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Status revision and update for Illinois' freshwater mussel Species in Greatest Need of Conservation

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Preface

A component of State Wildlife Grant T-82-R-1 (Defining expectations for mussel communities in Illinois wadeable streams) is to evaluate species' abundance, distribution, habitat requirements, ecological role and amount of information available regarding the species for all mussel Species in Greatest Need of Conservation (SGNC) in Illinois. This information will be used to update the freshwater mussel SGNC accounts included in the Illinois Comprehensive Wildlife Conservation Plan developed in 2005. This document updates Appendix I and II and Actions for the Streams Campaign for mussel SGNC to include in the 2015 revised Illinois Comprehensive Wildlife Action Plan. Additionally, distribution maps and host fish information for mussel SGNC and other species found currently or historically in Illinois are included.

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Contents

Section 1:

Illinois Wildlife Action Plan Overview and Appendices Review

Introduction and Background

The Illinois Comprehensive Wildlife Conservation Plan (hereafter, Plan) was established in 2005 as a condition for receiving funding from Federal programs such as the Wildlife Conservation and Restoration Program and State & Tribal Wildlife Grant Program (IDNR, 2005). These two federal aid programs were established as means for states and tribal areas to fund wildlife conservation projects that address Species in Greatest Need of Conservation (SGNC) and their habitats. The Plan provides information on the occurrence and distribution of SGNC, important habitat and community types, and potential negative impacts.

Eight elements define the Plan, which are paraphrased here:

1. Information on the distribution and abundance of wildlife species, low and declining populations that may be indicative of a species' health and diversity
2. Location description, key habitat and community types essential to a species' conservation
3. Descriptions of problems adversely affecting a species or their habitat, and factors identified that will aid in restoration
4. Conservation actions described which would conserve a species and its habitat
5. Proposed monitoring plans for a species and their habitats
6. Descriptions of procedures for the Plan review at intervals not to exceed ten years
7. Plans for coordinating the development, implementation, review, and revision with federal, state, local, and tribal agencies that manage land and water areas within the state
8. Public participation in the development, revision, and implementation of Plan projects and programs

A primary component of the Plan is the identification of SGNC, which were selected via eight criteria. These criteria were evaluated by applying a combination of objective information (e.g., species distribution, population trends) as well as informed professional judgment.

Much of the information and analysis for identifying mussel SGNC has not been updated since the list was developed in 2005. Specifically, mussel species were evaluated with data from the IDNR BIOTICS database (2004) and distribution maps from the INHS mussel collections (1999). Since then, a large statewide mussel survey was completed that added hundreds of additional surveyed locations (T-53-P-001).

The Plan also requires periodic revisions and updates to measure progress and address emerging issues. Evaluations of the status, distribution, and stresses to SGNC were expected to occur at 2- to 5-year intervals (IDNR, 2005). This report summarizes the first statewide evaluation and update of mussel SGNC since the Plan was developed.

The main components of the Plan were listed in Appendices I, II, and as priority conservation Actions for Illinois wildlife and habitat resources (divided into seven 'campaigns'). This report details the reevaluation and updates of those key appendices and includes suggested priority conservation Actions for the Streams Campaign. For background, we have summarized each Appendix as represented in the 2005 version of the Plan.

Appendix I identified criteria for listing as SGNC:

1. All species listed as threatened or endangered in Illinois, including federally listed species that occur within the state.
2. Species with a global conservation rank indicator of G1, G2, or G3.
3. Species is rare (small or low population size, density or range) or has significantly declined in abundance or distribution from historical levels.
4. Species is dependent upon a rare or vulnerable habitat for one or more life history needs (breeding, migration, wintering).
5. Species is endemic to Illinois, or the Illinois population is disjunct from the rest of the species' range.
6. Illinois' population of a species represents a significant proportion of the species' global population.
7. Species is representative of broad array of other species found in a particular habitat.
8. Species' status is poorly known, but available evidence suggests conservation concern.

Appendix II summarized status, objectives, and stresses to mussel SGNC and the main components consist of:

> Status: population, trend, and listing. Population was based on a population estimator (N) derived from the INHS mussel collection. Trend was estimated for the statewide population and was scored from -2 (strongly decreasing) to +2 (strongly increasing). Listing referred to state or federally threatened or endangered species.
>
> Objectives: population, trend, and listing. Population referred to a targeted N for 2025. Trend was a required trend for a targeted resource level by 2025. No target populations or trends were outlined in the Plan for freshwater mussels. Listing referred to the logical goal of delisting current state or federal endangered species.
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> Stresses: Habitat stresses, community stresses, and population stresses. Stresses were ranked by experts via rapid assessment and scored on a 3-point scale (1-3, from little or no effect to severe effect on population viability and abundance). Habitat stresses included extent, fragmentation, composition-structure, disturbance/hydrology, invasives/exotics, and pollution-sediment. Community stresses included competitors, predators, parasites-disease, prey-food, hosts, invasives/exotics, and other symbionts. Population stresses included genetics, dispersal, recruitment, and mortality. Direct human stresses included killing, disturbance, and structures – infrastructure. Details regarding each stress are found in the Plan (IDNR, 2005).

Priority conservation Actions are based on a matrix of wildlife and habitat objectives. Each stress or problem was addressed and actions were proposed to improve habitats, prioritize locations, and measure performance. Conservation actions for freshwater mussels were included in the Streams Campaign.

Current distribution maps were developed to inform components of the Plan related to population range and are included in this report (Section 2).

We evaluated the current state of the literature regarding host fish for Illinois mussels (including extirpated and stable species). The life cycle of freshwater mussels is complex and unique among bivalves. Larval mussels (glochidia) are released by the adult female and must attach to gills or fins of a suitable host. The host for most mussel glochidia is a fish, however, several amphibians are also known as glochidia hosts. If glochidia attach to an appropriate host, it remains on the host for several weeks before metamorphosis to a juvenile mussel. Juveniles are released from the host and fall to the river bottom to begin filter-feeding. Mussels also attach to non-suitable hosts; the hosts' immune system eventually rejects the glochidia, which fall off and perish. For each species in Illinois, we compiled references associated with hosts and the infestation or transformation type (Section 3).

Methods

We reviewed the status of all mussel species with current distributions in Illinois using data from multiple sources, published literature, and professional opinion (in the absence of published or collected data). Recent field data were obtained from State Wildlife Grant T-53-P-001 (Investigating mussel communities in wadeable Illinois streams). Other collection records came from vouchered material maintained by the Illinois Natural History Survey Mollusk Collection, collection records associated with these vouchered materials (e.g., live specimens that were recorded but not vouchered), and verified voucher material from regional academic and museum collections including the Field Museum, the Ohio State University Mollusk Collection, and others.

Appendix I

Plan criteria for selecting SGNC (see Introduction for summary of original Plan Appendices) were revised for the 2015 Plan, which created 4 new categories to classify rarity. We used the revised Appendix I to evaluate all species in Illinois for potential listing as SGNC (Appendix I). All freshwater mussels proposed or previously listed as SGNC in Illinois are found primarily in streams, thus all species listed in Appendix I should be officially associated with the Streams Campaign.

1. Changes to a species' state or federal listing from 2005-2014 were obtained from the U.S. Fish and Wildlife Service Environmental Conservation Online System (ECOS) and the Illinois Endangered Species Protection Board list (ESPB, 2014). We also added our summary of proposed listing changes for species that we believe should be up or downgraded, although these are only intended to provide feedback for future ESPB updates. We distinguished between 2005 listing from the Plan, ESPB (2014) official listing status, and our proposed listing changes.
2. Current global conservation rank was obtained through NatureServe *Explorer* (NatureServe, 2014, accessed June-July 2014).
3 - 6. Rarity, based on population size, density, or range, was based on empirical data, obtained through recent samples collected during T-53 and from the INHS Mollusk Collection. Population size was roughly based on number of extant occurrences (2000-2013), although true estimates of population size are not available due to the qualitative nature of collection and survey data (Strayer and Smith, 2003). Similarly, density was not available from recent surveys or collection records, but we evaluated density to the best of our ability from T-53 surveys and other collections (2000-2013) maintained by the INHS Mollusk Collection compared to densities known historically or as published in

scientific literature. Range was based on the frequency of occurrence in HUC8 watersheds of recent extant records (2000-2013) to previous ranges (1977-1999, 1950-1976, and pre-1950).
7. Habitat requirements for each species were evaluated by literature review, empirical data (from T-53 and INHS Mollusk Collection), and professional opinion.
8 and 9. Endemism, disjunction, and global population significance were evaluated based on information from published range maps in scientific literature or through NatureServe, U.S. Fish and Wildlife recovery plans, or similar resources. No freshwater mussels endemic to Illinois are known at this time.
10. Species in which the Illinois population represents a significant proportion of the species global population was determined through NatureServe or U.S. Fish and Wildlife recovery plans. This category held true for only three federally endangered species: Higgins eye, northern riffleshell, and scaleshell.
11. Representation of a broad array of other species in a particular habitat was reviewed for each species based on scientific literature.
12. Poorly known species were established using records from T-53, the INHS Mollusk Collection, and personal communication with the state malacologist (Kevin S. Cummings). We ranked species with significant knowledge gaps, such as unresolved distributions, taxonomic status, or unknown hosts, as poorly known and gathered further evidence regarding conservation concern from neighboring states' published wildlife action plans or state-listing for freshwater mussels.

Justification for a species' status is addressed in each species' review and specific citations are listed in Section 2. For species extirpated from Illinois, we summarized specific habitat and the global conservation rank (Table 2). Criteria 3-12 were ranked as "0" for each category because no recent data exist for inference. Additionally, if a species did not meet SGNC listing criteria in the 2005 Plan nor in this revision, we only summarized specific habitat and global conservation rank.

Appendix II

Status: We used Appendix II from the Plan (IDNR, 2005) and updated the value of each column when warranted (Appendix II). Population size (*N*) was not prepared for the original Plan evaluation or for this revision because survey data available are not appropriate for population estimation (Strayer and Smith, 2003). Listing status was obtained through NatureServe *Explorer* (NatureServe, 2014), the Illinois Endangered Species Protection Board (ESPB, 2014), or the U.S. Fish and Wildlife Service Environmental Conservation Online System. We determined trend by interpreting range and occurrence data from the distribution maps and trend was expressed as expansion (+ %) or contraction (- %) within Illinois.

Objectives: N (targeted population for 2025) and trend (by 2025) were not addressed, largely due to insufficient information available to propose a population threshold and "trend." These two objectives were not completed in the original Plan evaluation, and targeted population numbers are not available for any species in Illinois at this time. The listing objective for listed species was classified as "delist" in the 2005 Plan, and we support that objective.

Habitat, community, population, and direct human stresses were evaluated by professional opinion and literature review. All stresses were scored on a three-point scale -

1. The threat has had, is having, or is likely to have little or no effect on population viability or abundance.
2. The threat has had, is having, or is likely to have a moderate effect on population viability or abundance.
3. The threat has had, is having, or likely to have a severe effect on population viability or abundance.

Changes to the Appendix II from the 2005 Plan are addressed in each species' review. In general, we believe that the sampling data and literature review conducted during T-53 and T-82 provided valuable information. These data improved our confidence in understanding the extent of habitat, community, population and human stresses and we upgraded the confidence levels accordingly.

Suggested Actions for Streams Campaign

A list of six suggested Actions for the Streams Campaign was developed based upon professional opinion, Illinois Natural History Survey Mollusk Collection records, and literature review and is presented in the discussion section. Other factors incorporated into the suggested Actions include stresses addressed, habitat improvements, priority locations, and performance measurements with outputs and potential outcomes.

Species Reviews

We summarized the information contained in Appendices I and II, as well as any pertinent information we used for evaluating the status of a species (Section 2: Species Reviews). We provided our rationale for recommended status changes (e.g., from stable to SGNC) in each species' review, however, these recommendations are secondary to listing status established by the Illinois ESPB and are only intended to provide feedback for future ESPB updates. In situations where our recommendation differs from the ESPB recommendation, we note the current ESPB status for reference.

Distribution maps

In Section 2, distribution records were divided into time periods to document change in distributions. Time periods selected for this effort were pre-1950, 1950-1976, 1977-1999, and 2000-2013. Time periods were selected based on previous work by Metzke et al. (2012) and represent earliest/historic mollusk records, pre-Clean Water Act, post-Clean Water Act, and current distribution, respectively. Data reflect extant records for each time period except the pre-1950 period. Extant refers to live individuals or recent dead shell (periostracum present, nacre pearly, and soft tissue may be present). The pre-1950 time period data includes extant records and relict shell records (periostracum eroded, nacre faded, shell chalky; based on the condition of the best shell found).

The nomenclature employed follows Turgeon et al. (1998) and Graf and Cummings (2007) except recent taxonomic changes to the ending of the lilliputs (*Toxolasma spp.*), which follow Williams et al. (2008) (Table 1). Maps were created using ESRI ArcMap 10.1.

Fish Host Information

In Section 3, we have summarized the available information regarding mussel-host relationships for Illinois' species. Extirpated species (Table 1), stable species (Table 2), and SGNC species (Table 3) are listed separately. Each table is organized by fish family and scientific name, and mussel scientific names are listed as row headings. Due to the space requirements for these data, some of the tables eclipse more than one page.

Abbreviations (Hoggarth, 1992) used in Tables 1, 2, and 3 include the following:

NS: not stated (infestation type not described in literature source)

LI: lab infestation (infestation occurred in experimental conditions, but metamorphosis was not observed)

LT: lab transformation (metamorphosis from glochidia to juvenile observed in experimental conditions)

NI: natural infestation (infestation found on wild-caught fish, but metamorphosis was not observed)

NT: natural transformation (metamorphosis from glochidia to juvenile observed in natural conditions)

Discussion

Appendix I and II—Mussel SGNC and non-SGNC status reevaluation summary

The 2005 mussel SGNC list included 29 species. A reevaluation of each of these species plus 38 non-SGNC and their distribution maps are included in Section 2. The federally endangered species, scaleshell (*Leptodon leptodea*), was recently collected and, thereby, is no longer considered extirpated but listed as state endangered (ESPB, 2014). Several current non-SGNC species were determined to be rare or declining and/or meet one or more SGNC listing criteria requirements in Appendix I. These species include the elktoe, wartyback, Louisiana fatmucket, pocketbook, bankclimber, bleufer, Gulf mapleleaf, and pistolgrip.

Due to increased sampling effort statewide during T-53, new live and extant records for several SGNC species were revealed. Rock pocketbook, by our current assessment, does not meet SGNC listing and three species, black sandshell, slippershell mussel, and little spectaclecase, all currently listed as state threatened, appear to be increasing and likely may not meet requirements for ST status.

Conversely, sampling during T-53 revealed range retractions or fewer collections than expected based on historical comparisons for several state threatened or SGNC species. Based on recent evidence, monkeyface, SGNC, purple wartyback and spike, both currently listed as state threatened, are becoming more rare. Therefore, several mussels with proposed 2015 listing recommendations (Section 2: Species Reviews) differ from the current list established by the ESPB (see Table 1 for current listing status by ESPB).

Based on the changes listed above, the 2015 mussel SGNC list would include 39 species, as 1 species did not meet SGNC status in our review.

Suggested Actions for the Streams Campaign

1. Fill information gaps for species with unknown distribution or poorly understood taxonomic position. Specifically, the need for genetic research exists to determine whether the observed forms of Louisiana fatmucket, bleufer, and Gulf mapleleaf are more similar to the accepted genotype for these species or are something unique to Illinois or the midwestern region (as in, a new subspecies or species). Additionally, data collected in the southern portions of Illinois during T-53 suggested that a species morphologically similar to cylindrical papershell (*Anodontoides ferussacianus*) may be more closely related to the rayed creekshell (*A. radiatus*) and requires further sampling and genetic testing to determine taxonomic position.

2. Fill information gaps for mussel populations in large rivers through comprehensive large river surveys. Several species are primarily found in the Ohio, Wabash, Mississippi, and Illinois Rivers, yet no systematic samples with appropriate methodology have been conducted in these rivers for many decades. Lower reaches of large tributaries including the Saline, Little Wabash, Big Muddy, Sangamon, Kaskaskia, Kankakee, Rock, Fox Rivers and others are difficult to survey and therefore are often undersampled. Species such as pocketbook, scaleshell, and wartyback have unknown extents due to the paucity of recent large river data, and additional surveys are warranted to better ascertain their population viability or abundance within large rivers and tributaries. Furthermore, additional surveys may elucidate reasons for decline of large river species such as fat pocketbook or sheepnose.

3. Augment targeted populations of mussel Species in Greatest Need of Conservation within 5 years. Federally endangered mussel species likely to benefit from propagation include sheepnose, fat pocketbook, spectaclecase, rabbitsfoot, snuffbox, fanshell, and Higgins eye. Other state threatened or endangered species to consider augmenting populations are ebonyshell, spike, butterfly, elephantear, and kidneyshell. Additionally, we believe efforts to reintroduce purple wartyback and monkeyface in the Rock River should be explored, as extant populations of monkeyface were not discovered in this basin during T-53, despite known extant historical records.

With the exception of spectaclecase (host fish unknown), fish hosts for these mussels include common species of minnows, centrarchids, percids, catfishes, and drum, all easily obtainable for propagation efforts. Populations of these mussels are isolated, have low occurrences, or are extirpated from watersheds within their historic range, thus, augmenting their populations via propagation or inoculated host fish release may restore some historic populations. Ideally, the intention of this effort will be to repopulate or maintain populations with viable, reproducing populations in 50% or more of historic drainages where suitable habitat exists or can be restored. Implementation of an augmentation program would require, at a minimum, investigation of limiting factors for each species and host, and an analysis of feasibility. We recommend determining limiting factors for species listed above and investigating feasibility of augmentation in areas with limited habitat threats within the next 5 years.

4. Preserve and restore in-stream riffle habitat, host fish species (if extirpated), and associated riparian habitat in targeted watersheds to benefit species such as purple wartyback, wavy-rayed lampmussel, flutedshell, snuffbox, and elktoe that thrive in swift, clean and clear currents in or near riffle habitats. Examples of watersheds or portions of watersheds that may benefit from restoration efforts for these particular mussel species include the Vermilion (Wabash River), Embarras, Sangamon, Mackinaw, and/or Kishwaukee Rivers. Increasing riparian zone habitat and limiting runoff within the watershed may also reduce sedimentation within the Saline basin and will improve habitat for the fat pocketbook. Further research to determine limiting factors for each specific watershed is recommended.

5. Removing low-head dams that have no municipal use across the state (e.g., Krape Park, Freeport, Yellow Creek; Bellevidere Park, Bellevidere -Kishwaukee River; Crescent Falls Dam, Hanover-Apple River) or creating fish passages (around dams *and* reservoirs) to re-establish ecological continuity within a stream and ultimately enhance gene flow, dispersal, recruitment efforts and habitat use in depauperate mussel areas.

6. Research effects of water quality degradation on freshwater mussels in Illinois. A specific focus should be on known threats, such as ammonia, chlorination, and/or heavy metals (Wang et al., 2007), in regions of Illinois with acute or chronic inputs of these pollutants.

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Table 1. Current status of Illinois mussel species, based on 2014 Illinois Endangered Species Protection Board list, 2005 Plan, and most recent federal status (USFWS, 2013). The following list provides the scientific name, common name, and current status of each species in Illinois. X – Extirpated in Illinois, FE – Federally endangered, FT – Federally threatened, SE – State endangered, ST – State threatened, SGNC – Species in greatest need of conservation, RI – Reintroduced in Illinois.

Scientific Name	Common Name	Status
Actinonaias ligamentina	mucket	
Alasmidonta marginata	elktoe	
Alasmidonta viridis	slippershell	ST
Amblema plicata	threeridge	
Amphinaias nodulata	wartyback	
Amphinaias pustulosa	pimpleback	
Anodontoides ferussacianus	cylindrical papershell	
Arcidens confragosus	rock pocketbook	SGNC
Cyclonaias tuberculata	purple wartyback	ST
Cyprogenia stegaria	fanshell	FE, SE
Ellipsaria lineolata	butterfly	ST
Elliptio crassidens	elephantear	SE
Elliptio dilatata	spike	ST
Epioblasma obliquata	catspaw	FE, X
Epioblasma rangiana	northern riffleshell	FE, RI
Epioblasma torulosa	tubercled blossom	FE, X
Epioblasma triquetra	snuffbox	FE, SE
Fusconaia ebena	ebonyshell	SE
Fusconaia flava	Wabash pigtoe	
Fusconaia subrotunda	longsolid	X
Hemistena lata	cracking pearlymussel	FE, X
Lampsilis abrupta	pink mucket	FE, SE
Lampsilis cardium	plain pocketbook	
Lampsilis fasciola	wavy-rayed lampmussel	SE
Lampsilis higginsii	Higgins eye	FE, SE
Lampsilis hydiana	Louisiana fatmucket	
Lampsilis ovata	pocketbook	
Lampsilis siliquoidea	fatmucket	
Lampsilis teres	yellow sandshell	
Lasmigona complanata	white heelsplitter	
Lasmigona compressa	creek heelsplitter	SGNC
Lasmigona costata	flutedshell	SGNC
Leptodea fragilis	fragile papershell	
Leptodea leptodon	scaleshell	FE, SE
Ligumia recta	black sandshell	ST
Ligumia subrostrata	pondmussel	
Margaritifera monodonta	spectaclecase	FE, SE
Megalonaias nervosa	washboard	
Obliquaria reflexa	threehorn wartyback	
Obovaria olivaria	hickorynut	
Obovaria retusa	ring pink	FE, X
Obovaria subrotunda	round hickorynut	X

Plectomerus dombeyanus	bankclimber	
Plethobasus cicatricosus	white wartyback	FE, X
Plethobasus cooperianus	orangefoot pimpleback	FE, SE
Plethobasus cyphyus	sheepnose	FE, SE
Pleurobema clava	clubshell	FE, RI
Pleurobema cordatum	Ohio pigtoe	SE
Pleurobema plenum	rough pigtoe	FE, X
Pleurobema rubrum	pyramid pigtoe	X
Pleurobema sintoxia	round pigtoe	
Potamilus alatus	pink heelsplitter	
Potamilus capax	fat pocketbook	FE, SE
Potamilus ohiensis	pink papershell	
Potamilus purpuratus	bleufer	
Ptychobranchus fasciolaris	kidneyshell	SE
Pyganodon grandis	giant floater	
Quadrula fragosa	winged mapleleaf	FE, X
Quadrula nobilis	Gulf mapleleaf	
Quadrula quadrula	mapleleaf	
Simpsonaias ambigua	salamander mussel	SE
Strophitus undulatus	creeper	
Theliderma cylindrica	rabbitsfoot	FT, SE
Theliderma metanevra	monkeyface	SGNC
Toxolasma lividum	purple lilliput	SE
Toxolasma parvum	lilliput	
Toxolasma texasiensis	Texas lilliput	
Tritogonia verrucosa	pistolgrip	
Truncilla donaciformis	fawnsfoot	
Truncilla truncata	deertoe	
Uniomerus tetralasmus	pondhorn	
Utterbackia imbecillis	paper pondshell	
Utterbackia suborbiculata	flat floater	
Venustaconcha ellipsiformis	ellipse	SGNC
Villosa fabalis	rayed bean	FE, X
Villosa iris	rainbow	SE
Villosa lienosa	little spectaclecase	ST

Table 2. Summary of extirpated species and species that did not meet listing criteria.

Scientific Name	Habitat Association	1 - 2005 Listing	2 - Global Rank
Species currently believed extirpated in Illinois			
Epioblasma obliquata (catspaw)	rivers with swift flow, gravel	X, FE	G1
Epioblasma torulosa (tubercled blossom)	medium to large rivers, riffles, gravel	X, FE	G2
Fusconaia subrotunda (longsolid)	large rivers, gravel	X	G3
Hemistena lata (cracking pearlymussel)	medium to large rivers, sand, gravel, muck	X, FE	G1
Obovaria retusa (ring pink)	large rivers, sand, gravel	X, FE	G1
Obovaria subrotunda (round hickorynut)	medium rivers, flow, sand, gravel	X, SE	G4
Plethobasus cicatricosus (white wartyback)	large rivers, riffles, shoals, coarse substrates	X, FE	G1
Pleurobema plenum (rough pigtoe)	medium to large rivers, sand, gravel	X, FE	G1
Pleurobema rubrum (pyramid pigtoe)	medium to large rivers, swift flow, sand, gravel	X	G2G3
Quadrula fragosa (winged mapleleaf)	medium to large rivers, sand, gravel, muck	X, FE	G1
Species that did not meet listing criteria			
Actinonaias ligamentina (mucket)	medium to large rivers, sand, gravel		G5
Amblema plicata (threeridge)	rivers or impoundments, sand, gravel, mud		G5
Amphinaias pustulosa (pimpleback)	medium to large rivers, sand, gravel, muck		G5
Anodontoides ferussacianus (cylindrical papershell)	small streams, sand, muck, edges		G5
Fusconaia flava (Wabash pigtoe)	small to large rivers, sand, gravel, muck		G5
Lampsilis cardium (plain pocketbook)	small to large rivers, sand, gravel, muck		G5
Lampsilis siliquoidea (fatmucket)	small to medium rivers, slow flow, sand, gravel, muck		G5
Lampsilis teres (yellow sandshell)	small to medium rivers, sand, muck, slow flow		G5
Lasmigona complanata (white heelsplitter)	small to large rivers, all substrates		G5
Leptodea fragilis (fragile papershell)	small to large rivers, sand, muck		G5
Ligumia subrostrata (pondmussel)	small to medium rivers, sand, muck, edges		G5
Megalonaias nervosa (washboard)	medium to large rivers, in flow, sand to cobble		G5
Obliquaria reflexa (threehorn wartyback)	medium to large rivers, sand, gravel, muck		G5
Obovaria olivaria (hickorynut)	medium to large rivers, swift flow, sand, gravel		G4
Pleurobema sintoxia (round pigtoe)	medium to large rivers, sand, gravel, muck		G4G5
Potamilus alatus (pink heelsplitter)	medium to large rivers, slow flow, fine substrates		G5
Potamilus ohiensis (pink papershell)	medium to large rivers, slow flow, fine substrates		G5
Pyganodon grandis (giant floater)	small to large rivers, lakes, fine substrates		G5
Quadrula quadrula (mapleleaf)	medium to large rivers, reservoirs, all substrates		G5
Strophitus undulatus (creeper)	small to medium rivers, all substrates		G5
Toxolasma parvum (lilliput)	small to medium rivers, fine substrates, edges		G5
Toxolasma texasiense (Texas lilliput)	small to medium rivers, fine substrates, edges		G4
Truncilla donaciformis (fawnsfoot)	medium to large rivers, moderate flow, fine substrates		G5
Truncilla truncata (deertoe)	medium to large rivers, moderate flow, fine substrates		G5
Uniomerus tetralasmus (pondhorn)	small streams, sloughs, slow flow, fine substrates		G5
Utterbackia imbecillis (paper pondshell)	medium to large rivers, slow flow, fine substrates, edges		G5
Utterbackia suborbiculata (flat floater)	medium to large rivers, backwaters, slow flow, fine substrates		G5

Appendix I. 2015 revision of mussel SGNC in Illinois as identified by twelve criteria (1 = species meets criterion, 0 = species does not meet criterion).

