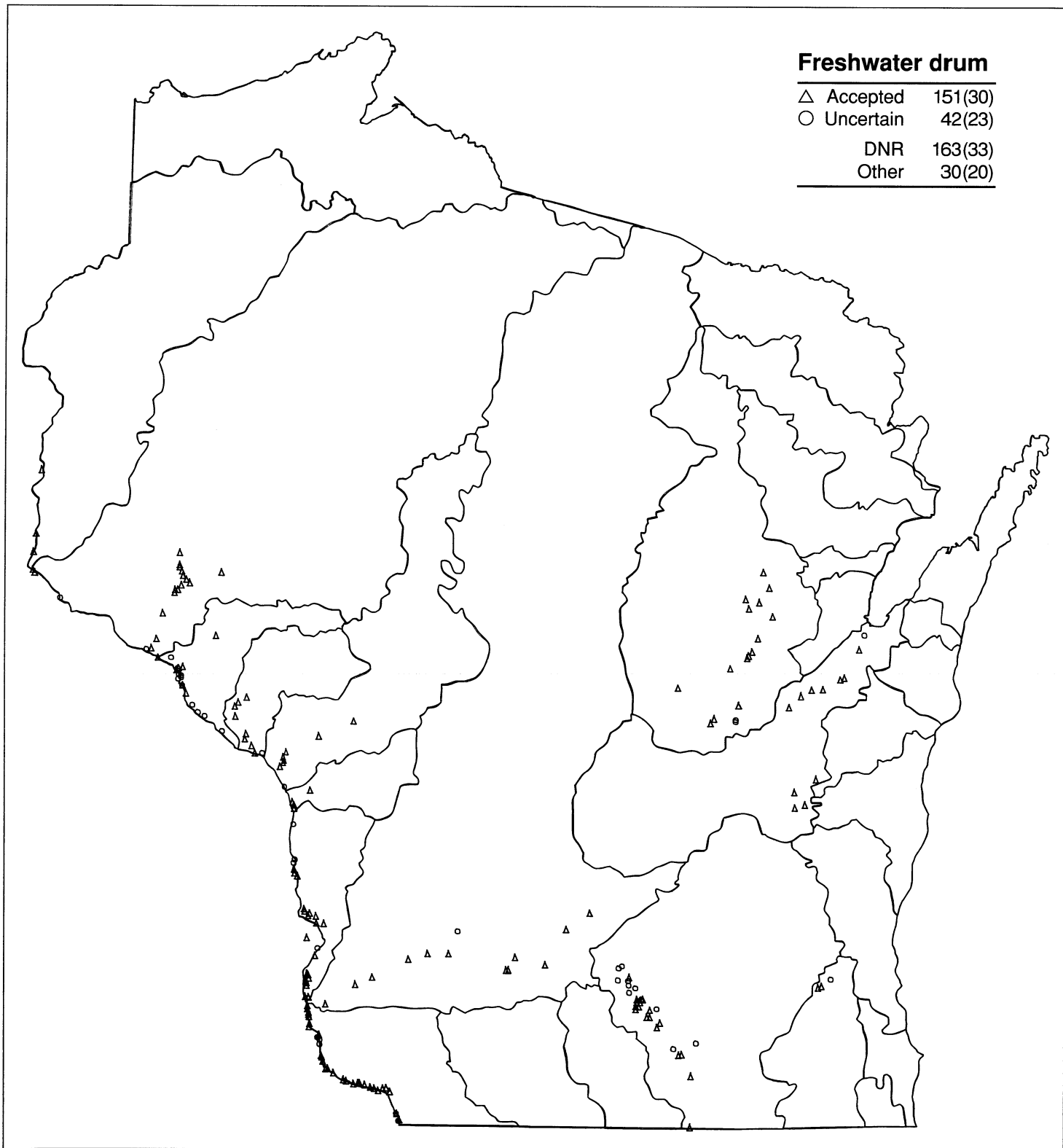
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