Scientific Name	Habitat Association	1 - 2005 Listing	1- 2104 ESPB/USFWS Listing	1 - 2015 Proposed Listing	2 - Global Rank	3 - Rare (Low Population)	4 - Rare (Limited Sites)	5 - Declining (Abundance)	6 - Declining (Range)	7 - Rare or Vunerable Habitat	8 - Endemic to IL	9 - Disjunct population	10 - Key Population	11 - Representative Species	12 - Poorly known status
Alasmidonta marginata (elktoe)	medium to large streams, swift flow			SGNC	G4	0	0	0	1	0	0	0	0	0	0
Alasmidonta viridis (slippershell)	small streams, sand, gravel, muck	ST	ST	SGNC	G4G5	1	0	0	0	0	0	0	0	0	0
Amphinaias nodulata (wartyback)	medium to large rivers, sand, gravel, muck			SGNC	G5	1	1	1	0	0	0	0	0	0	0
Arcidens confragosus (rock pocketbook)	medium to large rivers, sand, gravel, muck	SGNC			G4	0	0	0	0	0	0	0	0	0	0
Cyclonaias tuberculata (purple wartyback)	medium to large rivers, swift flow, coarse substrates	ST	ST	SE	G5	1	1	0	1	1	0	0	0	0	0
Cyprogenia stegaria (fanshell)	medium to large rivers, swift flow, gravel	FE, SE	FE, SE	X, FE, SE	G1	1	1	1	1	1	0	0	0	1	0
Ellipsaria lineolata (butterfly)	large rivers, swift flow, sand, gravel	ST	ST	ST	G4G5	1	1	1	1	1	0	0	0	0	0
Elliptio crassidens (elephantear)	large rivers, swift flow	ST	SE	SE	G5	1	1	1	1	0	0	0	0	0	0
Elliptio dilatata (spike)	medium to large rivers, coarse substrates	ST	ST	SE	G5	1	1	0	0	1	0	0	0	0	0
Epioblasma rangiana (northern riffleshell)	medium to large rivers, riffles, coarse substrates	X, FE	FE, SE	FE, SE, RI	G1	1	1	1	1	1	0	1	1	0	0
Epioblasma triquetra (snuffbox)	medium to large rivers, riffles, coarse substrates	SE	FE, SE	FE, SE	G3	1	1	1	1	1	0	1	0	1	0
Fusconaia ebena (ebonyshell)	large rivers, swift flow, sand, gravel	ST	SE	SE	G4G5	1	1	1	1	0	0	0	0	0	0
Lampsilis abrupta (pink mucket)	large rivers, swift flow, rocky substrate	FE, SE	FE, SE	FE, SE	G2	1	1	1	1	1	0	0	0	1	0
Lampsilis fasciola (wavy-rayed lampmussel)	small to medium rivers, flow, coarse substrates	SE	SE	SE	G5	1	1	1	0	1	0	0	0	1	0
Lampsilis higginsii (Higgins eye)	large rivers, sand, gravel	FE, SE	FE, SE	FE, SE	G1	1	1	1	1	0	0	0	1	0	0
Lampsilis hydiana (Louisiana fatmucket)	small to medium rivers, slow flow, sand, gravel, muck			SGNC	G4Q	0	1	0	0	0	0	0	0	0	1
Lampsilis ovata (pocketbook)	small to large rivers, all substrates			SGNC	G5	0	1	0	0	0	0	0	0	0	1
Lasmigona compressa (creek heelsplitter)	small to medium rivers, sand, gravel	SGNC		SGNC	G5	1	0	0	0	0	0	0	0	0	0
Lasmigona costata (flutedshell)	medium to large rivers, sand, gravel	SGNC		SGNC	G5	0	1	0	1	1	0	0	0	0	0
Leptodea leptodon (scaleshell)	medium to large rivers, in flow	X, FE	FE, SE	FE, SE	G1	1	1	1	1	0	0	1	1	0	1

Appendix I. (continued)

Scientific Name	Habitat Association	1 - 2005 Listing	1- 2104 ESPB/USFWS Listing	1 - 2015 Proposed Listing	2 - Global Rank	3 - Rare (Low Population)	4 - Rare (Limited Sites)	5 - Declining (Abundance)	6 - Declining (Range)	7 - Rare or Vunerable Habitat	8 - Endemic to IL	9 - Disjunct population	10 - Key Population	11 - Representative Species	12 - Poorly known status
Ligumia recta (black sandshell)	medium to large rivers, riffles, gravel to sand	ST	ST	SGNC	G4	1	0	0	0	0	0	0	0	0	0
Margaritifera monodonta (spectaclecase)	large rivers, sand, gravel, muck, roots	FC, SE	FE, SE	FE, SE	G3	1	1	1	1	1	0	0	0	1	1
Plectomerus dombeyanus (bankclimber)	medium to large rivers, sand, gravel, muck			SGNC	G5	0	1	0	0	0	0	0	0	0	1
Plethobasus cooperianus (orangefoot pimpleback)	medium to large rivers, swift flow, cobble to sand	FE, SE	FE, SE	FE, SE	G1	1	1	1	1	1	0	0	0	0	0
Plethobasus cyphyus (sheepnose)	medium to large rivers, swift flow, cobble to sand	FC, SE	FE, SE	FE, SE	G1	1	1	1	1	1	0	1	0	1	0
Pleurobema clava (clubshell)	medium to large rivers, swift flow, cobble to sand	FE, SE	FE, SE	FE, SE, RI	G1G2	1	1	1	1	1	0	1	0	1	0
Pleurobema cordatum (Ohio pigtoe)	medium to large rivers, sand, gravel	SE	SE	SE	G4	1	1	1	1	0	0	1	0	0	0
Potamilus capax (fat pocketbook)	medium to large rivers, sand, gravel, muck	FE, SE	FE, SE	FE, SE	G2	1	1	1	1	0	0	0	0	0	0
Potamilus purpuratus (bleufer)	medium to large rivers, slow flow, fine substrates			SGNC	G5	0	1	0	0	0	0	0	0	0	1
Ptychobranchus fasciolaris (kidneyshell)	medium to large rivers, fine to coarse substrates	SE	SE	SE	G4	1	1	1	1	1	0	1	0	1	0
Quadrula nobilis (Gulf mapleleaf)	large rivers, sand, gravel, muck			SGNC	G4	1	1	0	0	0	0	0	0	0	1
Simpsonaias ambigua (salamander mussel)	medium to large rivers, coarse substrates, slab rock	SE	SE	SE	G3	1	1	0	1	1	0	0	0	1	0
Theliderma cylindrica (rabbitsfoot)	medium to large rivers, sand, gravel	SE	FT, SE	FT, SE	G3G4	1	1	1	1	1	0	0	0	1	0
Theliderma metanevra (monkeyface)	medium to large rivers, sand, gravel	SGNC		SGNC	G4	0	1	1	1	0	0	0	0	1	0
Toxolasma lividum (purple lilliput)	small to medium rivers, sand, muck, roots, edges	SE	SE	SE	G3	1	1	1	1	0	0	0	0	0	0
Tritogonia verrucosa (pistolgrip)	medium to large rivers, sand, gravel, muck			SGNC	G4G5	0	0	1	1	0	0	0	0	0	0
Venustaconcha ellipsiformis (ellipse)	small to medium rivers, swift flow, cobble to sand	SGNC		SGNC	G3	1	0	0	1	1	0	0	0	0	0
Villosa fabalis (rayed bean)	small to large rivers, flow, fine substrates, vegetation	X, FC	X, FE	FE, SE	G2	1	1	1	1	1	0	0	0	1	1
Villosa iris (rainbow)	small to medium rivers, sand, gravel	SE	SE	SE	G5	1	1	1	1	1	0	1	0	1	0
Villosa lienosa (little spectaclecase)	small to medium rivers, sand, mud, edges	ST	ST	SGNC	G5	0	0	0	0	0	0	0	0	0	0

Appendix II. 2015 revision to Status and Stresses to mussel SGNC.

	Status					Habitat Stress						Community Stress							Population Stress				Human Stress		
Mussel Species	N (Extant HUC8)	Recent Trend	Change in historic range	2005 Status	Proposed 2015 Status	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
Alasmidonta marginata (elktoe)	15	-1	>25% and <50% decline		SGNC	1	2	2	2	1	2	1	1	1	1	2	2	1	2	2	2	2	1	1	1
Alasmidonta viridis (slippershell)	17	-1	>25% and <50% decline	ST	SGNC	1	1	1	2	1	2	1	1	1	1	2	1	1	1	1	2	2	1	2	1
Amphinaias nodulata (wartyback)	21	0	<25% change		SGNC	1	1	1	2	2	2	1	1	1	1	1	2	1	1	2	1	1	1	2	1
Arcidens confragosus (rock pocketbook)	23	1	<25% change	SGNC	-	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	2	2	1	2	1
Cyclonaias tuberculata (purple wartyback)	5	-1	>50% decline	ST	SE	2	3	2	2	1	3	1	1	1	1	1	1	1	1	2	2	1	1	2	2
Cyprogenia stegaria (fanshell)	0	-2	>50% decline	FE, SE	X, FE, SE	3	3	3	3	2	2	1	1	1	1	2	2	1	2	2	2	1	1	2	1
Ellipsaria lineolata (butterfly)	9	-1	>25% and <50% decline	ST	ST	2	2	2	2	2	3	1	1	1	1	1	3	1	1	2	2	2	2	2	1
Elliptio crassidens (elephantear)	3	-1	>50% decline	ST	SE	2	2	2	3	2	3	1	1	1	1	2	3	1	1	2	3	2	2	2	1
Elliptio dilatata (spike)	18	0	>50% decline	ST	SE	2	2	2	2	1	3	1	1	1	1	2	2	1	2	1	1	2	1	1	1
Epioblasma rangiana (northern riffleshell)	1	-1	>50% increase	X, FE	FE, SE	1	2	2	2	1	3	1	1	1	1	2	1	1	2	2	2	2	1	1	3
Epioblasma triquetra (snuffbox)	1	-2	>50% decline	SE	FE, SE	1	2	3	2	1	3	1	1	1	1	3	1	1	3	3	3	2	1	2	2
Fusconaia ebena (ebonyshell)	4	-1	>50% decline	ST	SE	1	2	1	2	2	3	1	1	1	1	3	3	1	1	2	2	2	2	2	3
Lampsilis abrupta (pink mucket)	0	-2	>50% decline	FE, SE	FE, SE	1	3	1	3	1	3	1	1	1	1	2	2	1	2	2	3	2	1	2	1
Lampsilis fasciola (wavy-rayed lampmussel)	1	-1	>50% decline	SE	SE	1	2	1	2	1	3	1	1	1	1	2	1	1	1	2	2	2	1	2	1
Lampsilis higginsii (Higgins eye)	2	0	>50% decline	FE, SE	FE, SE	1	1	1	1	3	2	3	1	1	1	1	3	1	2	2	2	2	1	1	2
Lampsilis hydiana (Louisiana fatmucket)	12	0			SGNC	1	1	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lampsilis ovata (pocketbook)	1	-2	>50% decline		SGNC	1	2	2	2	1	2	1	1	1	1	2	1	1	3	3	3	1	1	2	3
Lasmigona compressa (creek heelsplitter)	21	1	<25% change	SGNC	SGNC	1	1	2	2	1	2	1	1	1	1	1	1	1	1	2	2	1	1	2	1
Lasmigona costata (flutedshell)	12	-1	>50% decline	SGNC	SGNC	1	1	2	2	1	3	1	1	1	1	1	1	1	1	2	2	1	1	1	2
Leptodea leptodon (scaleshell)	1	-2	>50% decline	X, FE	FE, SE	2	2	2	3	2	2	1	1	1	1	1	2	1	3	3	2	3	1	1	1
Ligumia recta (black sandshell)	15	1	>50% decline	ST	SGNC	1	2	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1	1	1	3
Margaritifera monodonta (spectaclecase)	1	-2	>50% decline	FE,SE	FE,SE	1	3	1	3	2	3	1	1	1	1	2	3	1	1	2	3	2	2	2	1
Plectomerus dombeyanus (bankclimber)	2	2	>50% increase		SGNC	1	2	1	1	2	2	1	1	1	1	1	2	1	1	2	2	1	1	1	2
Plethobasus cooperianus (orangefoot pimpleback)	0	-2	>50% decline	FE, SE	FE, SE	1	2	1	2	2	3	1	1	1	1	2	3	1	3	2	3	2	1	1	3
Plethobasus cyphyus (sheepnose)	3	-2	>50% decline	FC, SE	FE, SE	3	3	2	3	2	3	1	1	1	1	1	2	1	2	3	3	1	1	2	2
Pleurobema clava (clubshell)	1	-2	>50% decline	FE, SE	FE, SE	1	3	2	2	1	3	1	1	1	1	2	1	1	3	3	3	2	1	2	3
Pleurobema cordatum (Ohio pigtoe)	1	-2	>50% decline	SE	SE	1	1	1	2	2	3	1	1	1	1	1	3	1	2	2	2	1	1	1	3
Potamilus capax (fat pocketbook)	5	-1	>50% decline	FE, SE	FE, SE	1	3	1	3	2	3	1	1	1	1	1	3	1	1	1	2	2	2	3	1
Potamilus purpuratus (bleufer)	4	0	<25% change		SGNC	2	2	1	2	1	2	1	1	1	1	1	2	1	1	2	2	1	1	1	1
Ptychobranchus fasciolaris (kidneyshell)	2	-1	>50% decline	SE	SE	1	2	1	2	1	3	1	1	1	1	2	1	1	2	3	3	2	1	2	2
Quadrula nobilis (Gulf mapleleaf)	2	-1	>25% and <50% decline		SGNC	1	1	1	1	1	2	1	1	1	1	2	1	1	2	2	2	1	1	1	3
Simpsonaias ambigua (salamander mussel)	1	-2	>50% decline	SE	SE	2	2	3	2	1	3	1	1	1	1	2	1	1	1	3	2	1	1	2	1
Theliderma cylindrica (rabbitsfoot)	2	-2	>50% decline	SE	FT, SE	1	2	1	2	1	3	1	1	1	1	3	1	1	2	2	3	2	1	2	3
Theliderma metanevra (monkeyface)	15	-1	>25% and <50% decline	SGNC	ST	1	2	1	2	1	3	1	1	1	1	2	1	1	1	2	2	2	2	2	1
Toxolasma lividum (purple lilliput)	3	0	>50% decline	SE	SE	1	2	2	2	1	2	1	2	1	1	1	1	1	1	3	2	1	1	2	1
Tritogonia verrucosa (pistolgrip)	29	0	<25% change		SGNC	1	1	1	2	1	2	1	1	1	1	1	1	1	1	2	2	1	1	1	2
Venustaconcha ellipsiformis (ellipse)	15	-1	>25% and <50% decline	SGNC	SGNC	2	2	3	2	1	3	1	1	1	1	2	1	1	1	2	2	2	1	2	1
Villosa fabalis (rayed bean)	1	-2	>50% decline	X. FC	FE, SE	2	2	2	2	1	3	1	1	1	1	2	1	1	3	3	3	1	1	1	2
Villosa iris (rainbow)	1	-2	>50% decline	SE	SE	1	3	1	2	1	3	1	1	1	2	2	1	1	2	3	2	2	1	1	3
Villosa lienosa (little spectaclecase)	6	1	>25% and <50% decline	ST	SGNC	1	1	1	2	1	2	1	1	1	1	1	1	1	1	1	2	2	1	2	1

Section 2:

Review Rationale and Related Components

Elktoe (*Alasmidonta marginata*)

Specific Habitat: Occurs in small to medium-sized streams (rare in large rivers), it is more typical of smaller streams (Wilson and Clark, 1914; Goodrich and van der Schalie, 1944; Parmalee, 1967; Buchanan, 1980; Oesch, 1984). Ortmann (1919) described it as a riffle species that is found in swift current in firmly packed fine to coarse gravel.

2005 status: None

Proposed 2015 status: Species in Greatest Need of Conservation

Criteria in Appendix I:

6 - Species has declined in range since 2000

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	1	2	2	2	1	2	1	1	1	1	2	2	1	2	2	2	2	1	1	1

Rationale: The current extant range has declined by 35% (15 HUC8s) from historical range (23 HUC8s) in Illinois. Although wide-ranging, this species occurs in very small numbers at most extant locations in Illinois (with a few exceptions), survey efforts often yield only one or two individuals at a site and few sites indicate recent recruitment. All neighboring states list the elktoe as imperiled or vulnerable, thus adjoining populations appear to be declining as well.

We believe the most significant threats to elktoe populations are declining habitat in the form of fragmentation, degradation, hydrologic disturbance, and sedimentation, due to the fact that elktoe are found in swift current in fine or coarse gravel. Host fish are numerous and most are common in Illinois (Section 3: Table 3), although many are associated with specific habitat (e.g., silt-free rivers for redhorse species or Hornyhead Chub) and may be declining in Illinois (Smith, 1979; Metzke, 2012).

Slippershell mussel (*Alasmidonta viridis*)

Specific Habitat: Creeks and small rivers, in sand, gravel, and muck habitat (van der Schalie, 1938; Cummings and Mayer, 1992; Watters, 1995).

2005 status: State Threatened (ESPB, 2014)

Proposed 2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I: None

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	3	1	2	1	1	1	1	2	1	1	1	1	2	2	1	3	1
2015	1	1	1	2	1	2	1	1	1	1	2	1	1	1	1	2	2	1	2	1

Rationale: Although the historic range (25 HUC8s) still exceeds the current extant range (17 HUC8s), slippershells have remained stable or have increased in range since 1977. Extant HUC8 count in 1977-1999 was 12, and slippershell are now known in 17 HUC8s in 2000-2013, an increase of 41% of extant range. We believe this change is due to an increased sampling effort in smaller streams, which revealed more live and extant locations for this species. Small streams are widespread throughout Illinois and threats in small-stream ecosystems are spread among many tributaries. However, channelization can significantly alter habitat in creeks and small streams for decades. Regardless, we believe slippershell populations are still low but are stable or increasing and continue to persist and even thrive in these altered habitats.

In Appendix II, we downgraded hydrologic disturbance and direct human disturbance to moderate threats to population viability or abundance. During T-53, we encountered slippershell populations frequently and individuals are common in many small drainages in central Illinois. Host fish are believed to be Mottled and Banded Sculpin (*Cottus bairdi* and *C. carolinae*) and Johnny Darter (*Etheostoma nigrum*), although no recent trials have been completed (Section 3: Table 3). Johnny Darters are widespread and common in Illinois (Smith, 1979). We also believe we have greater confidence in dispersal and recruitment values following T-53.

Wartyback (*Amphinaias nodulata*)

Specific Habitat: Medium to large rivers or reservoirs in mud, sand, or gravel (Cummings and Mayer, 1992).

2005 status: None

Proposed 2015 status: Species in Greatest Need of Conservation

Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	1	1	1	2	2	2	1	1	1	1	1	2	1	1	2	1	1	1	2	1

Rationale: The current extant range is nearly the same as the historic range (21 HUC8s versus 22 HUC8s), which is less than a 5% decline. However, few individuals have been collected within its range and wartybacks are generally considered rare, compared to closely related species that are generally abundant, such as pimpleback (*A. pustulosa*) or mapleleaf (*Quadrula quadrula*).

We believe the most significant threats to wartyback populations are hydrologic disturbance, invasives/exotics, sedimentation, dispersal, and human disturbance. Because wartyback live almost exclusively in large rivers, they are at increased risk to impacts from invasive zebra mussels (*Dreissena* spp.), sedimentation, and hydrologic barriers that limit dispersal ability between sparse populations. Host fish are several species of catfish, many of which are common throughout Illinois (Section 3: Table 3).

Rock pocketbook (*Arcidens confragosus*)

Specific Habitat: Medium to large rivers, low gradient, mud and sand bottom pools in standing to slow flowing water; typical of large lowland streams (Parmalee and Bogan, 1998).

2005 status: Species in Greatest Need of Conservation

Proposed 2015 status: None

Changes to Criteria in Appendix I:

Removal of Rare (low population) designation

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	1	1	2	1	1	1	1	2	2	1	1	1	2	2	1	2	1
2015	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	2	1	1	1

Rationale: Although the historic range (26 HUC8s) still exceeds the current extant range (23 HUC8s), rock pocketbooks have increased in range since 1977-1999. Extant HUC8 count in 1977-1999 was 21, which is an increase of 8%. We believe this change is due to an increased sampling effort in streams in the southern half of Illinois, an area not extensively sampled in the past. These new samples revealed more live and extant records for this species. Rock pocketbook habitat requirements, low gradient, mud or sand bottom pools, are not limited in Illinois, thus we believe populations are likely to increase.

In Appendix II, we believe we have greater confidence in host knowledge, dispersal and recruitment values following T-53. We downgraded the risk of human disturbance, hosts, invasive species and recruitment, as we believe these to be limited threats to population viability or abundance. Rock pocketbooks are generalists and use many host fish, most of which are common in Illinois (Section 3: Table 3; Smith, 1979).

Purple wartyback (*Cyclonaias tuberculata*)

Specific Habitat: Medium to large rivers in gravel or mixed sand/gravel; prefers riverine conditions with stronger flow (Cummings and Mayer, 1992; Watters, 1995).

2005 status: State Threatened (ESPB, 2014)

Proposed 2015 status: State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	2	1	1	1	2	2	2	2	1
2015	2	3	2	2	1	3	1	1	1	1	1	1	1	1	2	2	1	1	2	2

Rationale: The current extant range (5 HUC8s) for purple wartybacks has declined 28% from 1977-1999 (7 HUC8s) and 80% historically (26 HUC8s). Also, the Rock River and Ohio River populations are disjunct and widely separated, thus genetic mixing between each watershed is unlikely. Purple wartybacks are generally found in medium to large rivers, which are at increased risk of threats such as an accumulation of industrial or municipal contaminants, sedimentation, or hydrologic alterations in the form of dams. This species is also listed as state endangered in Wisconsin, threatened in Iowa, and as special concern in Michigan.

In Appendix II, we ranked habitat extent, fragmentation, composition, population dispersal, and structures/infrastructure (i.e., dams) as threats likely to have a moderate effect on population viability for reasons listed above. We do not believe invasive species, natural mortality of existing individuals, or human killing are as great a threat. Host fish for purple wartyback are several catfish species (Section 3: Table 3), all of which are widespread and stable in Illinois. However, because purple wartyback rely on large-bodied fishes that may migrate long distances, hydrologic alterations that impact the host fishes should be considered. We also believe we have greater confidence in dispersal and recruitment values following T-53.

Fanshell (*Cyprogenia stegaria*)

Specific Habitat: Medium to large rivers in gravel riffles (Cummings and Mayer, 1992); river habitats with gravel substrates and a strong current, in both deep and shallow water (Ortmann, 1919; Parmalee, 1967).

2005 status: Federally Endangered, State Endangered

2015 status: Extirpated, Federally Endangered, State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	3	1	3	1	3	1	1	1	1	2	2	1	2	1	3	2	1	2	1
2015	3	3	3	3	2	2	1	1	1	1	2	2	1	2	2	3	2	1	2	1

Rationale: Fanshell are likely no longer extant in Illinois with the most recent record in Illinois collected in the Wabash River in 1984. The extirpation of fanshell populations are likely due to a combination of factors, including but not limited to impacts from dams, dredging, pollution, and navigation projects (NatureServe, 2014). Fanshell require larger rivers and stable gravel substrates, which are limited in Illinois and unlikely to persist in the future.

In Appendix II, we ranked habitat extent, fragmentation, composition, hydrologic disturbance as likely to have a severe effect on population viability for reasons listed above. Dispersal was ranked as a moderate effect on population viability, because most existing populations are isolated. Host fish for fanshell are sculpins and several darter species (Section 3: Table 3), which are species sensitive to water quality degradation.

Butterfly (*Ellipsaria lineolata*)

Specific Habitat: Large rivers in sand or gravel (Cummings and Mayer, 1992); prefers large rivers in stretches with pronounced current and substrate of coarse sand and gravel but has adapted to impoundments in the Cumberland and Tennessee Rivers (Parmalee and Bogan, 1998).

2005 status: State Threatened

2015 status: State Threatened

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	2	3	1	1	1	1	2	3	1	1	1	2	2	2	2	1
2015	2	2	2	2	2	3	1	1	1	1	1	3	1	1	2	2	2	2	2	1

Rationale: Butterfly declined from 18 HUC8s to 9 HUC8s, a 50% decrease, but have remained relatively stable since 1977-1999 (10 HUC8s, a 10% decline). In Illinois, extant populations are in the Ohio, Mississippi, and extreme lower Rock Rivers and populations appear healthy based on recent survey data. Large river habitats are difficult to sample, thus survey data represent a small proportion of the existing community. Individuals of this species were not collected during T-53 and are rarely present in wadeable streams. We recommend more thorough sampling of large rivers to fully assess current threats or population levels.

In Appendix II, we ranked habitat extent, fragmentation, composition, and dispersal as likely to have moderate effects on population viability, mainly because large rivers are subject to threats such as hydrologic disturbance, accumulated pollution and sedimentation. Freshwater Drum have been confirmed as a host for butterfly (Boyer et al., 2011; Section 3: Table 3), which are common throughout the butterfly's range, thus we believe host availability has little to no effect on the population viability of butterfly.

Elephantear (*Elliptio crassidens*)

Specific Habitat: Large rivers with swift current in mud, sand, gravel and rocky substrates (commonly limestone) (Grier, 1922; Dawley, 1947; van der Schalie and van der Schalie, 1950; Cummings and Mayer, 1992; Brim Box et al., 2002; Gagnon et al., 2006).

2005 status: State Threatened

2015 status: State Endangered (ESPB, 2014)

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	2	3	1	1	1	1	2	3	1	1	1	3	2	2	2	1
2015	2	2	2	3	2	3	1	1	1	1	2	3	1	1	2	3	2	2	2	1

Rationale: The current extant range (3 HUC8s) for elephantear has declined 40% from 1977-1999 (5 HUC8s) and 82% historically (17 HUC8s). The only remaining populations in Illinois are in the Wabash and Ohio Rivers, and these populations appear to be mainly mature, non-reproducing individuals. Elephantear was recently upgraded to state endangered (ESPB, 2014). They are large river species and may have an increased risk of threats such as an accumulation of industrial or municipal contaminants, sedimentation, or hydrologic alterations in the form of dams. Elephantear are stable in southern parts of its range, outside of Illinois, but declining or disappearing in the Midwest, thus conservation measures to prevent future loss should be taken.

In Appendix II, we ranked habitat extent, fragmentation, composition, and dispersal as threats likely to have a moderate effect on population viability. Host fish are not known, but are speculated to be Skipjack Herring (Section 3: Table 3), a migratory riverine fish that may be negatively impacted by dams (Smith, 1979). More research is needed to test transformation success on this host and others.

Spike (*Elliptio dilatata*)

Specific Habitat: Medium to large rivers in gravel or mixed sand/gravel; prefers riverine conditions with stronger flow (Cummings and Mayer, 1992; Watters, 1995).

2005 status: State Threatened (ESPB, 2014)

Proposed 2015 status: State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
7 - Species is dependent upon rare or vulnerable habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	2	1	2	2	2	2	1	2	1
2015	2	2	2	2	1	3	1	1	1	1	2	2	1	2	2	2	2	1	2	2

Rationale: The current extant range (18 HUC8s) has declined 55% historically (40 HUC8s), although remained stable or increased since 1977-1999 (15 HUC8s, a 20% increase). While an increase was seen since 1977-1999, several of these new records are isolated points within a drainage that historically held widespread, abundant populations. Hence, we believe that remaining spike populations may be aging or non-reproducing. Habitat requirements for spike are swift rivers with mixed gravel and sand substrates. The habitat that remains in Illinois rivers may be separated by hydrologic disturbances like dams or have increasing sedimentation. Spike are common and abundant in areas outside of Illinois, thus the decline of this species in Illinois is puzzling and conservation measures to prevent future loss should be taken.

In Appendix II, we ranked habitat extent, fragmentation, composition, and structures/infrastructure as threats likely to have a moderate effect on population viability for reasons listed above. Spike use several hosts from different families, including sculpin, a darter, and Rock and Largemouth Bass (Section 3: Table 3). Largemouth Bass are common and widespread, yet do not share similar habitat requirements as spike. The remaining hosts generally prefer clear, rocky-bottomed streams (Smith, 1979) and may be sensitive to habitat degradation.

Northern riffleshell (*Epioblasma rangiana*)

Specific habitat: Medium to large rivers in clear, gravel riffles (Cummings and Mayer, 1992).

2005 status: Extirpated, Federally Endangered, State Endangered

2015 status: Federally Endangered, State Endangered, Reintroduced

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
9 - The Illinois population of this species is disjunct from the rest of the species' range
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	1	2	2	2	1	3	1	1	1	1	2	1	1	2	2	2	2	1	1	3

Rationale: Northern riffleshell were historically present in 2 HUC8s, the Wabash River (Ohio River) and Vermilion River (Wabash River) basin. They were believed extirpated in Illinois by the early 1990s (Cummings and Mayer, 1992) and in Indiana by early 2000s (Fisher, 2006). The extirpation of northern riffleshell populations is likely due to a combination of factors including but not limited to poor water quality, siltation, loss of host fish (NatureServe, 2014), and impacts from dams within the Vermilion River system.

Efforts to repopulate northern riffleshell into the Middle Fork Vermilion and Salt Fork Vermilion River were undertaken in 2011-2014 because no live northern riffleshell had been observed in decades. Population monitoring is on-going, and the majority of translocated adults are surviving as of 2014.

Snuffbox (*Epioblasma triquetra*)

Specific habitat: Medium to large rivers in clear, gravel riffles (Cummings and Mayer, 1992) in swift current, often deeply buried (Baker, 1928; Parmalee and Bogan, 1998).

2005 status: State Endangered

2015 status: Federally Endangered, State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
9 - The Illinois population of this species is disjunct from the rest of the species' range
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	1	1	3	2	3	2	1	2	1
2015	1	2	3	2	1	3	1	1	1	1	3	1	1	3	3	3	2	1	2	2

Rationale: Snuffbox was listed as federally endangered in February of 2012. Historical records indicate snuffbox occurred in 17 HUC8 drainages, but have dramatically decreased by 94% to 1 HUC8 drainage. Currently, it persists at limited sites within the Embarras River above Lake Charleston reservoir.

In Appendix II, we upgraded fragmentation, composition-structure, hosts, dispersal, and structures to likely having a moderate or severe threat to snuffbox population viability or abundance. We believe lack of habitat connectivity due to dams and a large reservoir on the Embarras River is likely having a negative effect on host fish population viability and dispersal, thereby severely limiting dispersal and recruitment efforts by snuffbox. Snuffbox distribution continues to decline and become increasingly isolated. Altered substrate composition from increased sedimentation, turbidity**,** and altered flow impacts riffles, utilized by snuffbox and their hosts. Snuffbox host fish include riffle-dwelling species like percids (*Percina* spp.*)* and cottids (Section 3: Table 3). Within the Embarras River, only *Percina* spp. are present but rare (2011 IDNR surveys). We believe we have greater confidence in understanding community stressors including host fish following T-82 and recent IDNR fish surveys.

Ebonyshell (*Fusconaia ebena*)

Specific habitat: Large rivers in swift water and stable sandy to gravely shoals; thrives in rivers with current in sand, silt, and mud at water depths of 3 to 5 meters (Cummings and Mayer, 1992; Parmalee and Bogan, 1998).

2005 status: State Threatened

2015 status: State Endangered (ESPB, 2014)

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	2	3	1	1	1	1	3	3	1	1	1	1	2	2	2	3
2015	1	2	1	2	2	3	1	1	1	1	3	3	1	1	2	2	2	2	2	3

Rationale: Ebonyshell are currently extant in 4 HUC8s in Illinois, a 78% decline from their historic range (18 HUC8s) and a 43% decline since 1977-1999 (7 HUC8s). Ebonyshell was recently upgraded to state endangered (ESPB, 2014), due to continued range restrictions and low population abundance.

In Appendix II, we upgraded fragmentation, dispersal, and recruitment to having a moderate threat on population viability or abundance. Confirmed host fish for ebonyshell include the Skipjack Herring *Alosa chrysochloris* and, potentially, Goldeneye *Hiodon alosoides* (Section 3: Table 3). Skipjack Herring are an anadromous, migratory species in large rivers that prefer fast water over sand and gravel substrate (Smith, 1979). Structures such as dams can impede their passage, and, thereby, lead to fragmented, isolated populations with minimal dispersal ability for ebonyshell. Another continued severe threat to ebonyshell populations is the invasive zebra mussel *Dreissena polymorpha* within the Mississippi River system.

Pink mucket (*Lampsilis abrupta*)

Specific Habitat: Large rivers with strong current, rocky or boulder substrates, in depths up to 1 meter; also found in deeper waters with slower currents and sand and gravel substrates (USFWS, 1985; Gordon and Layzer, 1989).

2005 status: Federally Endangered, State Endangered

2015 status: Federally Endangered, State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	3	1	3	1	3	1	1	1	1	2	2	1	2	1	3	2	1	2	1
2015	1	3	1	3	1	3	1	1	1	1	2	2	1	2	2	3	2	1	2	1

Rationale: Pink mucket have declined drastically throughout their range and are believed to have always been a small component of the mussel fauna (USFWS, 1985). The most recent extant record in Illinois was collected as dead shell in the Ohio River in 2011. Population declines are likely due to a combination of factors, including but not limited to impacts from dams, dredging, pollution, and navigation projects (NatureServe, 2014). We recommend more thorough sampling of large rivers to fully assess current threats or population levels.

In Appendix II, all values remained unchanged except hosts and dispersal. One of the primary threats to future existence of pink muckets is the lack of dispersal ability, thus we ranked this as a moderate threat to population viability. Known host fish include *Micropterus* spp. and Sauger (Barnhart and Riusech, 1997; Section 3: Table 3). These fish are common in Illinois, although they may not exist concurrently with remaining the population of pink mucket.

Wavy-rayed lampmussel (*Lampsilis fasciola*)

Specific habitat: Small to medium-sized rivers at depths of up to 1 meter in clear, stable riffles with clean substrates of gravel and sand, stabilized with cobble and boulders (Cudmore et al., 2004).

2005 status: State Endangered

2015 status: State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
7 - Species is dependent upon rare or vulnerable habitat
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	1	1	1	1	2	2	1	2	1
2015	1	2	1	2	1	3	1	1	1	1	2	1	1	1	2	2	2	1	2	1

Rationale: Wavy-rayed lampmussel continues to persist within one drainage (HUC8), the Vermilion River (Wabash River) basin, although historically it occurred in 3 drainages. The Vermilion River basin is the westernmost part of its range within the continental United States. Wavy-rayed lampmussel is listed as a species of special concern in Indiana, state threatened in Michigan, and apparently secure in Kentucky.

In Appendix II, we upgraded fragmentation and dispersal as having a moderate threat to population viability or abundance. Populations within the North Fork Vermilion River remain isolated from other extant populations within the Vermilion River system due to low head dams and a reservoir present thus limiting dispersal and genetic flow between populations. We ranked our confidence interval from very low confidence or no information to high confidence since recent host fish trials confirmed several centrarchids (*Micropterus* spp., Longear Sunfish) as main hosts for wavy-rayed lampmussel (Section 3: Table 3). These centrarchids are common in Illinois and occur within the wavy-rayed lampmussel distribution.

Higgins eye (*Lampsilis higginsii*)

Specific habitat: The Mississippi and Illinois River in gravel or sand substrates (Cummings and Mayer, 1992).

2005 status: Federally Endangered, State Endangered

2015 status: Federally Endangered, State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
10 - Illinois hosts a significant proportion of the species' global population

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	2	1	2	2	3	1	1	1	1	2	3	1	2	1	2	2	2	2	1
2015	1	1	1	1	3	2	3	1	1	1	1	3	1	2	2	2	2	1	1	2

Rationale: Higgins eye historically occurred in 12 drainages (HUC8), but range dramatically decreased by 83% and is extant only in the upper Mississippi River (2 HUC8s). Since 2006-2010, efforts to reintroduce Higgins eye into the Rock River near the mouth to the Mississippi River were undertaken, but a recent survey in 2014 for Higgins eye in the Rock River revealed only two live individuals (INHS Mollusk Collection).

In Appendix II, we upgraded invasive species, competitors, dispersal and structures/infrastructures as having moderate or severe threats on Higgins eye population viability or abundance. Higgins eye populations in the Mississippi River continue to be plagued by the invasive zebra mussel *Dreissena polymorpha*. In addition, dispersal rates may be hindered by reproduction failure due to zebra mussel-infested Higgins eye.

With recent propagation efforts at Genoa National Fish Hatchery (initiated in 2000) and their subsequent success of released juveniles and inoculated host fish throughout the upper Mississippi, we believe fragmentation and host fish (Largemouth and Smallmouth Bass, Walleye; Section 3: Table 3) are not a limiting factor. We also believe hydrology, pollutants-sediment and human stresses such as killing and disturbance are less of a threat on population viability or abundance than others stated above.

Louisiana fatmucket (*Lampsilis hydiana*)

Specific Habitat: Medium to small rivers, and reservoirs in mud, mud and sand, or gravel in areas of backwater and slow flow (Howells et al., 1996).

2005 status: None

Proposed 2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I:

4 - Species exists at limited sites
12 - Species' status is poorly known

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	1	1	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Rationale: Louisiana fatmuckets were unconfirmed in Illinois prior to genetic work completed as part of T-82, but were recently confirmed in several drainages in southern Illinois. Their entire distribution is still unknown and the exact taxonomic rank is yet to be determined. While individuals tested are genetically similar to Louisiana fatmuckets, further testing is required to determine whether Illinois populations are true Louisiana fatmuckets. The distribution map presented in this revision reflects the state of our knowledge as of October 2014. We believe more data regarding this species' distribution and true taxonomic status is warranted. Additionally, they are morphologically similar to fatmucket (*L. siliquoidea*) and coexist in at least one drainage, thus more samples and genetic testing may reveal the extent of the range overlap.

In Appendix II, we estimated threats to the Louisiana fatmucket relative to threats to similar mussels with ranges in southern Illinois. We believe the greatest threats to population viability are hydrologic disturbance and sedimentation, both of which are presumed threats to most freshwater mussels. Known hosts are Green Sunfish and Blue and Channel Catfish (Section 3: Table 3), common species (with the exception of Blue Catfish) in the current range of Louisiana fatmucket in Illinois.

Pocketbook (*Lampsilis ovata*)

Specific habitat: Large rivers in coarse sand or gravel (Cummings and Mayer, 1992).

2005 status: None

Proposed 2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I:

4 - Species exists at limited sites
12 - Species' status is poorly known

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	1	2	2	2	1	2	1	1	1	1	2	1	1	3	3	3	1	1	2	3

Rationale: The pocketbook is often confused with plain pocketbook (*L. cardium*) and current extent in Illinois is unknown. Historically, pocketbook was present in the Wabash and Ohio Rivers (4 HUC8s) bordering Illinois and currently occurs sporadically within the Ohio River (75% decline, 1 HUC8). It likely is extirpated from the Wabash River where it appears to have been replaced by *L. cardium* (Cummings and Mayer, 1997). Fisher (2006) reported live, reproducing populations of pocketbook in the upper Wabash mainstem and its lower tributary, East Fork White River in Indiana. Pocketbook is currently not listed in Indiana, and state endangered in Kentucky and Ohio. According to NatureServe (2014), pocketbook is imperiled in Indiana.

No known host fish information is available in the current literature (Watters et al., 2009). We recommend upgrading to Species in Greatest Need of Conservation because key components of the species' biology and distribution are poorly understood. Further research on the extent of this species in Illinois would be beneficial.

Creek heelsplitter (*Lasmigona compressa*)

Specific Habitat: Usually found in creeks and headwaters of small to medium rivers. Prefers fine gravel or sand and typically is in slow-moving currents near the edge or above or below riffles (van der Schalie, 1938; Cummings and Mayer, 1992; Watters, 1995).

2005 status: Species in Greatest Need of Conservation

2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I: None

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	2	3	1	2	1	1	1	1	2	1	1	1	1	2	2	1	3	1
2015	1	1	2	2	1	2	1	1	1	1	1	1	1	1	1	2	1	1	2	1

Rationale: The current extant range (21 HUC8s) is nearly the same as the historic range (22 HUC8s), and creek heelsplitters have slightly increased in range since 1977-1999 (19 HUC8s). We believe this change is due to an increased sampling effort in smaller streams, which revealed more live and extant records for this species. Small streams are widespread throughout Illinois and threats in small-stream ecosystems are spread among many tributaries. However, channelization can significantly alter habitat in creeks and small streams for decades. Creek heelsplitters comprise a very small portion of the mussel fauna, thus populations at each site are low but appear stable.

In Appendix II, we downgraded hydrologic disturbance, mortality, hosts, and direct human disturbance to low or moderate threats to population viability or abundance. Creek heelsplitters use hosts from many fish families, and most of the host species are common throughout Illinois (Section 3: Table 3). We also believe we have greater confidence in dispersal and recruitment values following T-53 and these are low and moderate threats to population viability, respectively.

Flutedshell (*Lasmigona costata*)

Specific habitat: In medium-sized rivers in sand/mud, coarse sand and gravel, or fine gravel in slow to moderate flow (Cummings and Mayer, 1992; Parmalee and Bogan, 1998).

2005 status: Species in Greatest Need of Conservation

2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I:

4 - Species exists at limited sites
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	1	1	1	1	2	2	2	2	1
2015	1	1	2	2	1	3	1	1	1	1	1	1	1	1	2	2	1	1	1	2

Rationale: Flutedshell is known from 27 drainages (HUC8) and experienced a 48% range reduction (14 HUC8s) according to surveys during 1977-1999. Since 2000, it continued to decline and is currently found in 12 HUC8s (approximately 14% range reduction since 1977-1999, and a 55% decline overall).

In Appendix II, we upgraded composition-structure, dispersal, and structures-infrastructures (i.e., dams) to moderate threats on flutedshell population viability or abundance. Flutedshell are often found in stable substrates of coarse sand, gravel, and riffle habitat with moderate flow. Substrates could be subject to change through sedimentation, hydrology variances, and structures such as dams, thereby influencing fish and mussel communities inhabiting it.

We downgraded host fish, mortality, and human stresses such as killing and disturbance to having little or no threat on population viability or abundance. Recent host fish studies reveals flutedshell to be a host generalist with the potential to utilize numerous fishes within and across several families (Section 3: Table 3). Even though flutedshell can host on numerous fish, dispersal limitations should still be considered as a moderate threat to their population due to more imminent habitat stressors, increasingly isolated populations, physical barriers, and competition of utilizing host species, for instance.

Scaleshell (*Leptodea leptodon*)

Specific Habitat: Medium to large rivers with moderate to high gradients in a variety of substrates including gravel, cobble, boulders, and occasionally mud or sand (Buchanan, 1980; Oesch, 1995), particularly in areas with stable channels (Buchanan, 1980).

2005 status: Extirpated

2015 status: Federally Endangered, State Endangered (ESPB, 2014)

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
9 - The Illinois population of this species is disjunct from the rest of the species' range
10 - Illinois hosts a significant proportion of the species' global population
12 - Species' status is poorly known

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	2	2	2	3	2	2	1	1	1	1	1	2	1	3	3	2	3	1	1	2

Rationale: Scaleshell were believed extirpated in Illinois prior to a recent find during a river drawdown in the Illinois River in 2013, the only recent extant record for Illinois. The individual collected was less than 10 years old via external aging, thus recent reproduction from a source population is likely. Location of the source population remains unknown. Sporadic records from 9 HUC8s in Illinois mean that scaleshell have declined at least 88% from their historic range. Scaleshell have a burrowing nature that makes them difficult to find and are primarily found in large rivers. Scaleshell were not collected during T-53, and we recommend more thorough sampling of large rivers to fully assess current threats or population levels.

Scaleshell have declined throughout their range and most remaining populations are tenuous or in need of more data (NatureServe, 2014). Reasons for decline include channel alteration, sedimentation, hydrologic disturbance, degraded water quality, and genetic isolations, all of which are future threats. We ranked stresses in Appendix II accordingly. Freshwater Drum have been confirmed as a host for scaleshell (Barnhart et al., 1998; Section 3: Table 3), which are common throughout the Illinois River, thus we believe host availability has little to no effect on the population viability.

Black sandshell (*Ligumia recta*)

Specific habitat: Medium to large rivers in riffles or raceways in gravel or firm sand (Cummings and Mayer, 1992).

2005 status: State Threatened (ESPB, 2014)

Proposed 2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I: None

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	1	1	1	1	3	2	2	2	1
2015	1	2	1	1	1	2	1	1	1	1	1	1	1	1	2	1	1	1	1	3

Rationale: Although black sandshell historically occurred in 32 drainages (HUC8), since 1977-1999 it remained stable and increased in range by approximately 36% (15 HUC8s from 11 HUC8s). We believe this change is due to an increased sampling effort during T-53 in tributaries to large rivers, which revealed more live and extant records for this species. We believe populations are stable and increasing in smaller streams and larger rivers such as the Rock River.

In Appendix II, we downgraded hydrology, pollutants-sediment, hosts, recruitment, mortality, killing, and disturbance to having little or no threat on population viability or abundance. Black sandshell is a host generalist, utilizing common species such as Bluegill, Largemouth Bass, Crappie, Walleye, and Sauger (Section 3: Table 3). A few of these sportfish species are readily stocked in the state. Hence, this gives us a moderate to high confidence that host fish are not a limiting factor in black sandshell population viability or abundance. Of special note, the zebra mussel within the Rock River system historically has not been present, but a few individuals have been collected within the last several years. Monitoring zebra mussel infestation in the Rock River system should be an important future consideration.

We upgraded fragmentation, dispersal, and structures-infrastructures to having moderate or severe threats to population viability or abundance. Several dams are present throughout the Rock River system and elsewhere in the black sandshell's range. Dispersal (via host fish) and fragmentation should still be of concern. To increase population viability and repopulate some of its historical range, access (via fish passage for instance) is necessary for migratory host fishes.

Spectaclecase (*Margaritifera monodonta*)

Specific habitat: In medium to large rivers in mud, sand gravel, cobble, and boulders in relatively shallow riffles and shoals with slow to swift current; found in tree stumps and in beds of rooted vegetation; may aggregate under slab boulders or bedrock shelves (Buchanan, 1980; Oesch, 1995; Parmalee and Bogan, 1998; Baird, 2000).

2005 status: Federally Endangered, State Endangered

2015 status: Federally Endangered, State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
11- Species is representative of a broad array of other species found in particular habitat
12 - Species' status is poorly known

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	2	1	2	2	3	1	1	1	1	2	3	1	1	1	3	2	2	2	1
2015	1	3	1	3	2	3	1	1	1	1	2	3	1	1	2	3	2	2	2	1

Rationale: Since 2000, spectaclecase has been found extant in only a few locations within the Mississippi River bordering Illinois (1 HUC8 of 6 HUC8s historically). It is considered extirpated from Indiana and Kansas, and limited extant populations are known in Missouri and the upper Mississippi River near St. Croix, Wisconsin.

In Appendix II, we upgraded fragmentation, disturbance/hydrology, and dispersal as having a moderate to severe effect on population viability or abundance. Spectaclecase populations are becoming increasingly isolated and disjunct often leading to local, extirpated populations thereby becoming more vulnerable and susceptible to habitat, community and population stresses. Even with many host trials on a multitude of fish species, there remains no known host for spectaclecase (Section 3: Table 3). This lack of information limits resource managers in decision-making to best augment spectaclecase's dwindling populations. Continued research into the life history of spectaclecase is vital to effectively manage their current populations.

Bankclimber (*Plectomerus dombeyanus*)

Specific habitat: Medium to large rivers, oxbow lakes, and lowland ditches with slow to moderate current in clay, mud, sand or rocky substrates (Oesch, 1984, Williams et al., 2008).

2005 status: None

Proposed 2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I:

4 - Species exists at limited sites
12- Species' status is poorly known

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	1	2	1	1	2	2	1	1	1	1	1	2	1	1	2	2	1	1	1	2

Rationale: In 2012, bankclimber was recently discovered in the Ohio River bordering Illinois (Tiemann et al., 2013). It occurs within Gulf Coast drainages of Alabama's Mobile Basin to eastern Texas' San Jacinto River and then northwardly in the Mississippi River to the mouth of the Ohio River (Oesch, 1995, Howells et al., 1996, Williams et al., 2008). It appears to be expanding its range with documented occurrences in the lower Tennessee River in Kentucky and Tennessee (Parmalee and Bogan, 1998).

Host fish for bankclimber remain unknown.

We recommend upgrading to Species in Greatest Need of Conservation because key components of the species' biology and distribution are poorly understood.

Orangefoot pimpleback (*Plethobasus cooperianus*)

Specific habitat: Medium to large rivers in sand, gravel, and cobble in riffles and shoals, in deep water and steady currents as well as shoals and riffles (Bogan and Parmalee, 1983; USFWS, 1984; Gordon and Layzer, 1989; Cummings and Mayer, 1992).

2005 status: Federally Endangered, State Endangered

2015 status: Federally Endangered, State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	2	1	2	2	3	1	1	1	1	2	3	1	1	1	3	2	2	3	1
2015	1	2	1	2	2	3	1	1	1	1	2	3	1	3	2	3	2	1	1	3

Rationale: Orangefoot pimpleback are known from the Ohio River, with records dating pre-1950 and the latest extant record in Illinois in1994 (INHS Mollusk Collection). It is considered extirpated in much of its range including Indiana, Ohio, and Pennsylvania. Cummings and Mayer (1995) reported, "though considered rare, live individuals have been regularly documented in the Ohio River in the vicinity of Metropolis, Illinois."

In Appendix II, we upgraded genetics, dispersal, and structures-infrastructures as having a moderate to severe threat to population viability or abundance. Due to the isolated populations, dispersal and gene flow are especially vulnerable. There are no known host fish for *P. cooperianus* although other *Plethobasus* species (*P. cyphyus*) utilize small-bodied cyprinids for main hosts (Section 3: Table 3). Large structures such as dams could deter viable population dispersal via host fish. Although this species may have been commercially harvested at one time, direct human threats such as harvesting are no longer occurring for this particular species in Illinois; therefore, we downgraded human killing and disturbance as having little or no threat to population viability or abundance.

Sheepnose (*Plethobasus cyphyus*)

Specific Habitat: Medium to large rivers; often associated with riffles and gravel or cobble substrates in depths greater than two meters in slight to swift currents; sand, mud or gravel bottoms (Gordon and Layzer, 1989; Parmalee and Bogan, 1998).