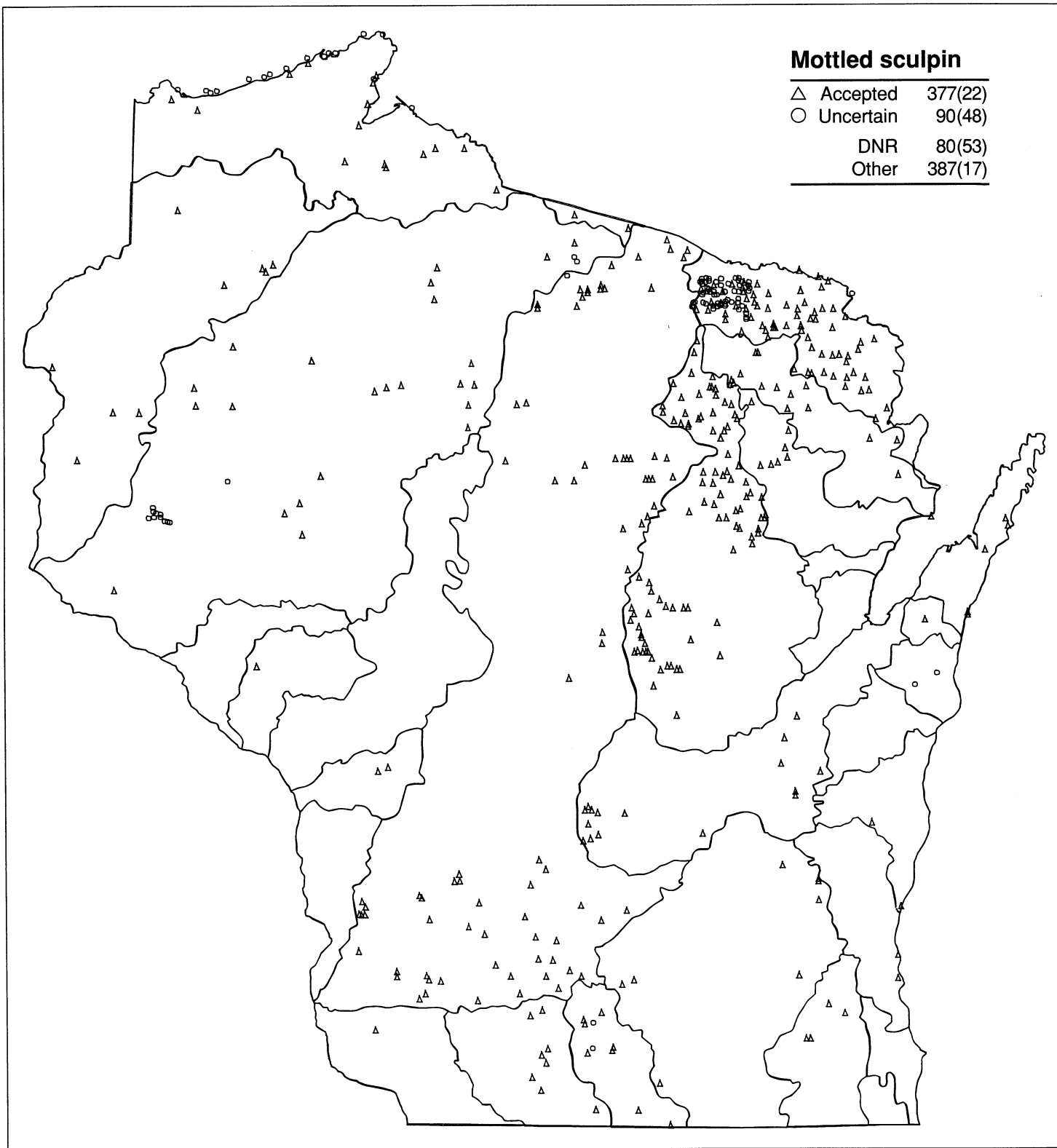


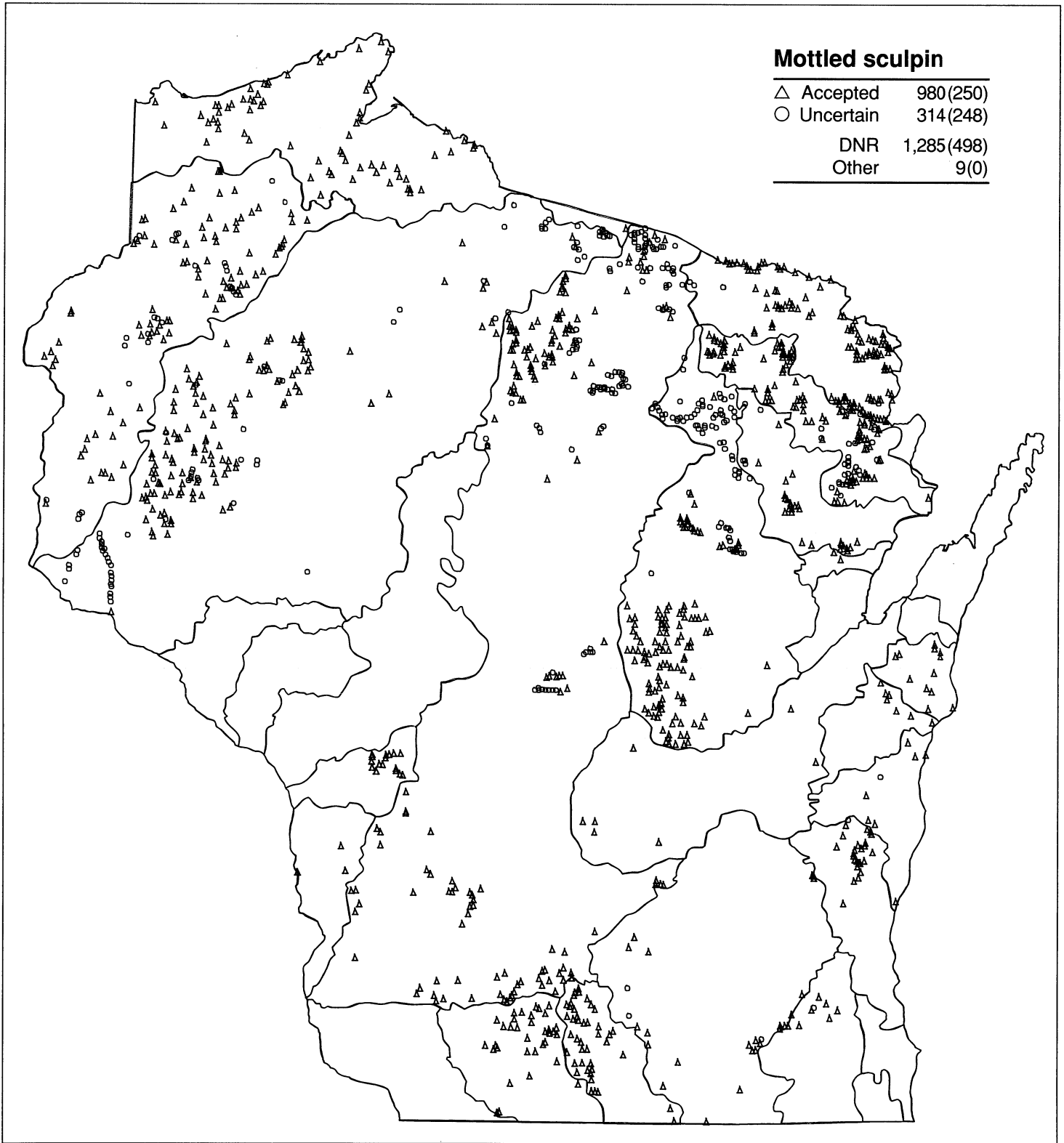
Map 142(E)