2005 status: Federal Candidate, State Endangered

2015 status: Federally Endangered, State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
9 - The Illinois population of this species is disjunct from the rest of the species' range
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	3	2	1	2	1	3	2	2	2	1
2015	3	3	2	3	2	3	1	1	1	1	1	2	1	2	3	3	1	1	2	2

Rationale: The current extant range for sheepnose has declined 50% from 1977-1999 (3 versus 6 HUC8s) and 81% historically (16 HUC8s). The Kankakee River supports the most extant records, with others in the Rock and Mississippi Rivers. Sheepnose have declined throughout their range and now may be below the critical level to persist (NatureServe, 2014). Population declines are likely due to a combination of factors, including impacts from dams, dredging, pollution, and commercial harvest. The availability of cobble riffles with adequate water depth is likely a limiting factor, as well as connectivity between individuals and populations for reproduction and dispersal.

In Appendix II, we ranked habitat extent, fragmentation, hydrologic disturbance, dispersal, and recruitment as likely to have a severe effect on population viability, and habitat composition, invasive species, and structures (e.g., dams) are likely to have a moderate effect on population viability. Recent host trials demonstrated that sheepnose may use many minnow species as hosts (Section 3: Table 3), several of which are common throughout Illinois, thus we do not believe that hosts are a limiting factor for sheepnose.

Clubshell (*Pleurobema clava*)

Specific habitat: Medium to large rivers in gravel, mixed gravel and sand, clean, coarse sand and cobble in current; often buries several inches in depth (Cummings and Mayer, 1992; Watters et al., 2009).

2005 status: Federally Endangered, State Endangered

2015 status: Federally Endangered, State Endangered, Reintroduced

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
9 - The Illinois population of this species is disjunct from the rest of the species' range
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	1	1	2	1	3	2	1	2	1
2015	1	3	2	2	1	3	1	1	1	1	2	1	1	3	3	3	2	1	2	3

Rationale: Pre-1950, clubshell was found in 5 drainages (HUC8) and then sharply declined to being extant in one HUC8, the Vermilion River (Wabash River) drainage. Within the Vermilion River basin, extant shell records from the last decade exist only from the Middle Branch North Fork Vermilion River.

In Appendix II, we upgraded fragmentation, composition-structure, genetics, dispersal, and structures-infrastructures to moderate or severe threats to population viability or abundance. Several low head dams exists within the Vermilion River system, causing population fragmentation, low dispersal and genetic depression that has severely impacted the clubshell population within the Vermilion River system, especially since host fish mainly include small-bodied cyprinids (Section 3: Table 3).

Efforts to repopulate clubshell into the Middle Fork Vermilion and Salt Fork Vermilion River were undertaken in 2011-2014 since no live clubshell has been observed in decades. Population monitoring is on-going, and the majority of translocated adults are surviving as of 2014.

Ohio pigtoe (*Pleurobema cordatum*)

Specific habitat: Medium to large rivers in sand or gravel in areas of moderate flow; favors areas with strong current in firm sand and gravel substrates (Cummings and Mayer, 1992; Parmalee and Bogan, 1998).

2005 status: State Endangered

2015 status: State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
9 - The Illinois population of this species is disjunct from the rest of the species' range

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	2	3	1	1	1	1	2	3	1	1	1	2	2	2	2	1
2015	1	1	1	2	2	3	1	1	1	1	1	3	1	2	2	2	1	1	1	3

Rationale: The Ohio pigtoe was historically present in 5 drainages (HUC8); but currently persists only in the Ohio River (1 HUC8). It is a species of concern in Indiana but not state-listed in Kentucky. Further studies for Ohio pigtoe populations within the Ohio River bordering Illinois should be considered to gain a better understanding as to whether this species is persisting and reproducing. Identifying whether their populations are stable can assist in downgrading state status and, ultimately, delisting this species.

In Appendix II, we downgraded hosts, mortality and human stresses such as killing and disturbance to having little or no known effect on population viability or abundance. Host fish studies within the last decade identified a couple small-bodied cyprinids as (potential) main host, however further host and life history studies are warranted for this mussel species. Continued habitat stresses, dam structures, and minimal migration of small-bodied host fishes can become limiting factors in successful dispersal and recruitment opportunities for fragmented populations throughout the Ohio River; therefore, we upgraded genetics, dispersal, recruitment, and structure-infrastructure to having a moderate or severe effect on population viability or abundance.

Fat pocketbook (*Potamilus capax*)

Specific Habitat: Medium to large rivers, in sand, mud, and fine gravel substrates and flowing water (USFWS, 1989), or in slow-flowing water (often near the bank) in mud or sand (Cummings et al., 1990). Recently found to be tolerant of depositional areas that are usually unfavorable to other mussels (USFWS, 1989), such as man-made ditches and bayous, sloughs, and streams (Miller and Payne, 2005).

2005 status: Federally Endangered, State Endangered

2015 status: Federally Endangered, State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	2	3	1	1	1	1	1	3	1	1	1	2	2	2	3	1
2015	1	3	1	3	2	3	1	1	1	1	1	3	1	1	1	2	2	2	3	1

Rationale: Fat pocketbooks have declined 54% from their historic range (5 HUC8s versus 11 HUC8s). In Illinois, the only remaining extant populations are in the Wabash and Ohio Rivers and a few tributaries. Fat pocketbooks are common in the lower Wabash and Ohio, but densities are low. Large river habitats are difficult to sample, thus survey data represent a small proportion of the existing community.

In Appendix II, we ranked fragmentation and hydrologic disturbance as severe threats to population viability, because the Wabash and Ohio Rivers have increasing amounts of sedimentation and have major hydrologic disturbances. Freshwater Drum have been confirmed as a host for fat pocketbook (Section 3: Table 3), which are common throughout their range, thus we believe host availability has little to no effect on the population viability of fat pocketbook.

Bleufer (*Potamilus purpuratus*)

Specific Habitat: Large rivers in mud or mixed mud and gravel in areas of backwater or slow flow (Cummings and Mayer, 1992; Parmalee and Bogan, 1998).

2005 status: None

Proposed 2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I:

4 - Species exists at limited sites
12 - Species' status is poorly known

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	2	2	1	2	1	2	1	1	1	1	1	2	1	1	2	2	1	1	1	1

Rationale: Bleufer are at the edge of their northern range in Illinois and are sporadic in the state. The historic range of bleufer is 5 HUC8s and current extant records are in 4 HUC8s, two of which are new records for the state. The current range of this species is unknown, thus we believe more data regarding this species' distribution is warranted. Additionally, bleufer resemble pink heelsplitter (*P. alatus*), thus genetic testing of nearby populations of pink heelsplitter may elucidate distributions. Bleufer's preferred habitats (e.g., slow flow in mud or gravel) are not limited in Illinois, thus we believe populations are likely to increase. Low gradient, backwater areas were not sampled extensively in T-53 or historically, thus this species may be more widespread than current data suggest.

In Appendix II, we estimated threats to the bleufer relative to threats to similar low gradient stream mussels, given our limited knowledge of bleufer's preferred habitat. Hosts are assumed to be Warmouth and Golden Shiner, and, potentially, Freshwater Drum (as with other *Potamilus* spp.) although there are no host trial confirmations (Howells, 1995; Section 3: Table 3). All are common species in the current range of bleufer in Illinois. We recommend upgrading to Species in Greatest Need of Conservation because key components of the species' biology and distribution are poorly understood.

Kidneyshell (*Ptychobranchus fasciolaris*)

Specific habitat: Medium to large rivers in gravel (Cummings and Mayer, 1992). Appears tolerant to a variety of habitats with the most suitable including moderately strong current and coarse gravel and sand substrates (Parmalee and Bogan, 1998).

2005 status: State Endangered

2015 status: State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
9 - The Illinois population of this species is disjunct from the rest of the species' range
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	1	1	2	2	3	2	1	2	1
2015	1	2	1	2	1	3	1	1	1	1	2	1	1	2	3	3	2	1	2	2

Rationale: Kidneyshell have declined 71% from their historic range (7 HUC8s versus 2 HUC8s). They currently exist in the Vermilion (Wabash River drainage) and Embarras river drainages. Survey efforts during T-53 only revealed dead shell in the Vermilion drainage, but populations within the Embarras River system appear to be persistent.

In Appendix II, we upgraded fragmentation, dispersal, and structures-infrastructure as having a moderate or severe threat to population viability or abundance. Kidneyshell primarily utilize darters as hosts (*Etheostoma* spp. and *Percina* spp., similar to other *Ptychobranchus* species; Haag and Warren 2007; Section 3: Table 3). Due to the specialized mussel-host relationship, we believe factors that negatively impact host fish (e.g., sedimentation, hydrologic disturbance, other habitat loss) are a moderate threat to kidneyshell population viability or abundance. Further, kidneyshell may be too far below the population threshold in the Vermilion River (Wabash River) drainage to successfully recolonize its former range within this basin. Conservation of remaining stocks is critical, and this species may be a candidate for future restoration efforts.

Gulf mapleleaf (*Quadrula nobilis*)

Specific habitat: Large rivers in swift to sluggish water in mud to sand or gravel substrates (Williams et al., 2008).

2005 status: None

Proposed 2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
12- Species' status is poorly known

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	1	1	1	1	1	2	1	1	1	1	2	1	1	2	2	2	1	1	1	3

Rationale: Gulf mapleleaf occurs within the Gulf Coast drainages of Alabama's Mobile Basin to eastern Texas' San Jacinto River and then northwardly in the Mississippi River to the Ohio River in northwestern Kentucky (Howells et al., 1996, Serb et al., 2003). Historical records indicate the Gulf mapleleaf occurred in 3 drainages in Illinois. Since 2000, extant records exist for 2 drainages—a live occurrence in the Ohio River bordering Illinois and, additionally, a population discovered in the Saline River (Ohio River drainage) in 2005. Southern Illinois appears to be the northernmost edge of its extant range.

Gulf mapleleaf utilize ictalurids as host fish with observed transformation success on Channel Catfish (*Ictalurus punctatus*) and Flathead Catfish (*Pylodictis olivaris*) (Section 3: Table 3). Hosts are stable and common throughout Illinois, thus we do not believe they are a limiting factor to Gulf mapleleaf's population persistence.

Gulf mapleleaf are morphologically similar to mapleleaf (*Q. quadrula*) and often cannot be distinguished without genetic analysis. Future research or analysis of genetic material is necessary to grasp the current distribution of this species in Illinois. We recommend upgrading to Species in Greatest Need of Conservation because taxonomic placement and distribution are poorly understood.

Salamander mussel (*Simpsonaias ambigua*)

Specific Habitat: Found where its host, *Necturus maculosus* exists, in areas of silt or sand within medium to large rivers or lakes, often under large flat stones (Cummings and Mayer, 1992; Watters, 1995).

2005 status: State Endangered

Proposed 2015 status: State Endangered, consider as a Federal candidate

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	3	2	1	2	2	3	2	1	2	1
2015	2	2	3	2	1	3	1	1	1	1	2	1	1	2	3	2	1	1	2	1

Rationale: The salamander mussel is currently found in 1 HUC8, a 91% decline from historic levels (12 HUC8s) and a 50% decline from 1977-1999 (2 HUC8s). Salamander mussel records are sporadic throughout the state, and requires habitat specific to the host, mudpuppy (Section 3: Table 3). Both host and mussel are cryptic and difficult to locate via normal methods (e.g., electrofishing and tactile surveys), because animals are often in currents under large slab rocks. We recommend more thorough, targeted samples for salamander mussels in areas with historic records and suitable habitats.

No live salamander mussels have been collected in Illinois, although fresh shell vouchers from 2000-2014 have been collected. If populations do exist, they are likely low abundance and density and at risk of extirpation. We believe salamander mussels should be considered for federal listing status, as habitat extent, fragmentation, composition, hydrologic disturbance, sedimentation, host availability, genetic stresses, dispersal, recruitment and human disturbance are moderate or severe risks to population viability.

Rabbitsfoot (*Theliderma cylindrica*)

Specific habitat: Medium to large rivers in sand and gravel in depths up to 3 meters (Cummings and Mayer, 1992). In addition, found in small to medium rivers in gravel and cobble bars with moderate to swift current (Gordon and Layzer, 1989).

2005 status: State Endangered

2015 status: Federally Threatened, State Endangered

Changes to Criteria in Appendix I:

1 - Illinois or federal threatened or endangered species
3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	3	1	1	2	1	3	2	1	2	1
2015	1	2	1	2	1	3	1	1	1	1	3	1	1	2	2	3	2	1	2	3

Rationale: Rabbitsfoot was listed as federally threatened in October 2013. In Illinois, it is extant in two drainages, the Vermilion River (Wabash River) basin and the Ohio River. Current extant records in the Ohio River basin are extremely sparse (1 live individual), and the current extent for rabbitsfoot in the Ohio River is unknown; intensive survey effort is recommended to determine its current range and status. Threats to the Ohio River are numerous, including hydrologic disturbance, sedimentation, and invasive species. Rabbitsfoot persists within the North Fork Vermilion River system but is likely extirpated in the rest of the Vermilion River (Wabash River) basin.

In Appendix II, we upgraded fragmentation, dispersal and structures-infrastructures as having a moderate to severe threat on population viability or abundance. Re-colonization of rabbitsfoot to its historic range within the Vermilion River basin is unlikely due to host fish (small-bodied cyprinids; Section 3: Table 3) dispersal barriers in the form of a reservoir and multiple dams on the North Fork Vermilion River and Vermilion River.

Monkeyface (*Theliderma metanevra*)

Specific Habitat: Medium to large rivers in gravel or mixed sand and gravel (Cummings and Mayer, 1992).

2005 status: Species in Greatest Need of Conservation

Proposed 2015 status: State Threatened

Changes to Criteria in Appendix I:

4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	1	1	1	1	2	2	2	2	1
2015	1	2	1	2	1	3	1	1	1	1	2	1	1	1	2	2	2	2	2	1

Rationale: The current extant range (15 HUC8s) has declined 31% historically (22 HUC8s). Furthermore, extant records are isolated in several drainages in Illinois and may not persist during a stochastic mortality event (e.g., drought, pollutant spill, etc.).

In Appendix II, we ranked fragmentation and dispersal as threats likely to have a moderate effect on population viability for reasons listed above. Monkeyface hosts are most recently shown to be mainly smaller bodied minnow species (Section 3: Table 3), several of which are common in Illinois (e.g., Creek Chub, *Semotilus atromaculatus*, Smith, 1979). However, because the hosts are small-bodied, they may have limited mobility, which could further hinder dispersal in fragmented habitat (e.g., due to dams).

Purple lilliput (*Toxolasma lividum*)

Specific Habitat: Inhabits small to medium-sized rivers, in slow to swift currents, in mud, sand and gravel substrates or shallow, rocky gravel points and sandbars (Cummings and Berlocher, 1990; Parmalee and Bogan, 1998; Williams et al., 2008). Recent sampling in T-82 revealed most individuals in silty areas along stream edges.

2005 status: State Endangered

2015 status: State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	1	1	1	1	2	2	1	2	1
2015	1	2	2	2	1	3	1	2	1	1	1	1	1	2	3	2	1	1	2	1

Rationale: Purple lilliputs have declined 57% from their historical range (7 HUC8s compared to 3 HUC8s), although they have remained stable since 1977-1999 (3 HUC8s). Although their range has declined, recent targeted sampling in T-82 revealed several healthy populations in two watersheds and it may be more common than previously believed. However, lilliput (*T. parvum*) are found throughout the entire range of purple lilliput and *T. parvum* are found in similar habitats and are typically locally abundant. This suggests that *T. lividum* may have a specific habitat or life history requirement that makes it vulnerable to population decline.

In Appendix II, we ranked habitat fragmentation, hydrologic disturbance, predation, and dispersal as moderate or severe threats to population viability due to the isolation of existing populations, the predation risk due to edge-preference, and the lack of mobility of host fish. Known hosts are Green and Longear Sunfish, species common throughout Illinois (Section 3: Table 3), although recent host trials have not been completed.

Pistolgrip (*Tritogonia verrucosa*)

Specific habitat: Medium to large rivers in swift to sluggish water in mud, sand and/or gravel substrates (Williams et al., 2008).

2005 status: None

Proposed 2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I:

5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	1	1	1	2	1	2	1	1	1	1	1	1	1	1	2	2	1	1	1	2

Rationale: Historically present in 38 drainages (HUC8), pistolgrip declined in range and was found in 23 HUC8s during 1977-1999. Since 2000, pistolgrip has been found in 29 drainages. We believe this change, in part, is due to an increased sampling effort during T-53, which revealed more live and extant records for this species. Although pistolgrip can be found across the state, it appears to be shrinking within its range, particularly the northern and western edges. We also see this retraction occurring in its northern and westernmost range within the continental United States, as pistolgrip is state threatened in Wisconsin and state endangered in Iowa. It is considered critically imperiled in the Dakotas and imperiled in Minnesota (NatureServe, 2014).

Primary threats to pistolgrip include hydrology disturbances, sedimentation, dispersal and recruitment efforts, and structures (i.e., dams). Pistolgrips are a host family specialist, primarily utilizing bullheads, Channel and Flathead Catfish (Section 3: Table 3). These species are common throughout Illinois, but may be unable to traverse dams or other impediments to disperse juvenile mussels. Although pistolgrip is commonly found in soft substrates along edges, it is not found in very silty areas thus increases in sedimentation is likely to have a moderate effect on population viability or abundance.

Ellipse (*Venustaconcha ellipsiformis*)

Specific Habitat: Found in small to medium-sized streams with swift current in clear water with sand and/or gravel. (van der Schalie and van der Schalie, 1963; Cummings and Mayer, 1992; Watters, 1995).

2005 status: Species in Greatest Need of Conservation

2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I:

3 - Species has low population numbers
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	2	1	1	2	1	3	1	1	1	1	2	1	1	1	1	1	2	1	2	1
2015	2	2	3	2	1	3	1	1	1	1	2	1	1	1	2	2	2	1	2	1

Rationale: Ellipse have declined 28% from their historical range (21 HUC8s compared to 15 HUC8s in 2000-2013), although they have slightly increased in range (15%) since 1977-1999 (13 HUC8s). We believe this change is due to an increased sampling effort in smaller streams, which revealed more live and extant records for this species. Ellipse seem to prefer clear streams, and may be at risk to sedimentation and hydrologic disturbance.

In Appendix II, we ranked habitat fragmentation, composition, population dispersal and recruitment as moderate or severe threats to population viability due to ellipse's habitat specificity and isolated populations in some watersheds. Ellipse rely primarily on sculpins and darters as hosts (Section 3: Table 3), which are species sensitive to water quality degradation that also have limited long-distance mobility.

Rayed bean (*Villosa fabalis*)

Specific habitat: Lakes, small to large streams in sand or gravel (Cummings and Mayer, 1992); often associated with being buried among roots of vegetation (e.g., water willow, water milfoil) in and adjacent to riffles and shoals (Ortmann, 1919).

2005 status: Extirpated, Federal Candidate, State Endangered

2015 status: Federally Endangered, State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
9 - The Illinois population of this species is disjunct from the rest of the species' range
11- Species is representative of a broad array of other species found in particular habitat
12 - Species' status is poorly known

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population Stresses				Human Stresses		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2015	2	2	2	2	1	3	1	1	1	1	2	1	1	3	3	3	1	1	1	2

Rationale: Rayed bean were historically present in 2 HUC8s, the Embarras River and Vermilion River (Wabash River) basins. Rayed bean were considered extirpated in Illinois by the mid-1990s (Cummings and Mayer, 1997). The extirpation of rayed bean was likely due to limiting factors such as poor water quality, habitat loss due to siltation, loss or limited dispersal of host fish (NatureServe, 2014), and impoundment impacts from dams within the Vermilion and Embarras River systems.

A shell was vouchered in 2011 (catalogued as recently dead, or considered extant) from the North Fork Vermilion River during T-53 surveys [INHS 41377]. If populations do exist, they are low abundance and density. We believe habitat extent, fragmentation, composition, hydrologic disturbance, sedimentation, host availability, genetic stresses, dispersal, recruitment and human disturbance are moderate or severe risks to population viability. Targeted sampling in specific habitats (i.e., along vegetation patches near riffles or shoals) is required to determine whether any viable rayed bean populations remain in Illinois. Further, confirmed fish hosts for rayed bean are not present in Illinois, thus fish hosts for Illinois populations are unknown.

Rainbow (*Villosa iris*)

Specific habitat: Small to medium-sized streams in coarse sand or gravel (Cummings and Mayer, 1992). Occurs in riffles, along emerging vegetation edges and in gravel and sand in moderate to strong current (Parmalee and Bogan, 1998).

2005 status: State Endangered

2015 status: State Endangered

Changes to Criteria in Appendix I:

3 - Species has low population numbers
4 - Species exists at limited sites
5 - Species has declined in abundance since 2000
6 - Species has declined in range since 2000
7 - Species is dependent upon rare or vulnerable habitat
9 - The Illinois population of this species is disjunct from the rest of the species' range
11- Species is representative of a broad array of other species found in particular habitat

Changes and additions to Appendix II:

	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	1	1	1	1	2	2	1	2	1
2015	1	3	1	2	1	3	1	1	1	2	2	1	1	2	3	2	2	1	1	3

Rationale: Historically, rainbow was present in 15 drainages (HUC8); it is currently extant only in the Vermilion River (Wabash River) drainage. This population is isolated from the nearest populations in Wisconsin (state endangered) and Indiana (unlisted).

In Appendix II, we upgraded fragmentation, prey/food, genetics, dispersal and structures-infrastructure to having moderate or severe effects on population viability or abundance. On-going threats to dispersal and gene flow include hydrologic disturbance and structures, as several low head dams and a reservoir separate the North Fork Vermilion populations from the remaining populations. This species is frequently observed buried or partially buried along edges and near or within riffles. Predation may be a threat due to rainbow's small, thin shell, although not much is known regarding mussel predation. Rainbow is a host generalist, using centrarchids, percids, small-bodied cyprinids, *Gambusia,* and a cottid species (Section 3: Table 3). These fish are relatively common in Illinois yet have limited dispersal ability.

Little spectaclecase (*Villosa lienosa*)

Specific habitat: Small creeks to medium-sized rivers usually along the banks in slower currents; prefers sand or mud substrates particularly when rich in detritus (Clench and Turner, 1956; Heard, 1979).

2005 status: State Threatened (ESPB, 2014)

Proposed 2015 status: Species in Greatest Need of Conservation

Changes to Criteria in Appendix I:

Removal of Rare (low population) designation

Changes and additions to Appendix II:

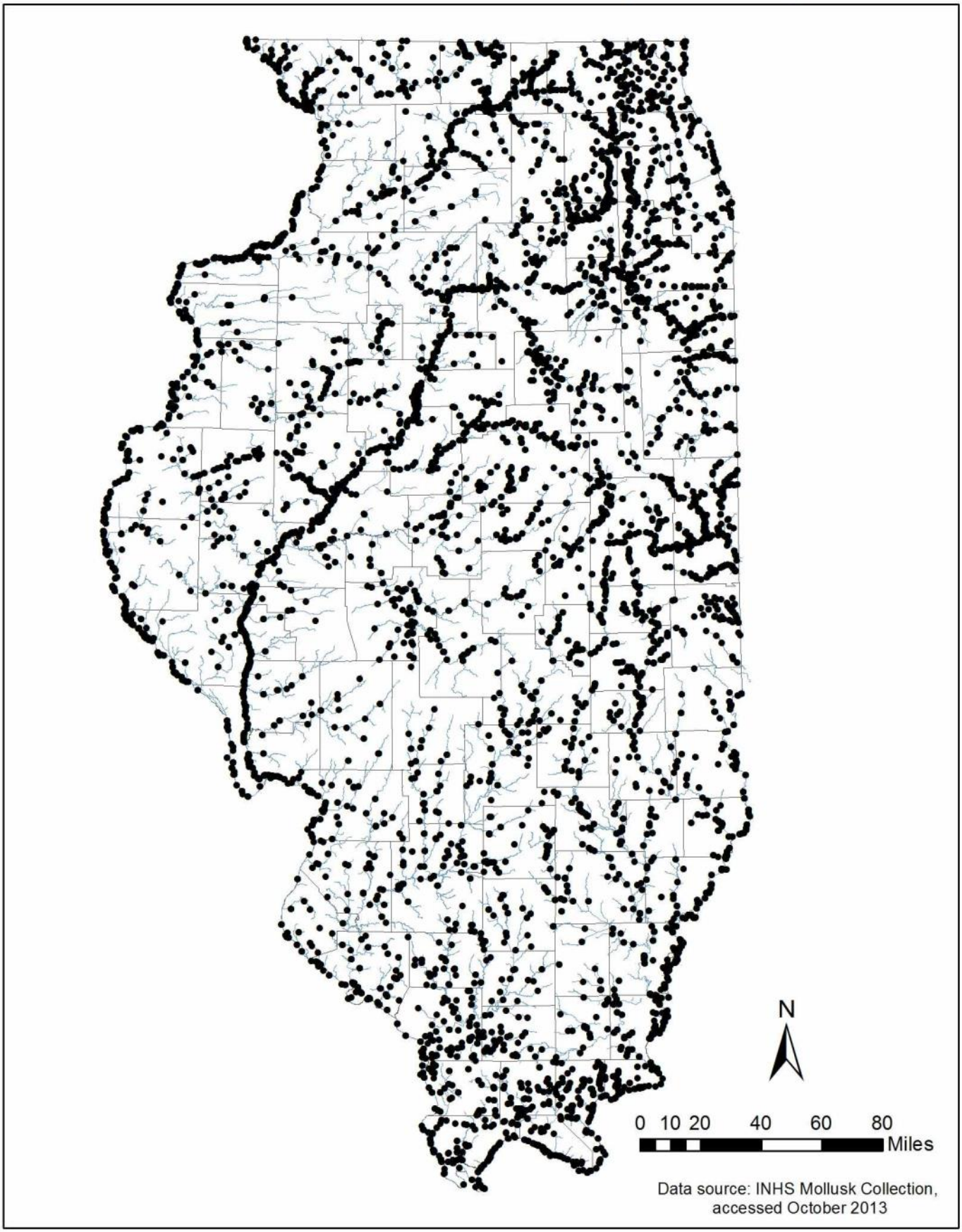
	Habitat Stresses						Community Stresses							Population				Human		
	Extent	Fragmentation	Composition-structure	Disturbance/Hydrology	Invasives/Exotics	Pollutants-Sediment	Competitors	Predators	Parasites/Disease	Prey/Food	Hosts	Invasive/Exotics	Other Symbionts	Genetics	Dispersal	Recruitment	Mortality	Killing	Disturbance	Structures/Infrastructure
2005	1	1	1	2	1	3	1	1	1	1	2	1	1	1	1	2	2	1	2	1
2015	1	1	1	2	1	2	1	1	1	1	1	1	1	1	1	2	2	1	2	1

Rationale: Little spectaclecase was historically present in 10 drainages (HUC8) and decreased in range by 50% (5 HUC8s) by 1977-1999. Since 2000, little spectaclecase occurrence has increased by 40% (7 HUC8s). In addition, during T-53 and T-82 surveys we encountered extant populations in southern Illinois (for further information see Shasteen et al., in press). The increased sampling effort has revealed more extant locations; therefore, it appears that little spectaclecase is more common than earlier assumed. Illinois is at the northern limit of the species' range and it is currently described as stable throughout its range (Williams et al., 1993).

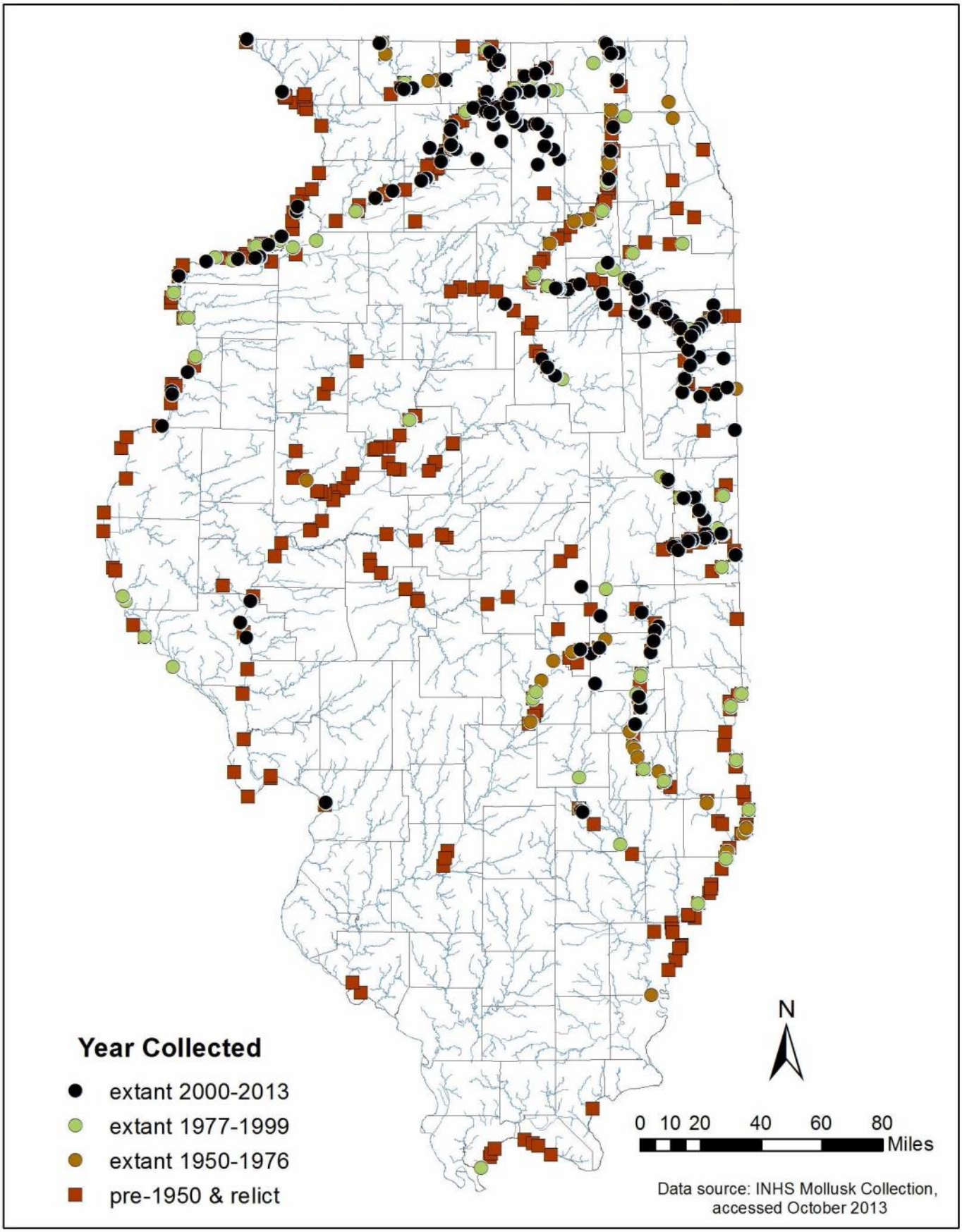
In Appendix II, we downgraded pollutants-sediment and hosts to having a moderate and little or no threat to population viability or abundance. Recent host fish trials confirm common centrarchids as primary host fish for little spectaclecase (Section 3: Table 3) thus increasing our confidence level that host fish are not a limiting factor in little spectaclecase population viability or abundance.

Little spectaclecase readily persist in soft substrates such as mud and silt/sand mixtures hence, downgrading pollutants-sediments to having a moderate effect on population viability or abundance.

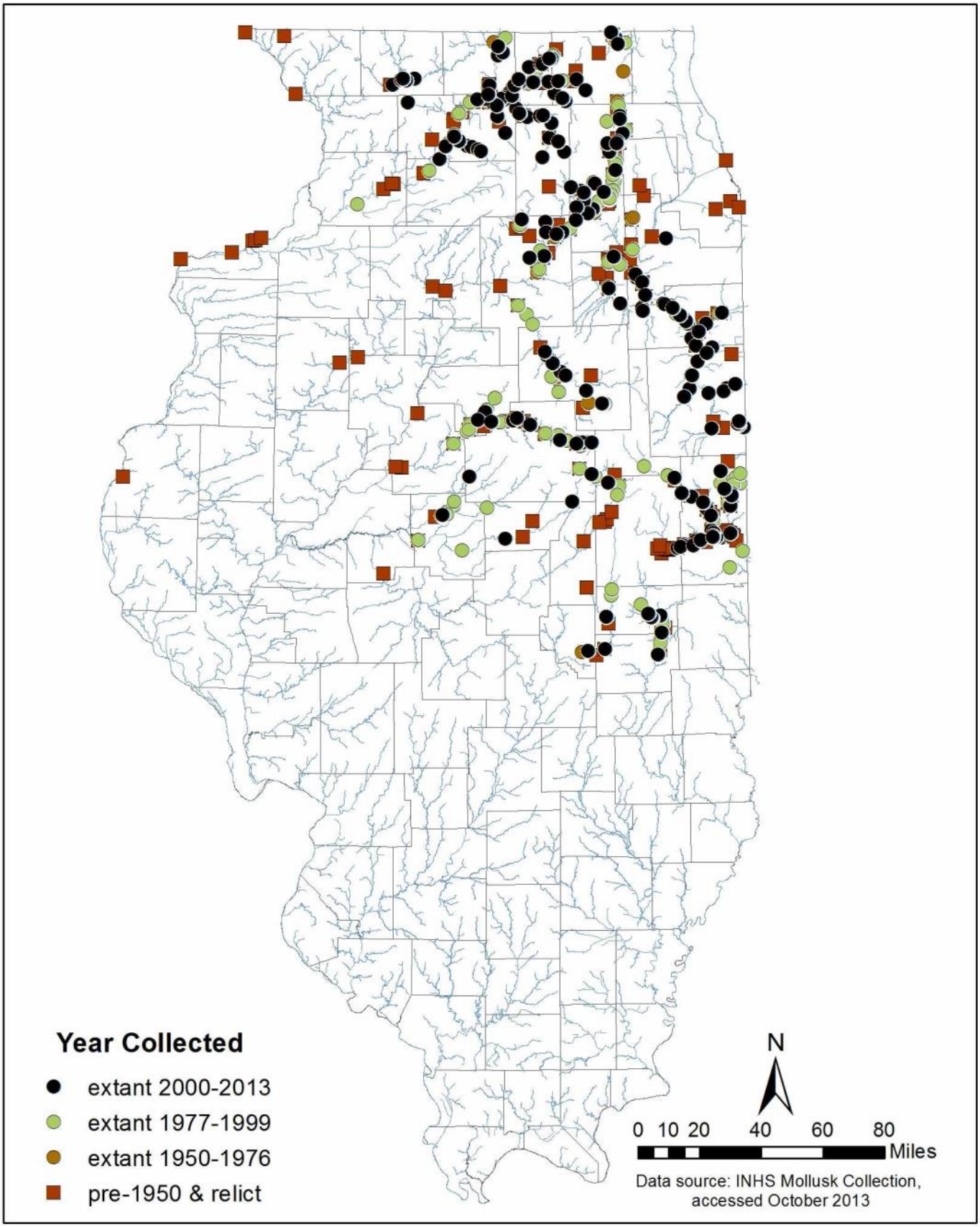
Mollusk collections in Illinois (1861-2013)



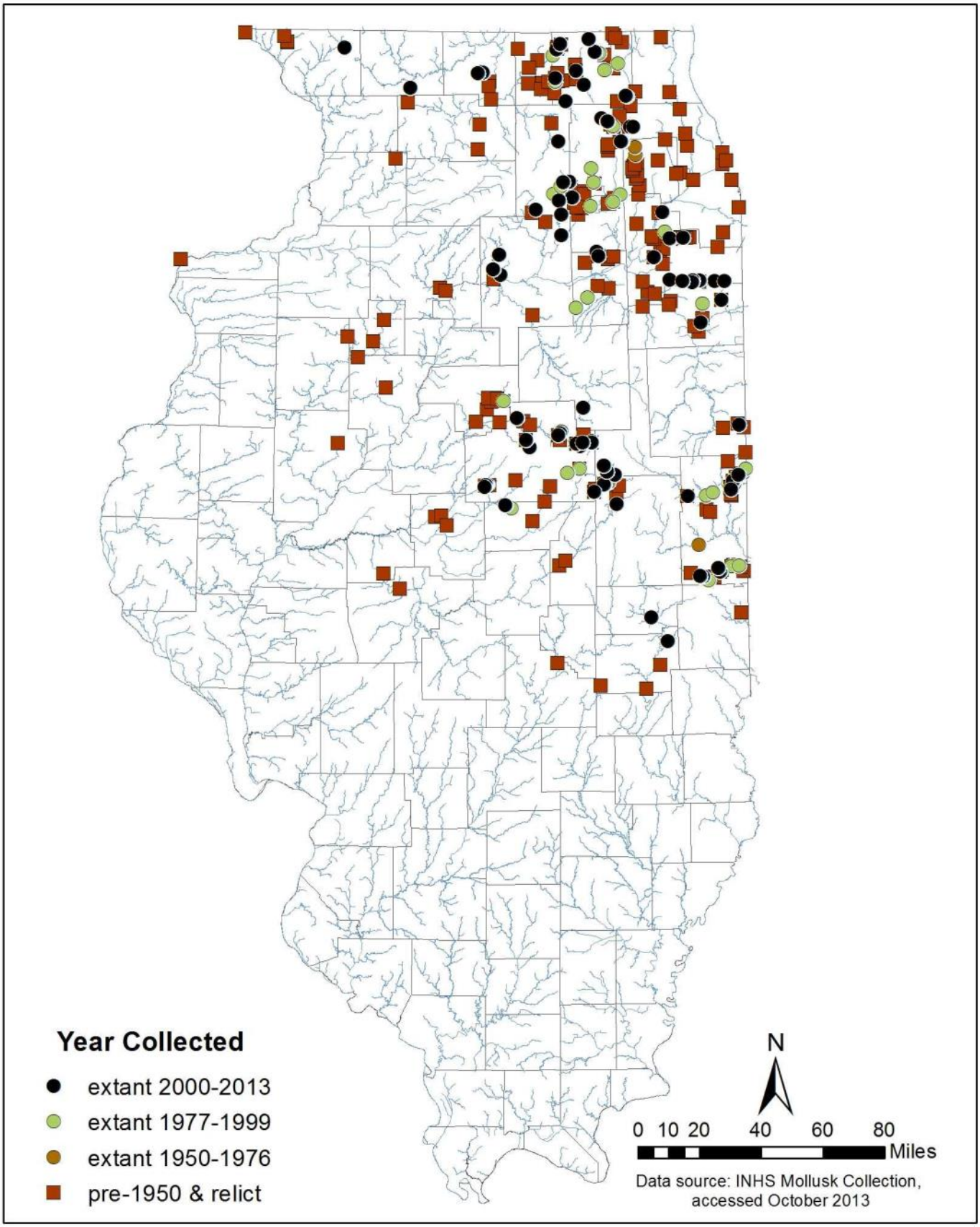
Mucket (*Actinonaias ligamentina*)



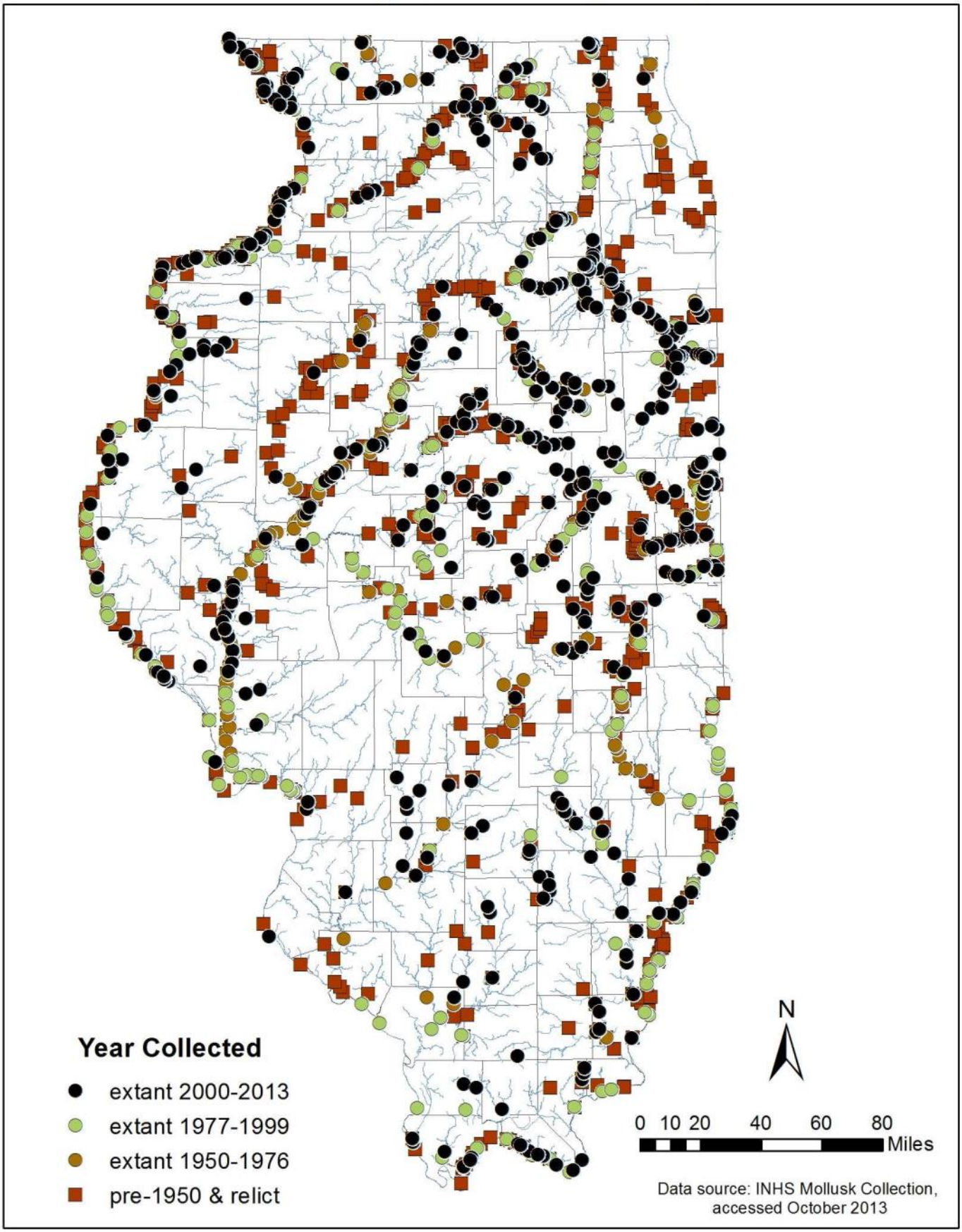
Elktoe (*Alasmidonta marginata*)



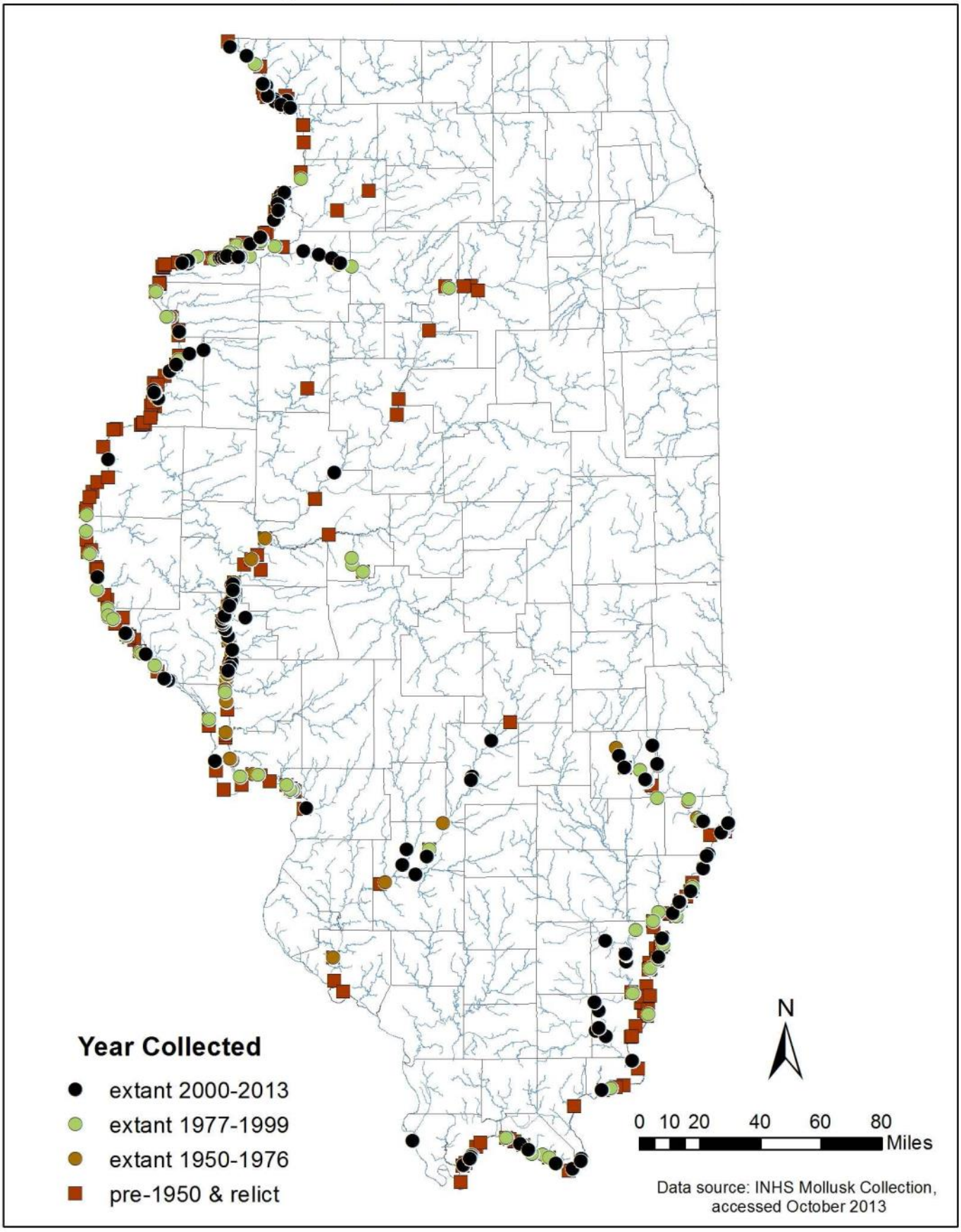
Slippershell mussel (*Alasmidonta viridis*)



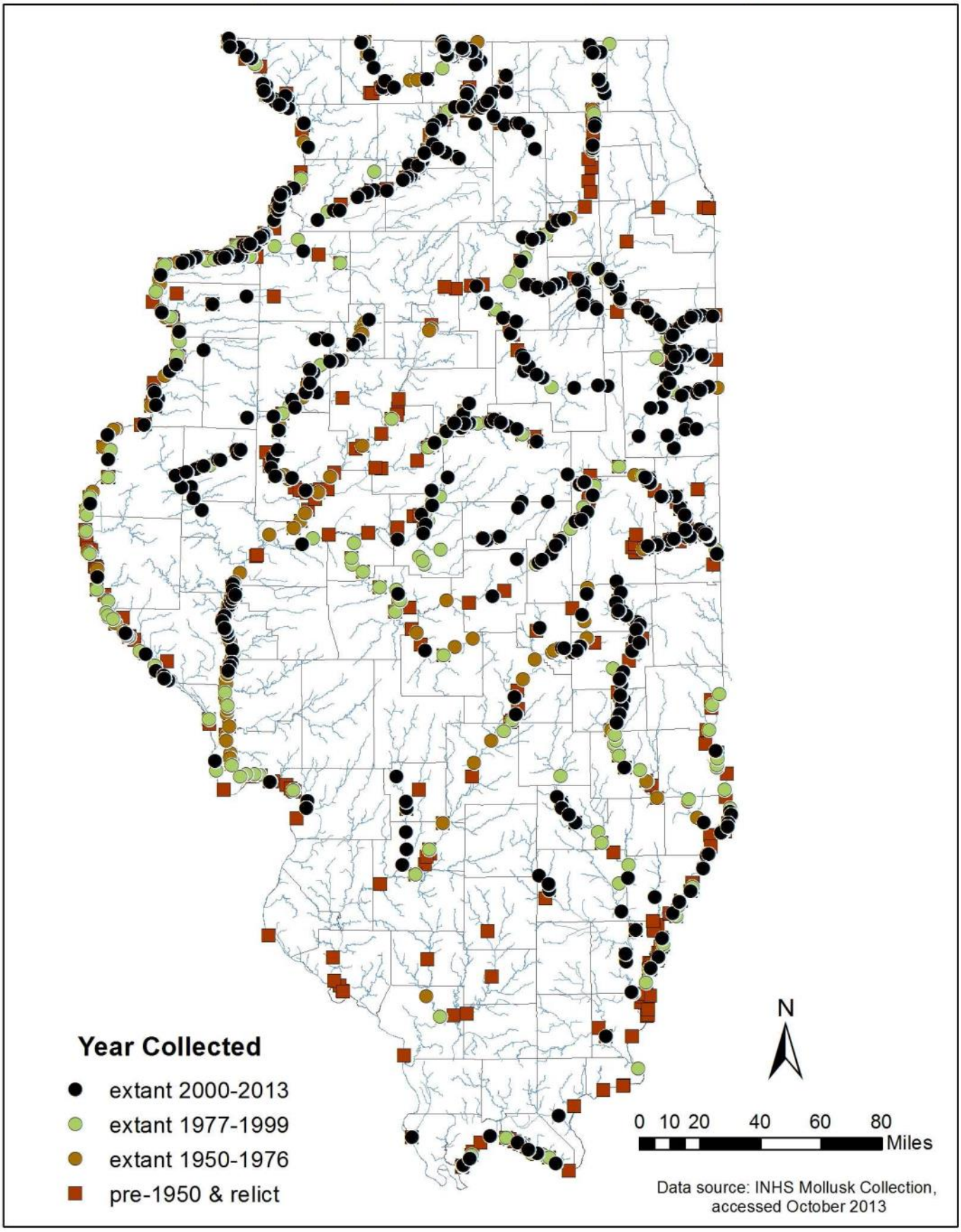
Threeridge (*Amblema plicata*)