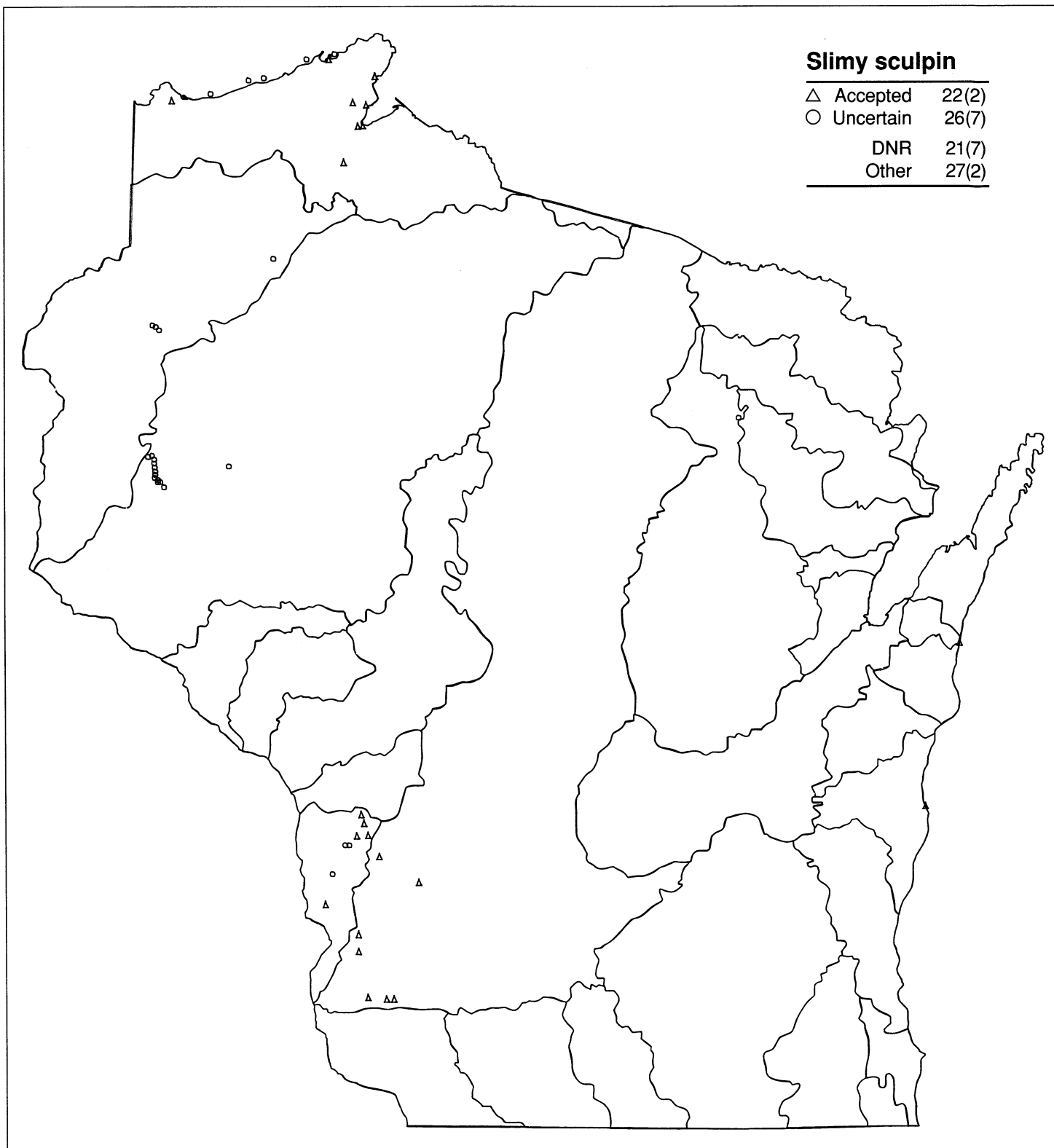


Map 143(E)

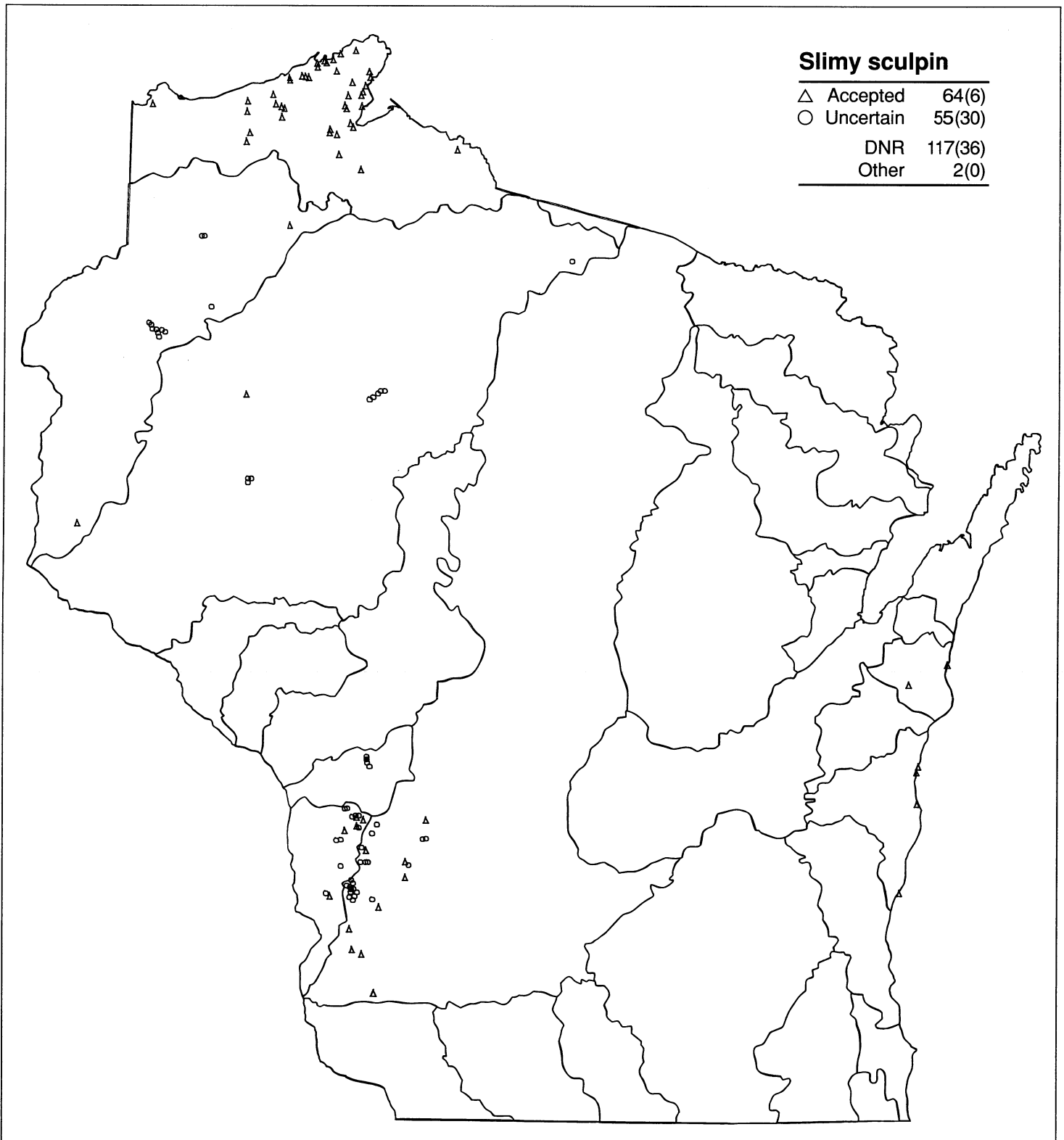




Map 144(E)



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 | | | Pickereel, 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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