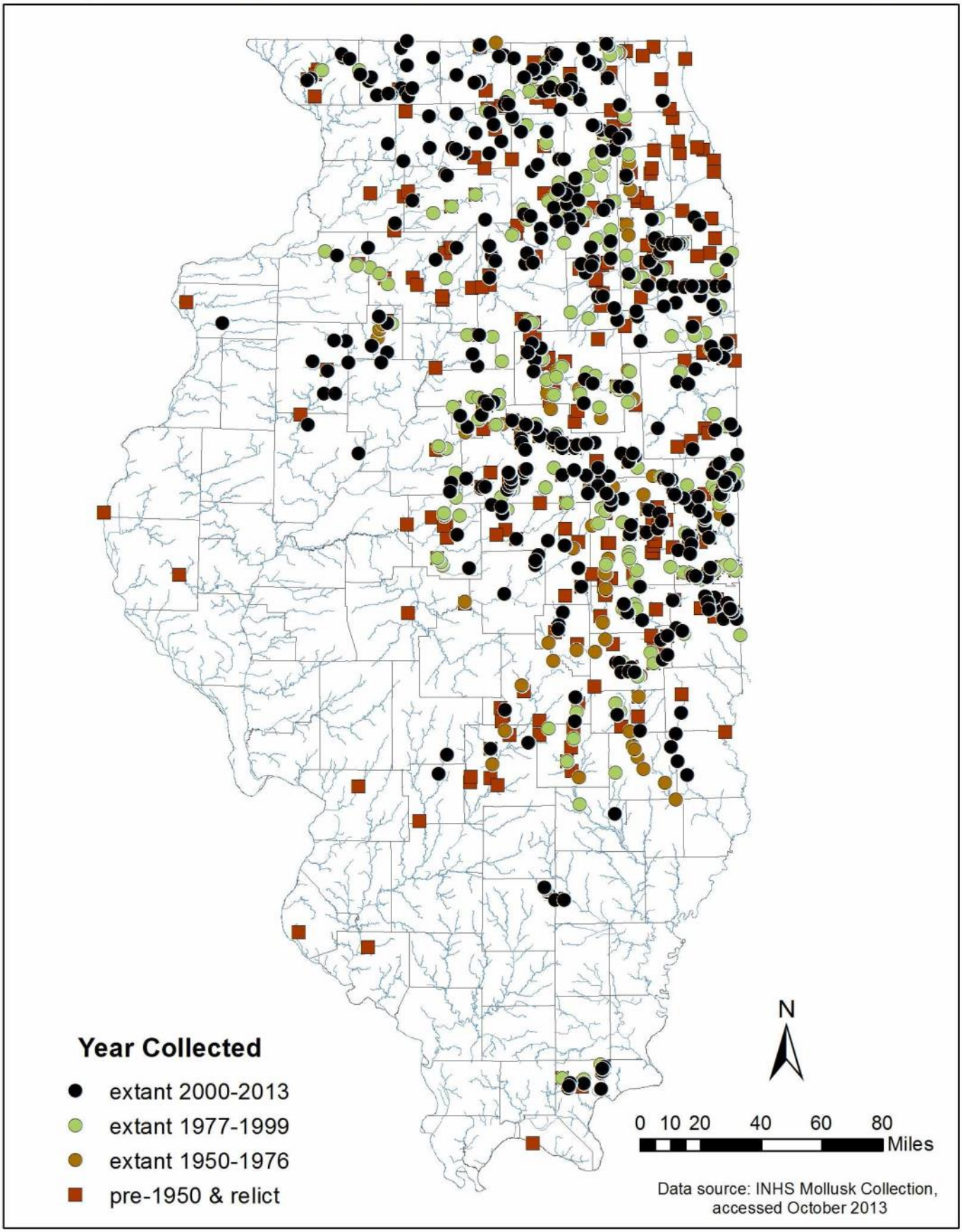
Wartyback (*Amphinaias nodulata*)



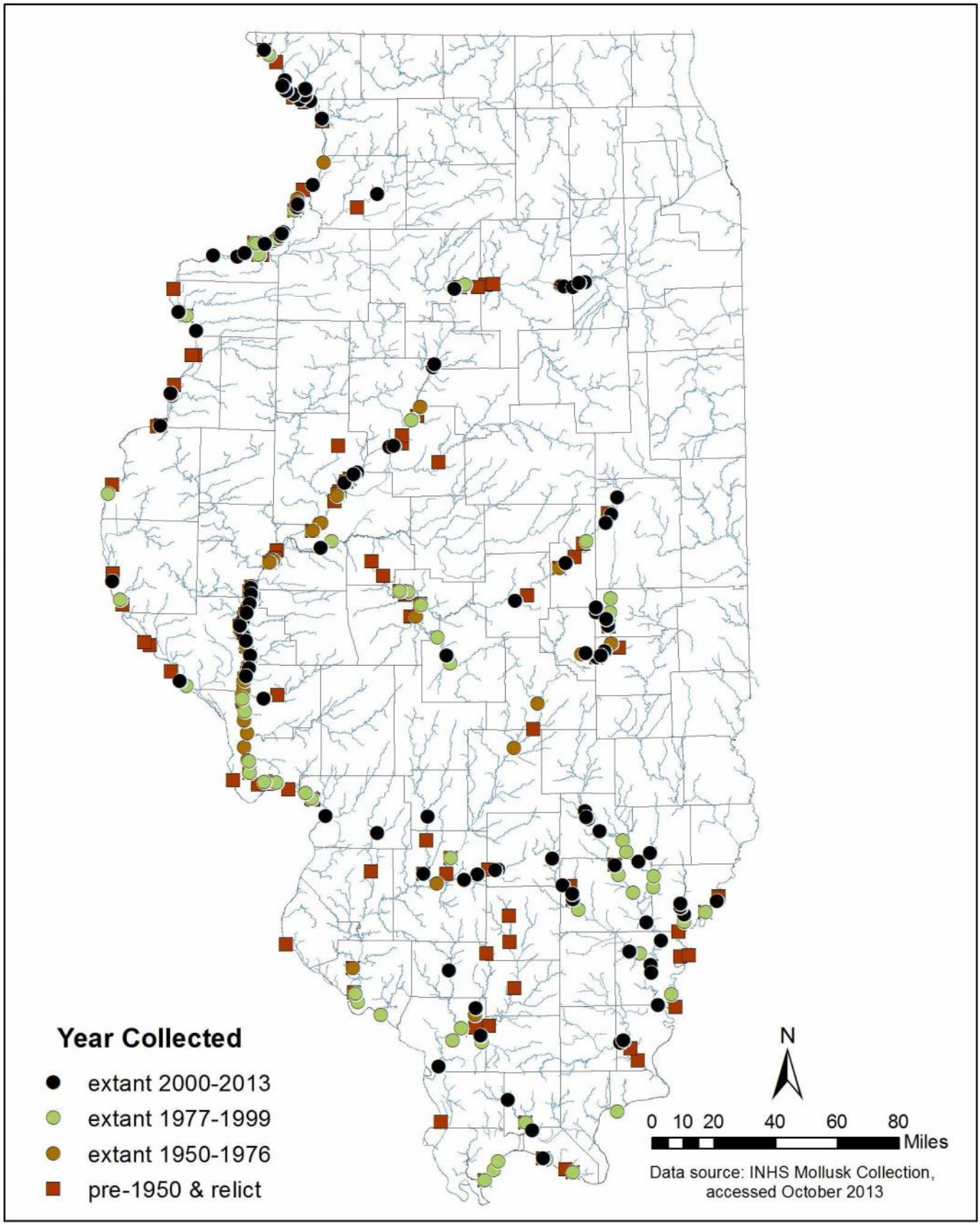
Pimpleback (*Amphinaias pustulosa*)



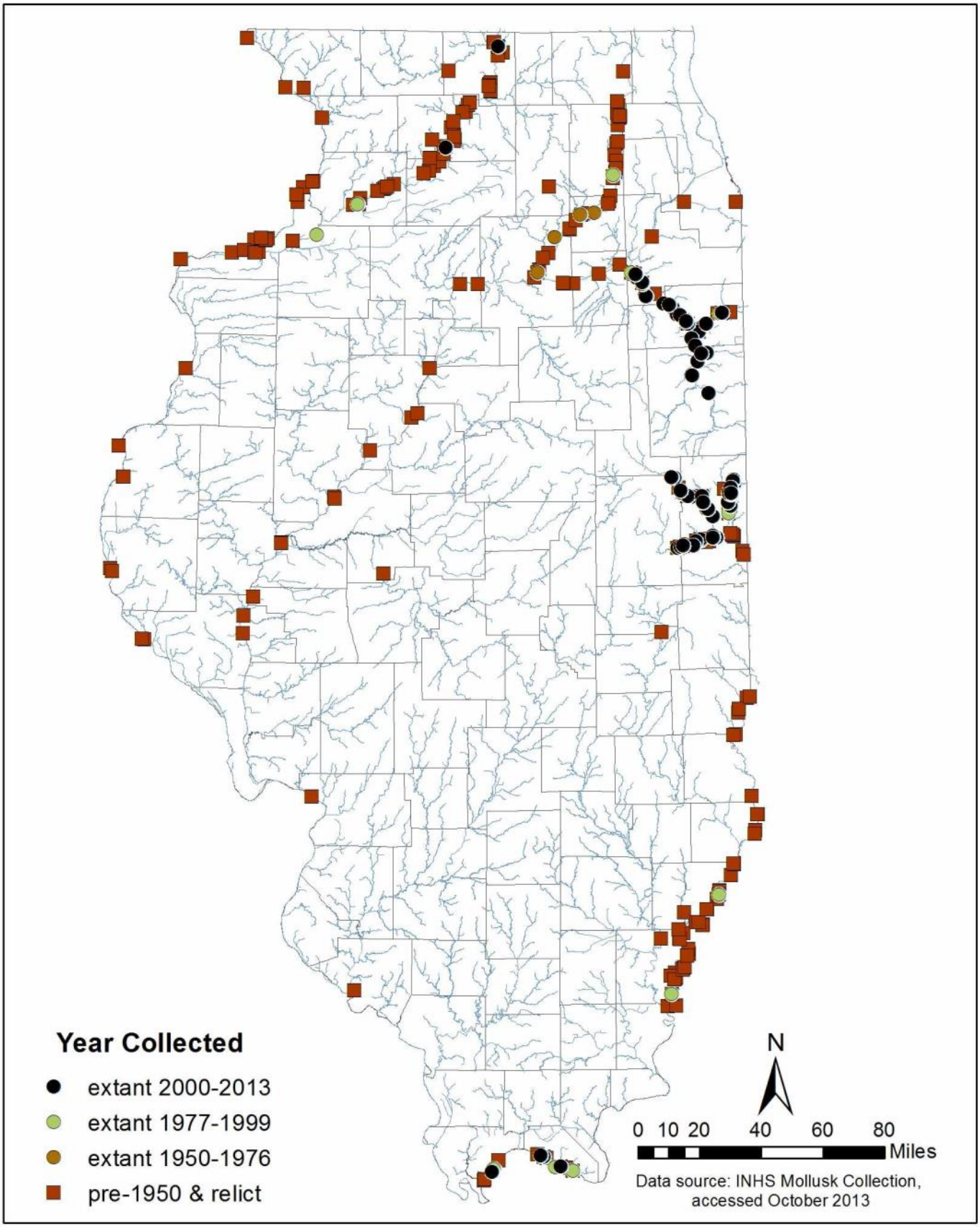
Cylindrical papershell (*Anodontoides ferussacianus*)



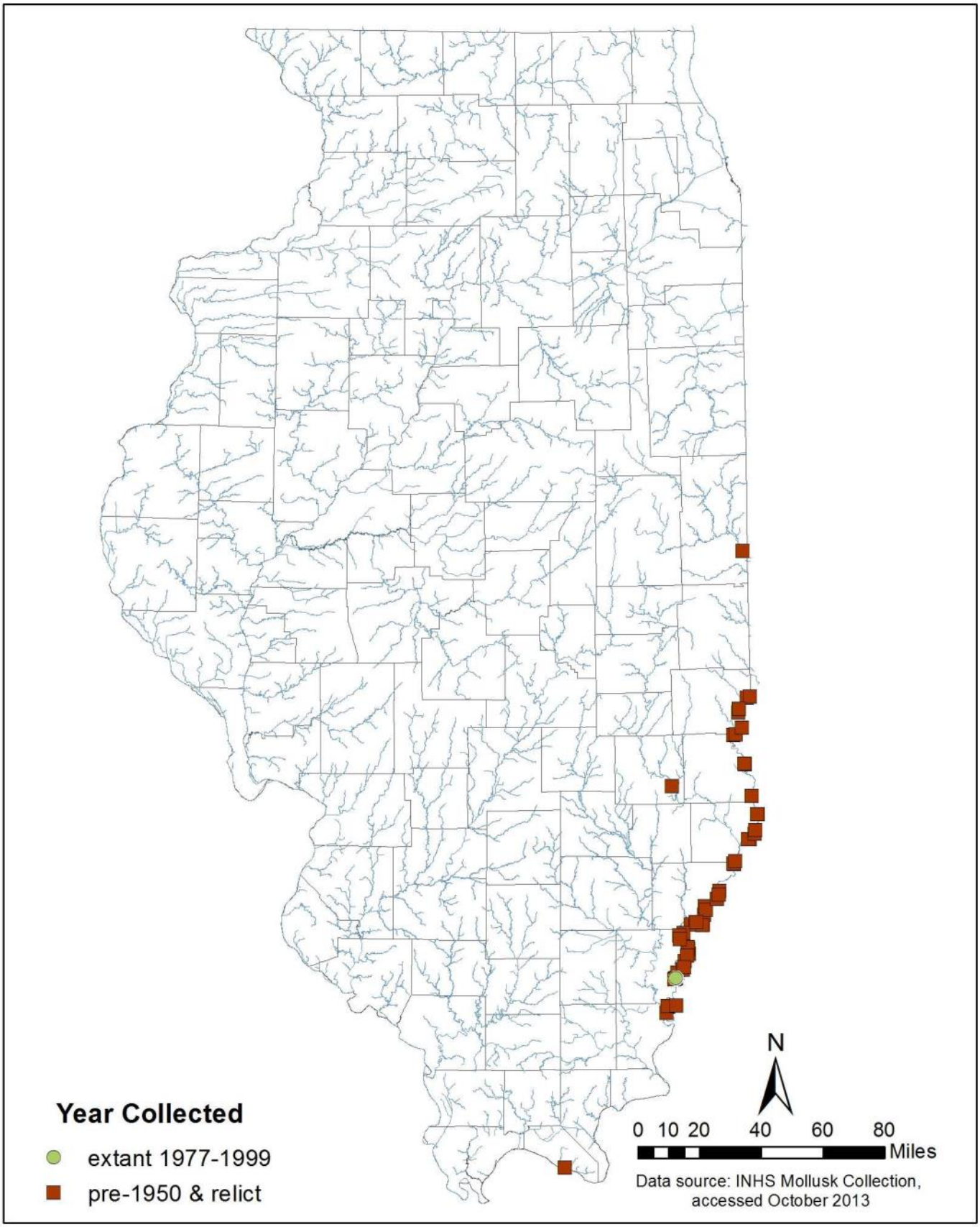
Rock pocketbook (*Arcidens confragosus*)



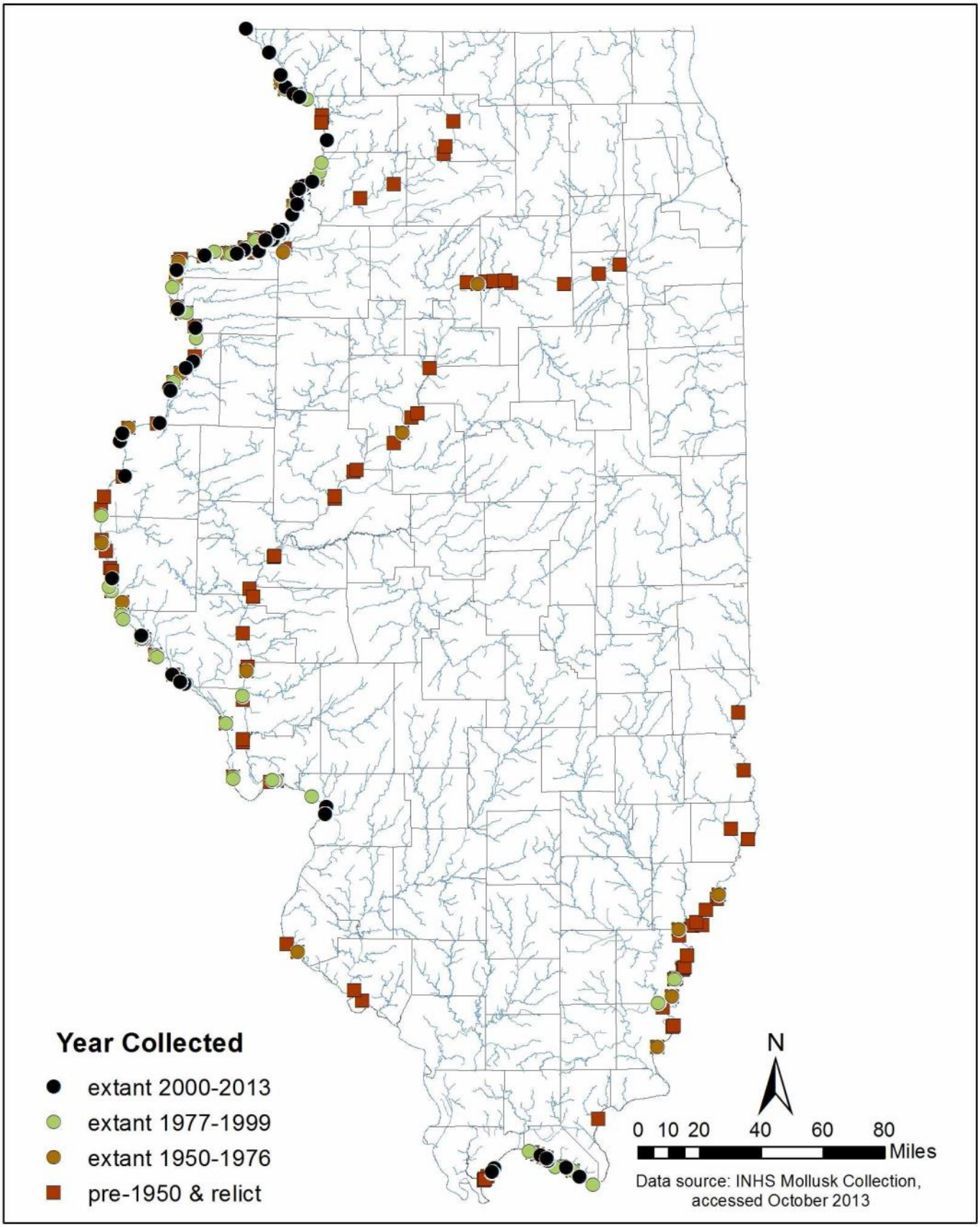
Purple wartyback (*Cyclonaias tuberculata*)



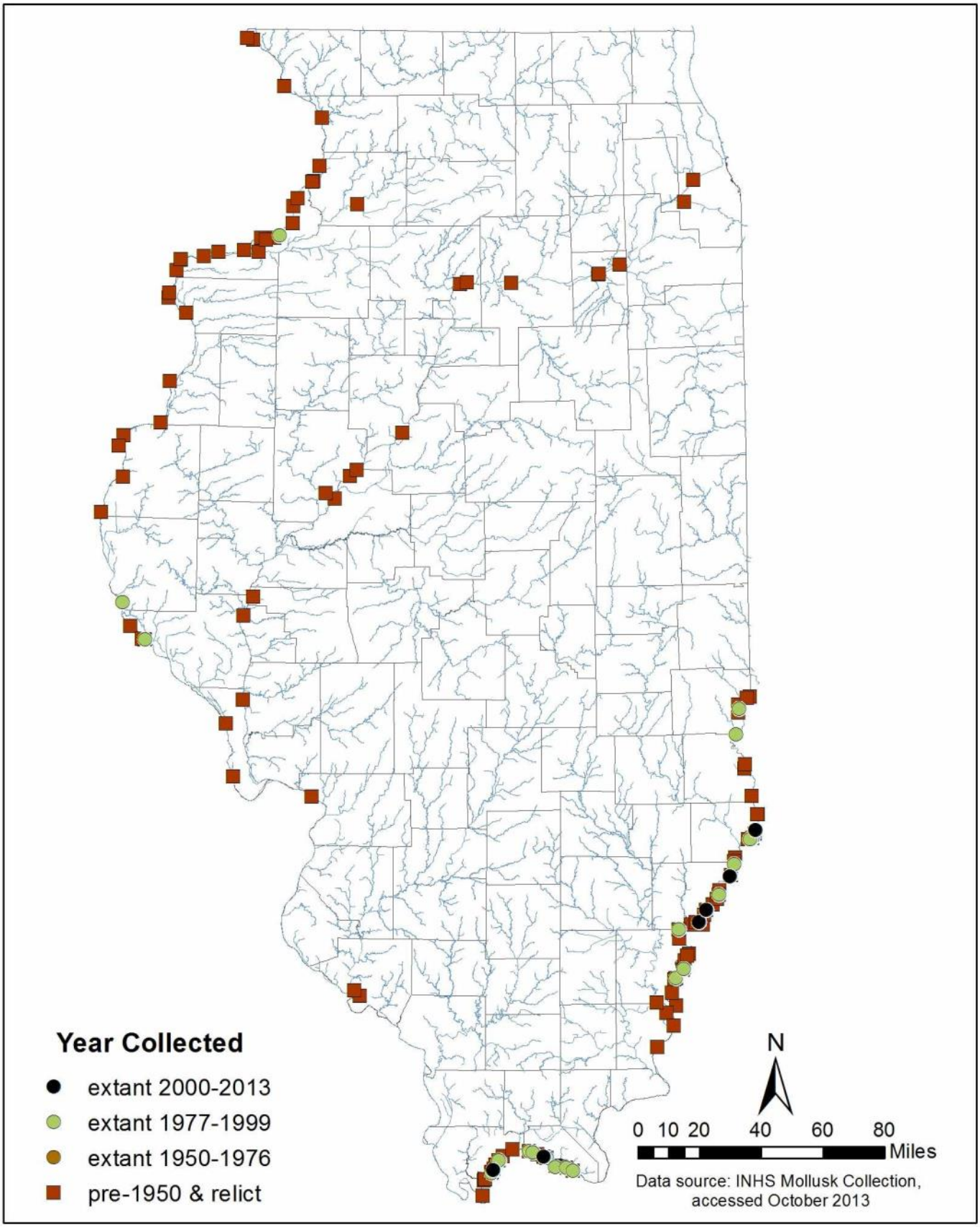
Fanshell (*Cyprogenia stegaria*)



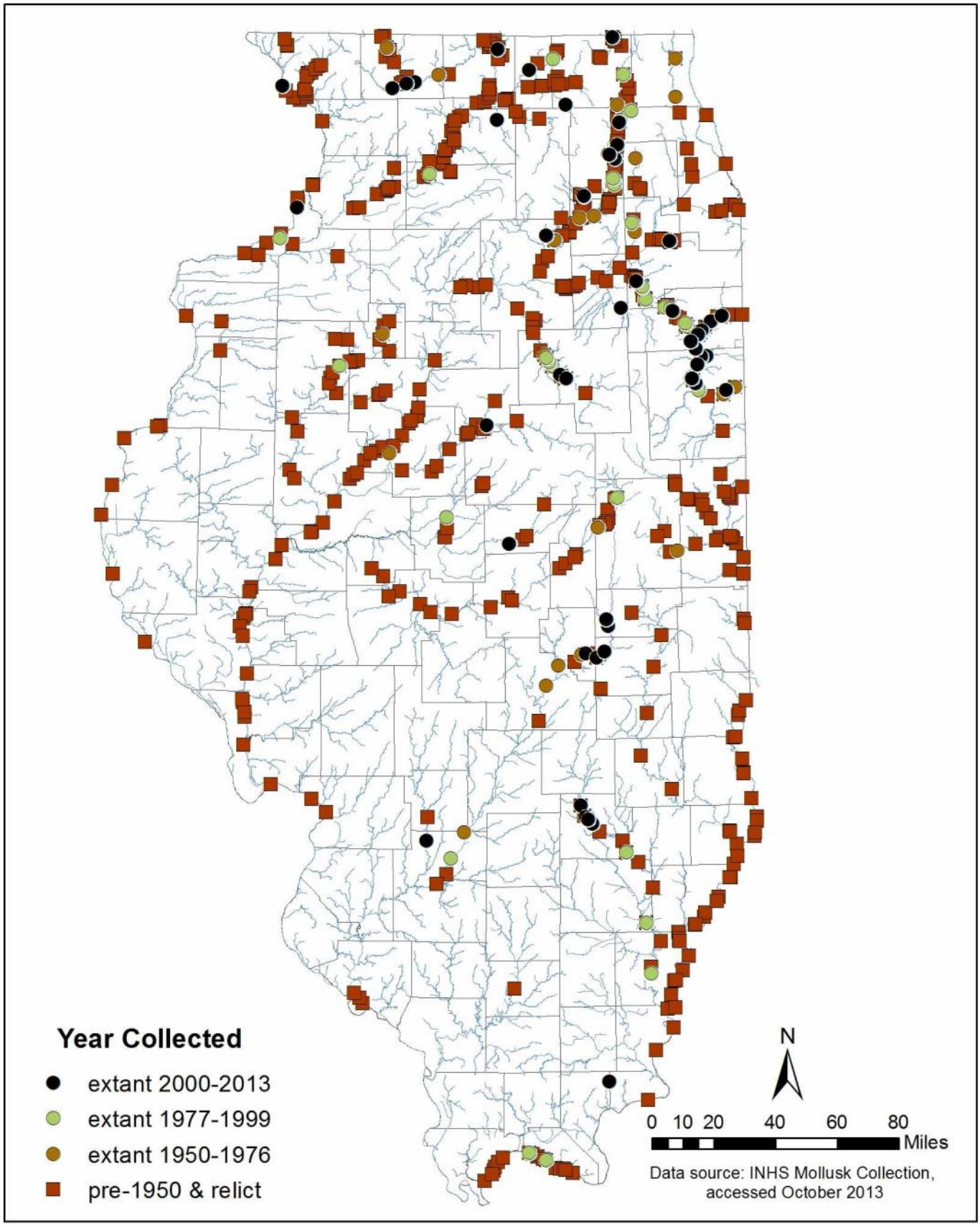
Butterfly (*Ellipsaria lineolata*)



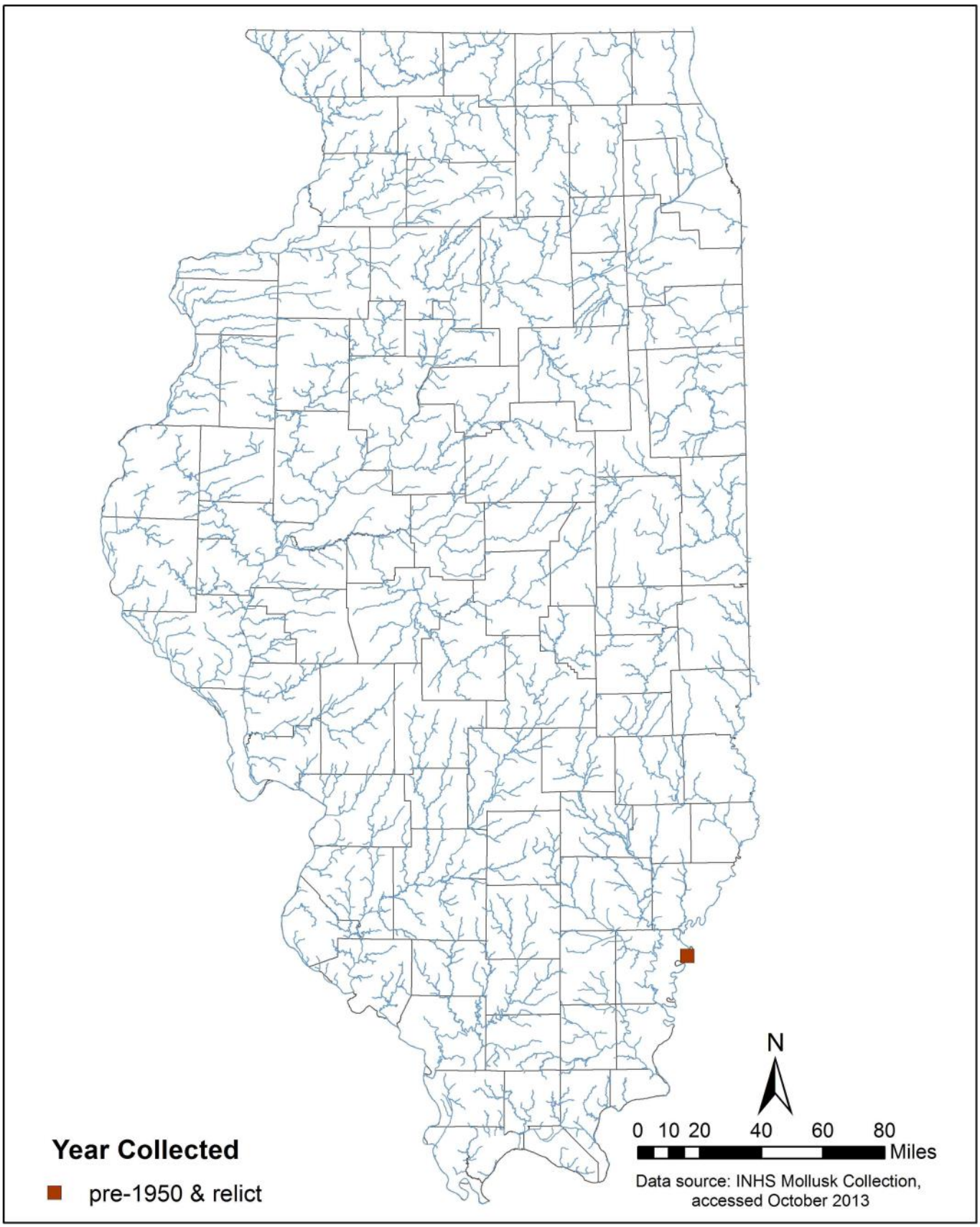
Elephantear (*Elliptio crassidens*)



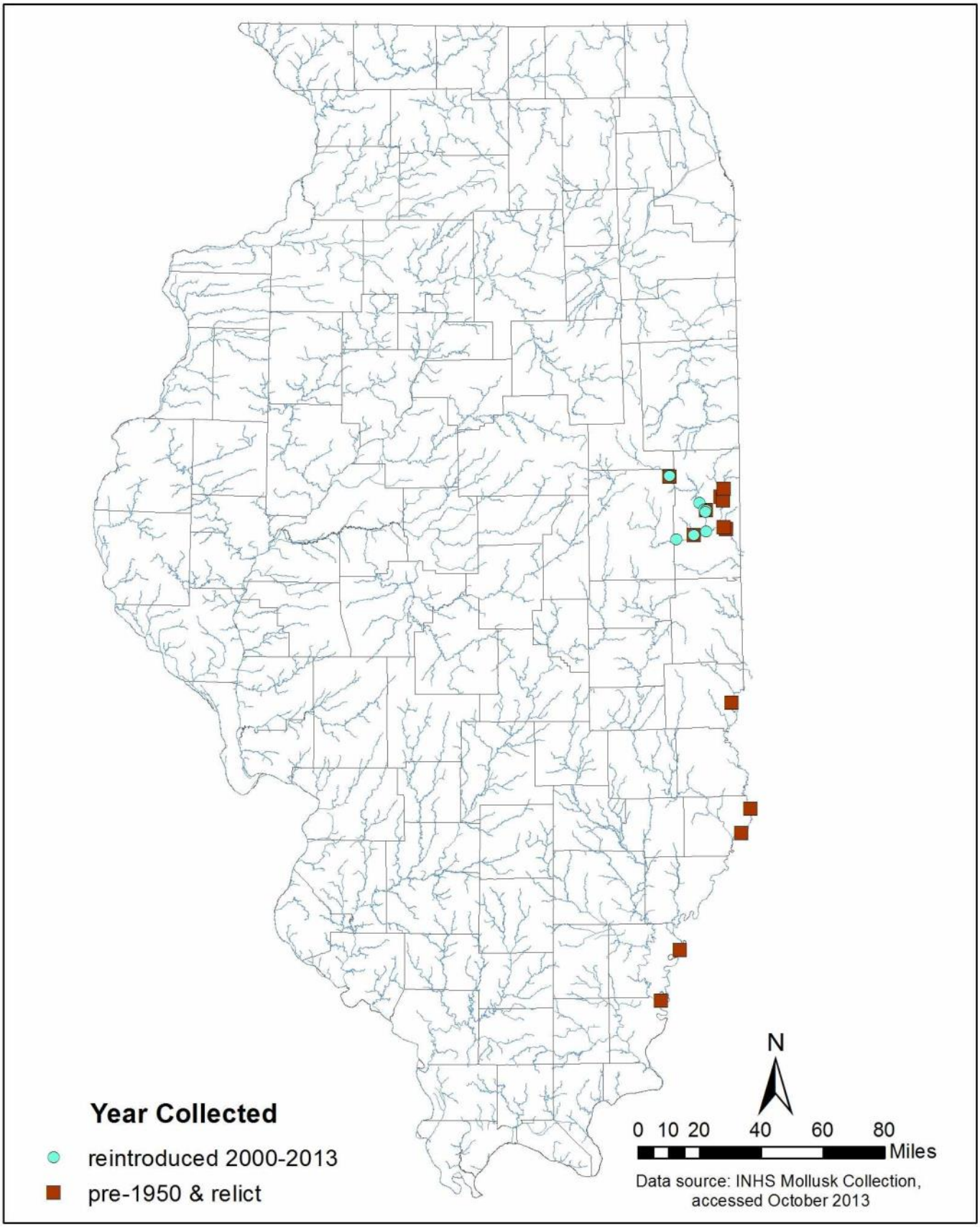
Spike (*Elliptio dilatata*)



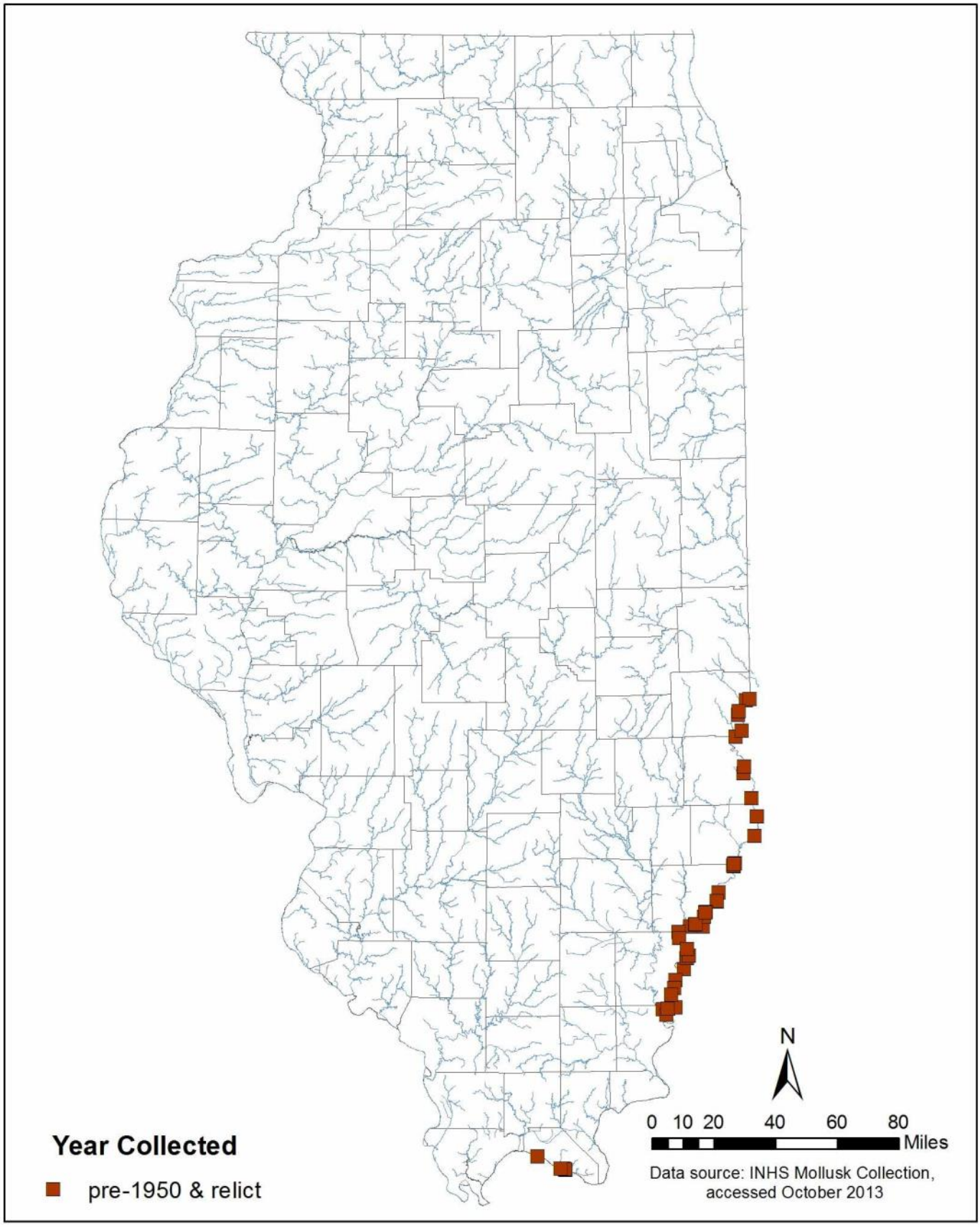
Catspaw (*Epioblasma obliquata*)



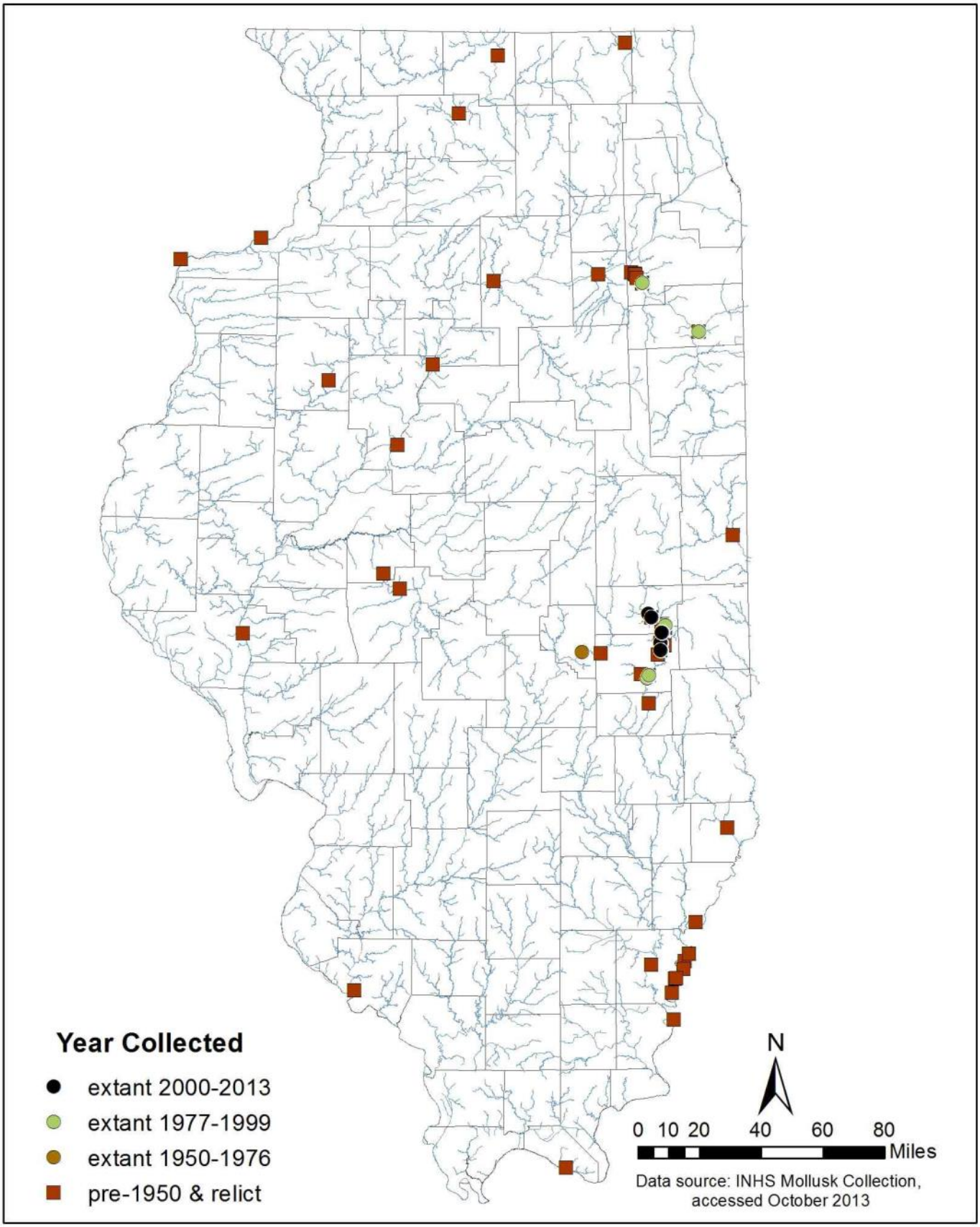
Northern riffleshell (*Epioblasma rangiana*)



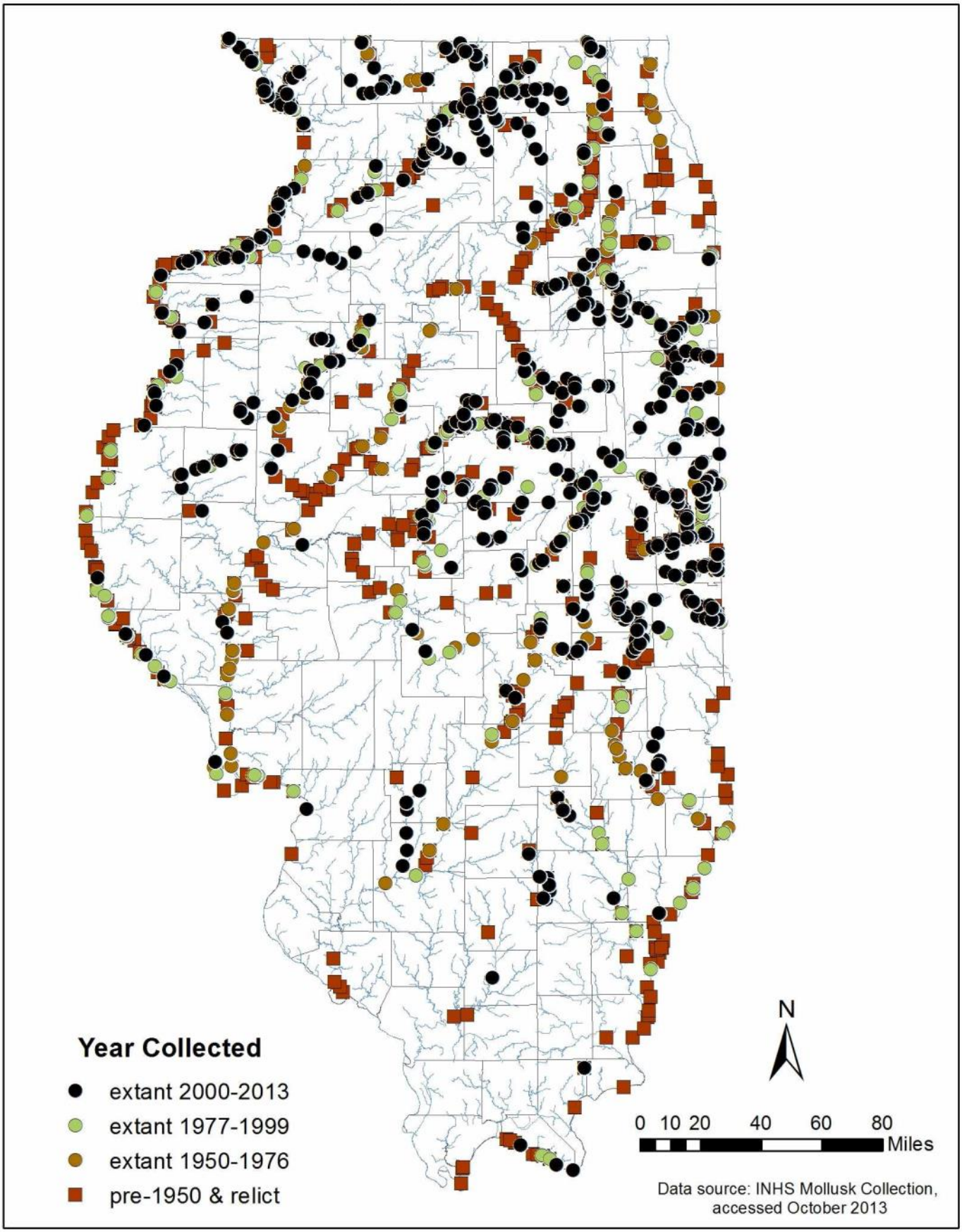
Tubercled blossom (*Epioblasma torulosa*)



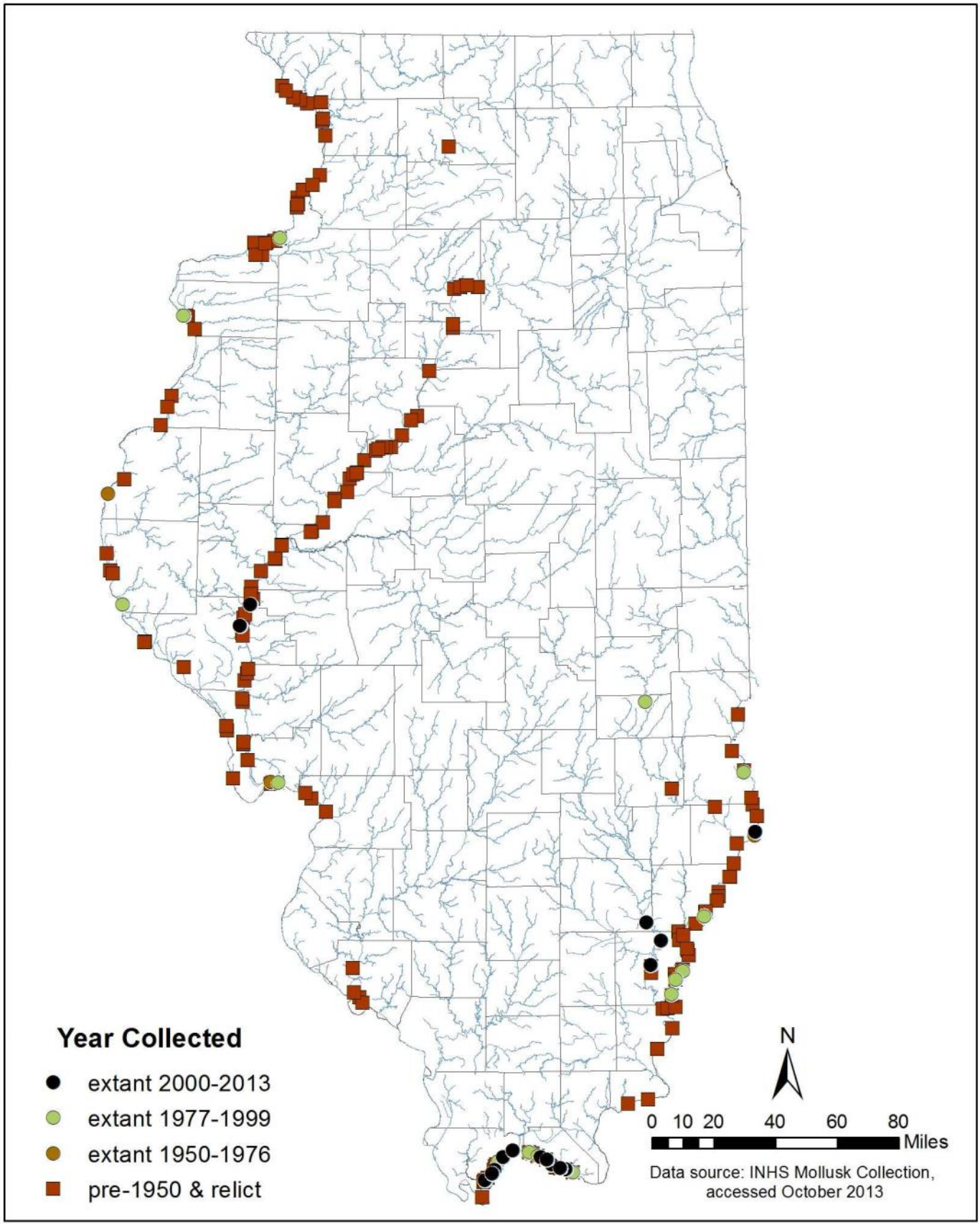
Snuffbox (*Epioblasma triquetra*)



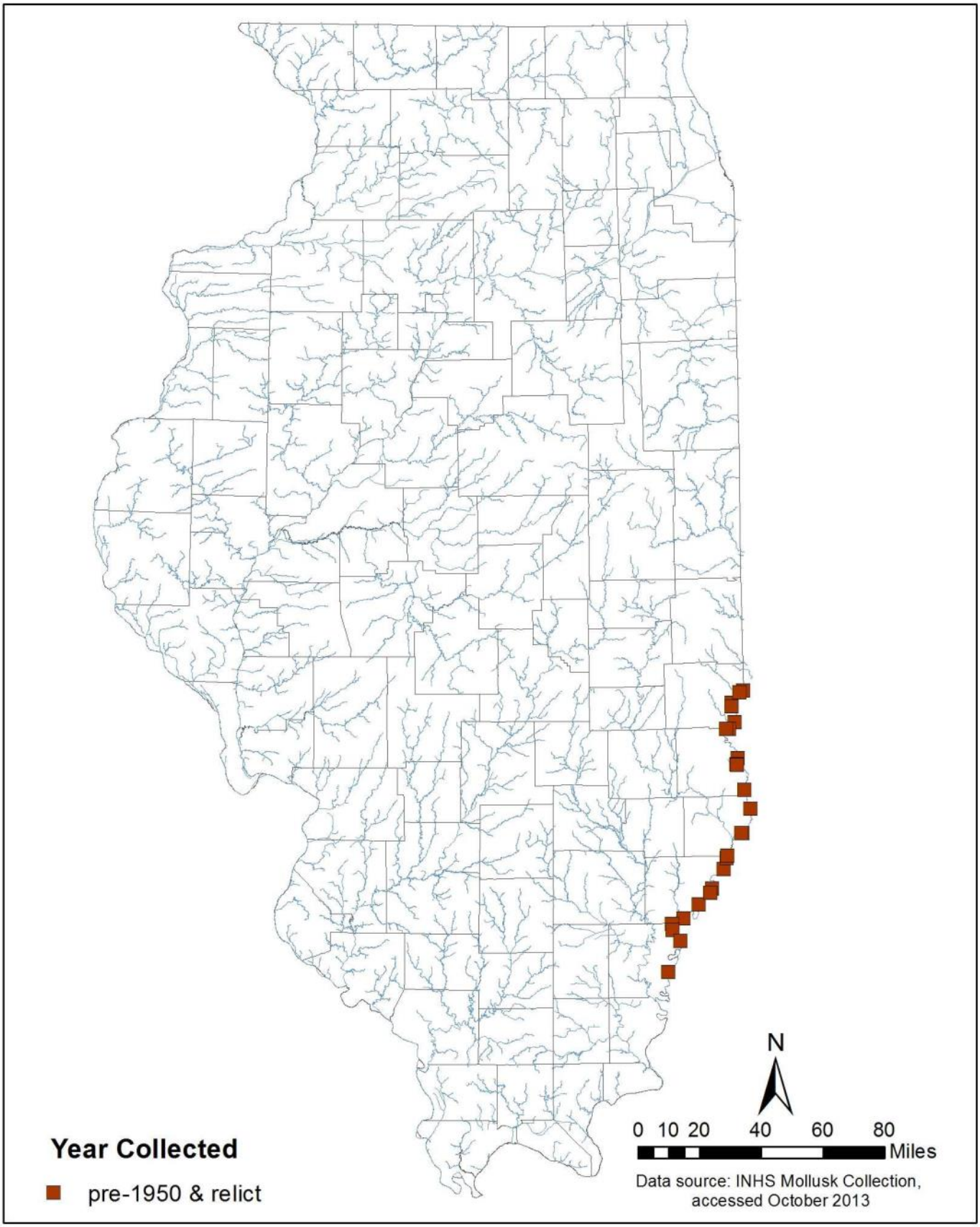
Wabash pigtoe (*Fusconaia flava*)



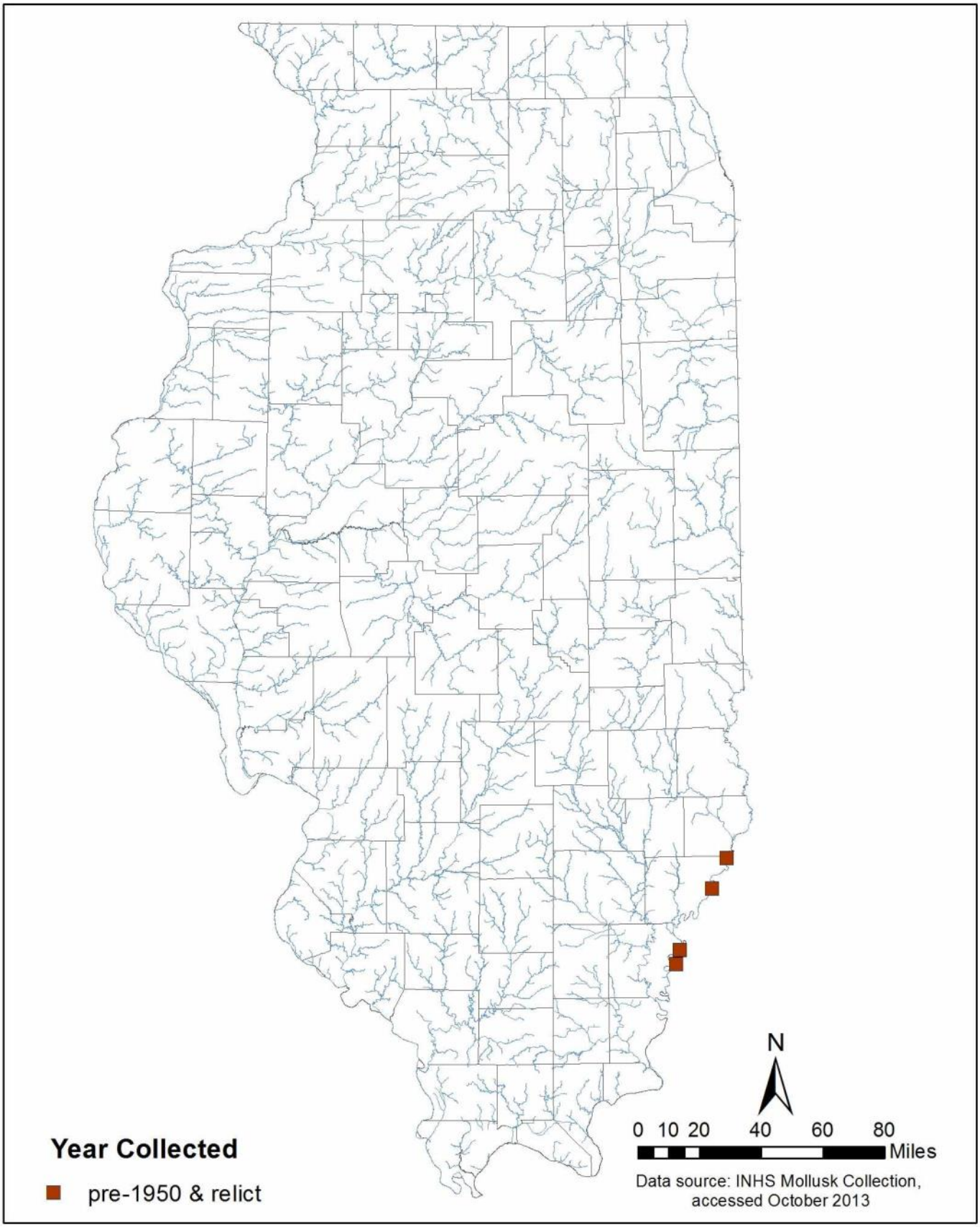
Ebonyshell (*Fusconaia ebena*)



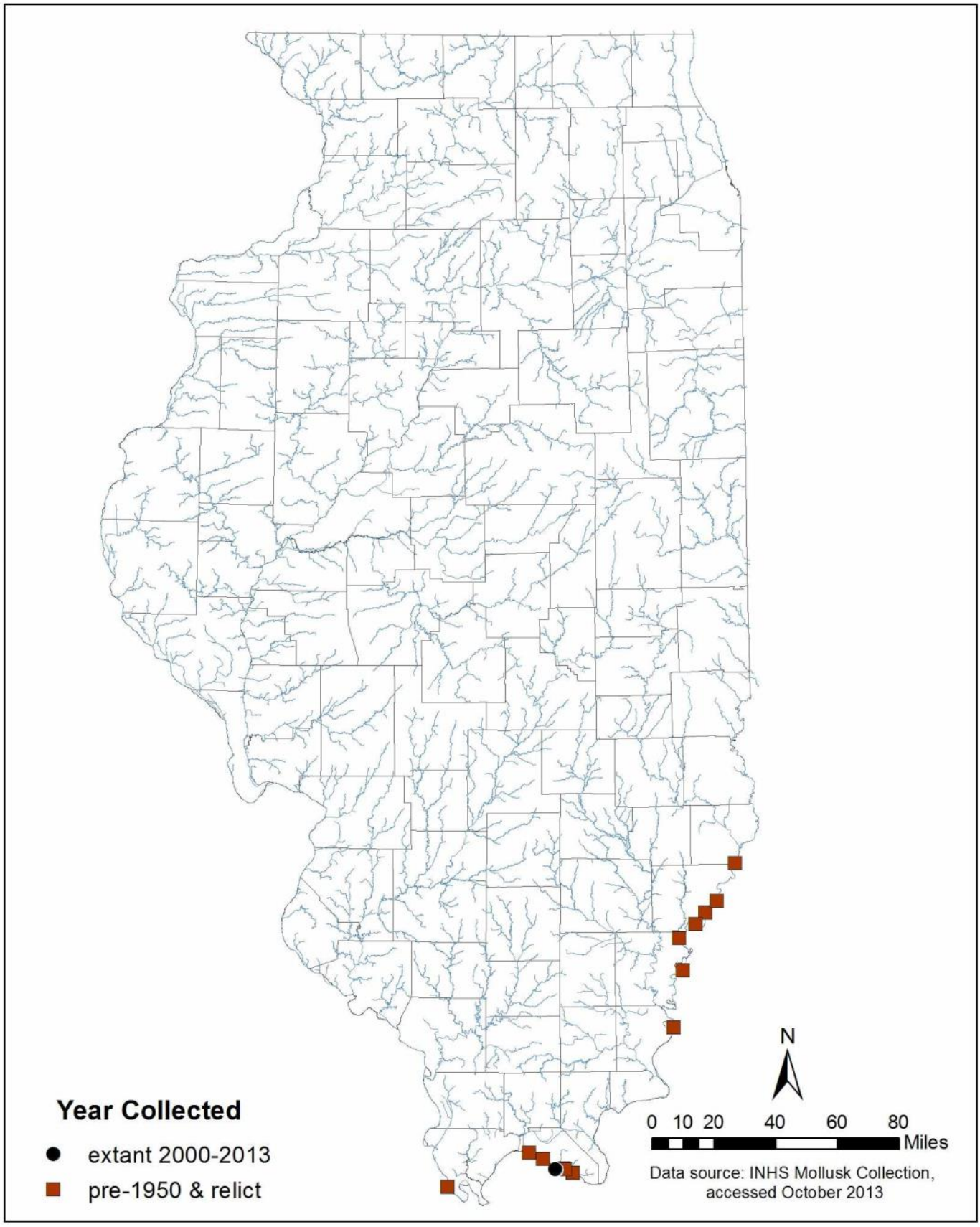
Longsolid (*Fusconaia subrotunda*)



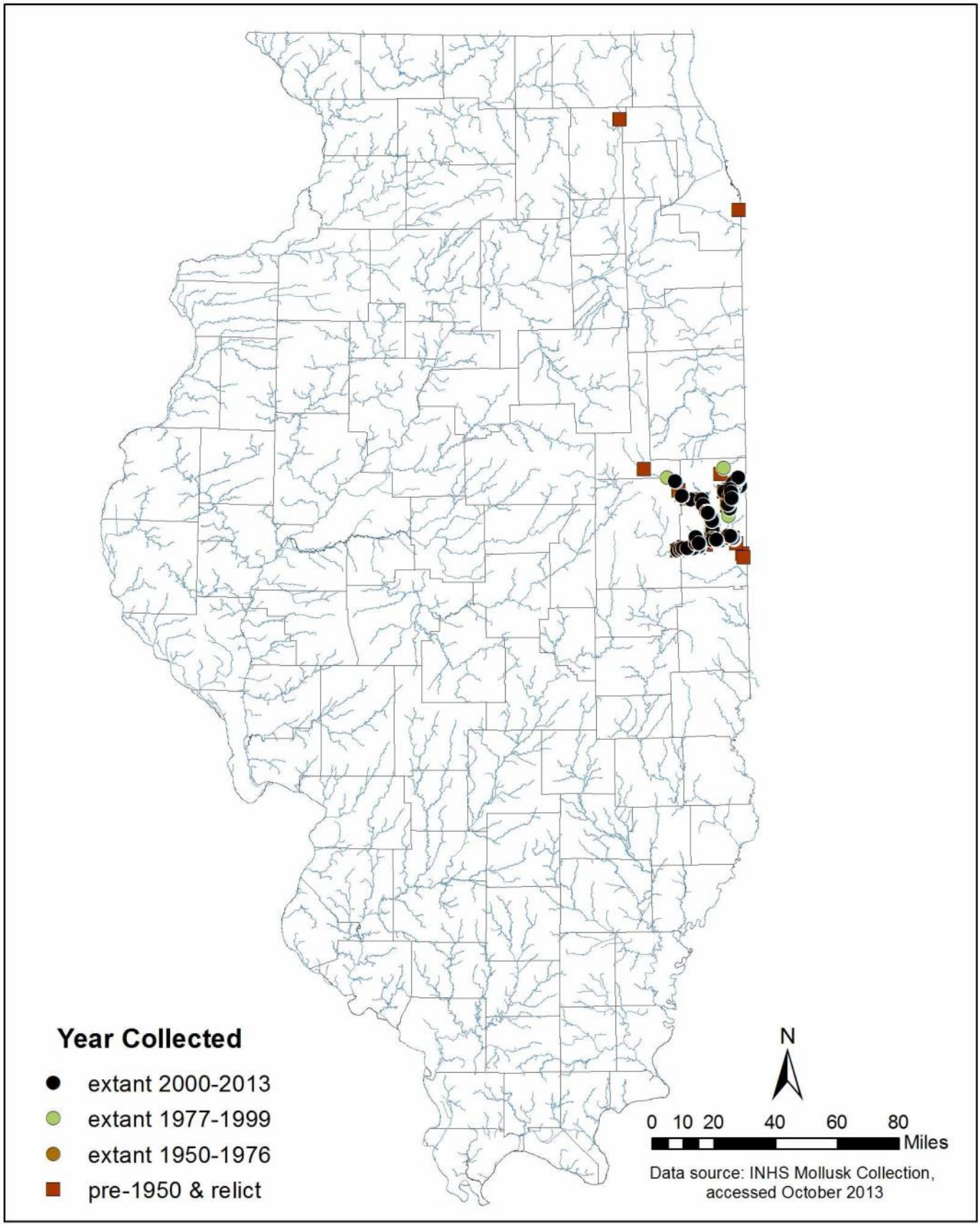
Cracking pearlymussel (*Hemistena lata*)



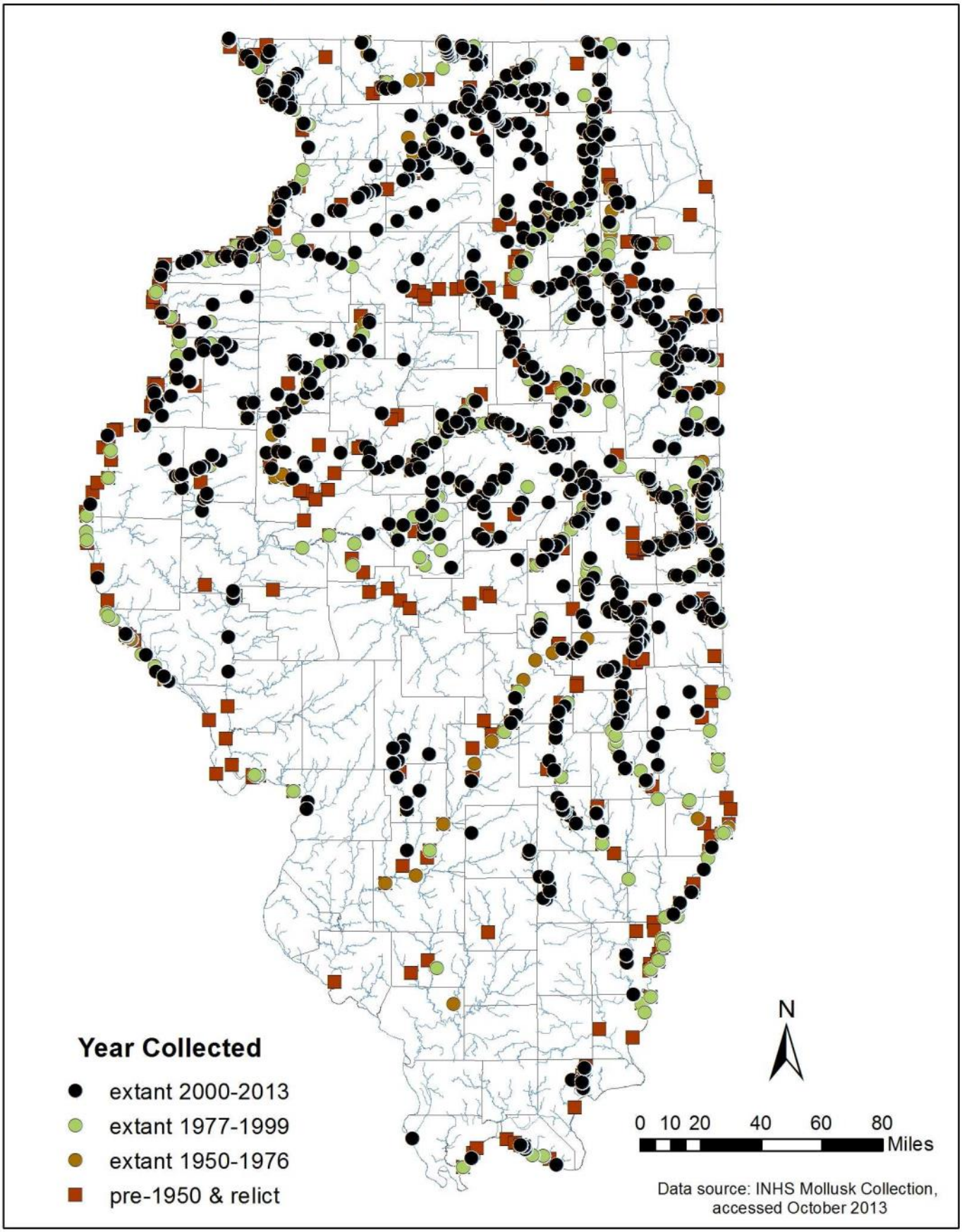
Pink mucket (*Lampsilis abrupta*)



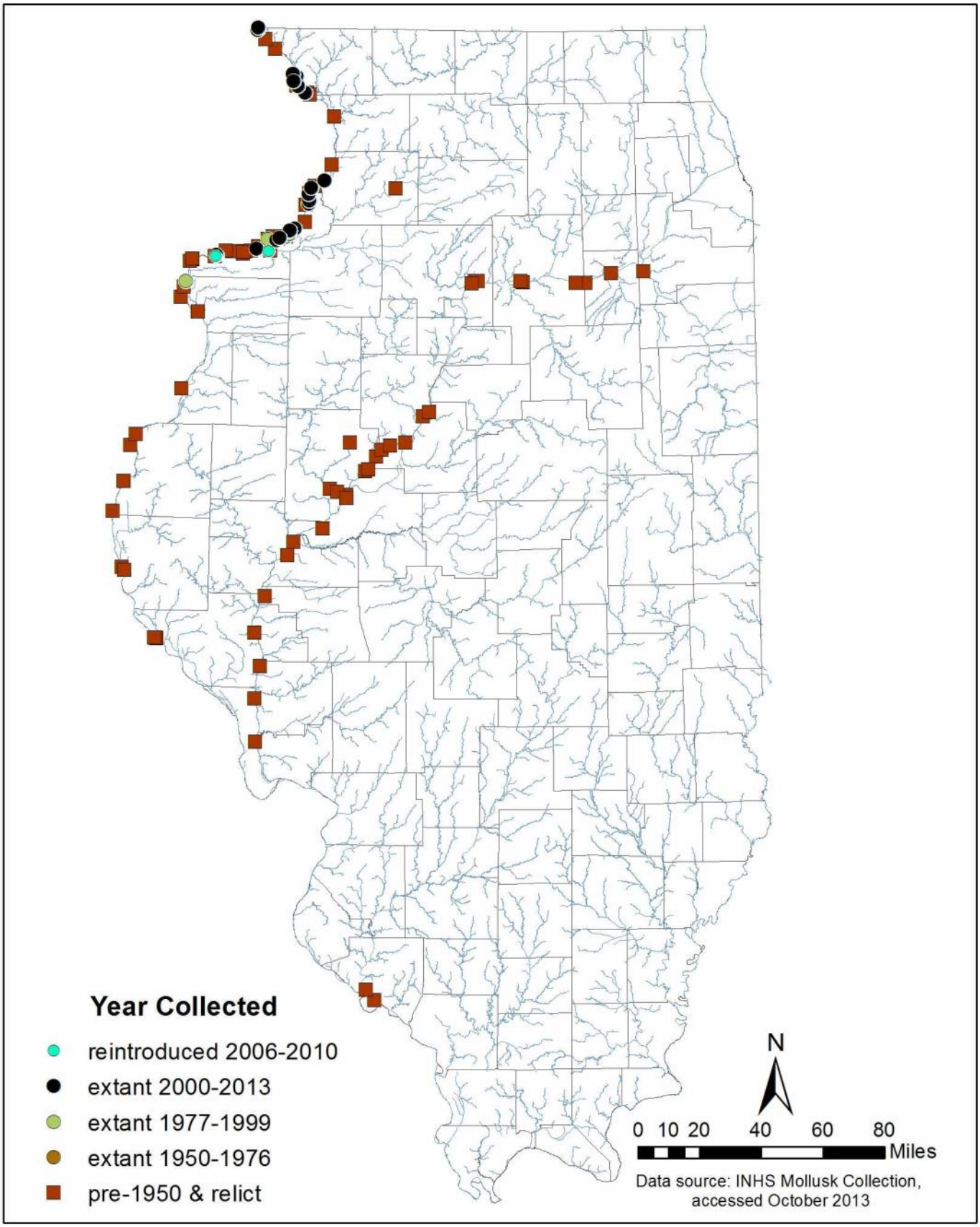
Wavy-rayed lampmussel (*Lampsilis fasciola*)



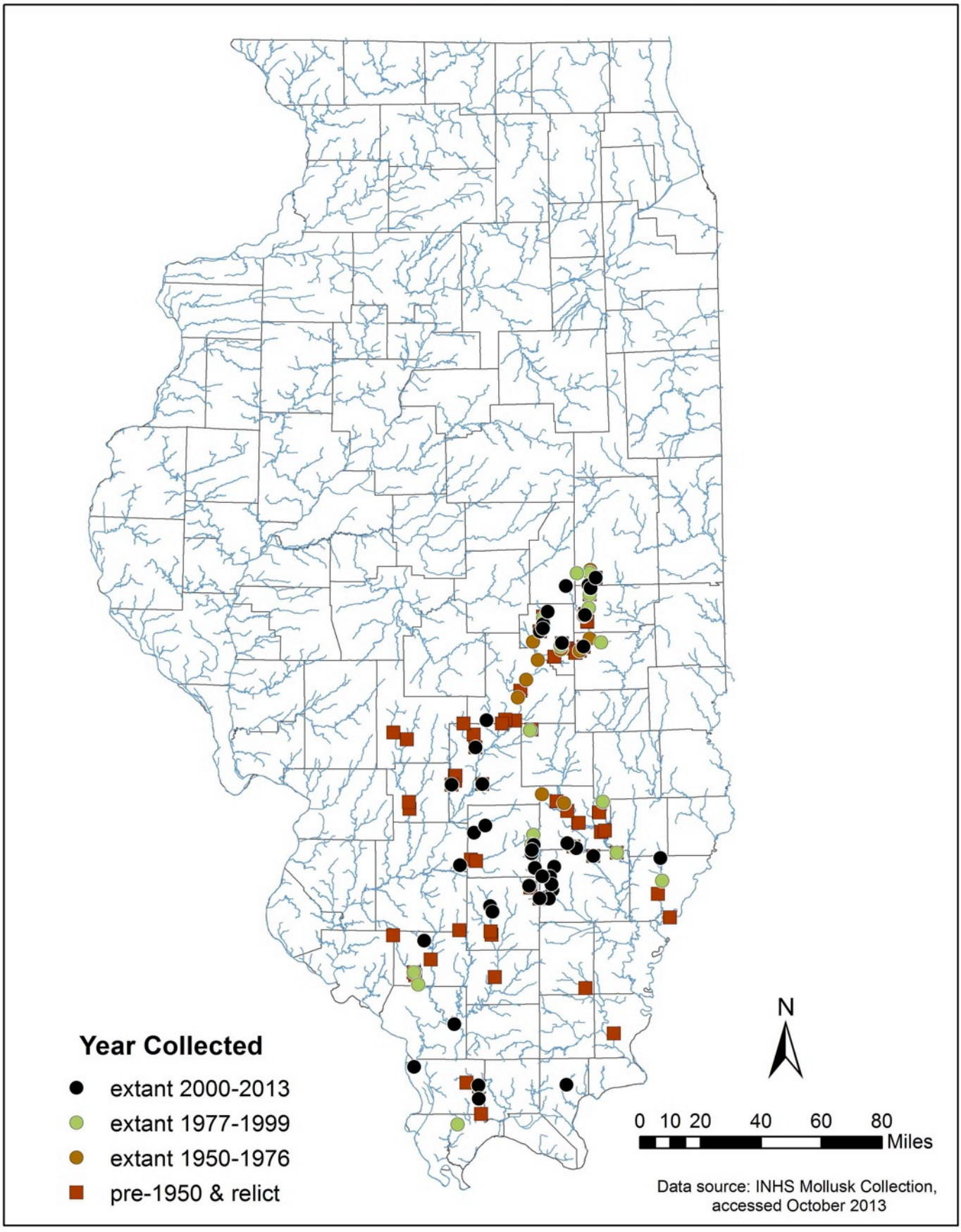
Plain pocketbook (*Lampsilis cardium*)



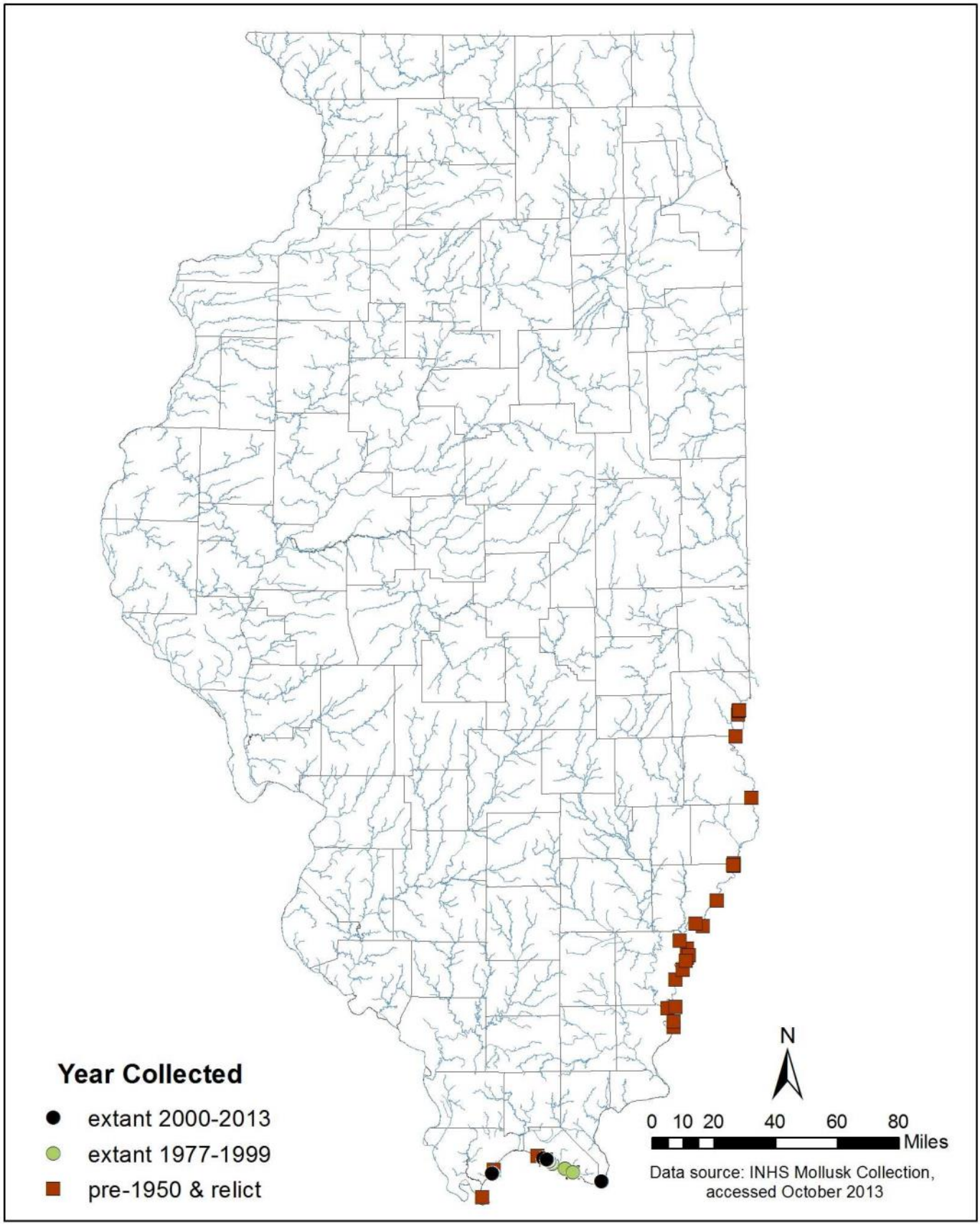
Higgins eye (*Lampsilis higginsii*)



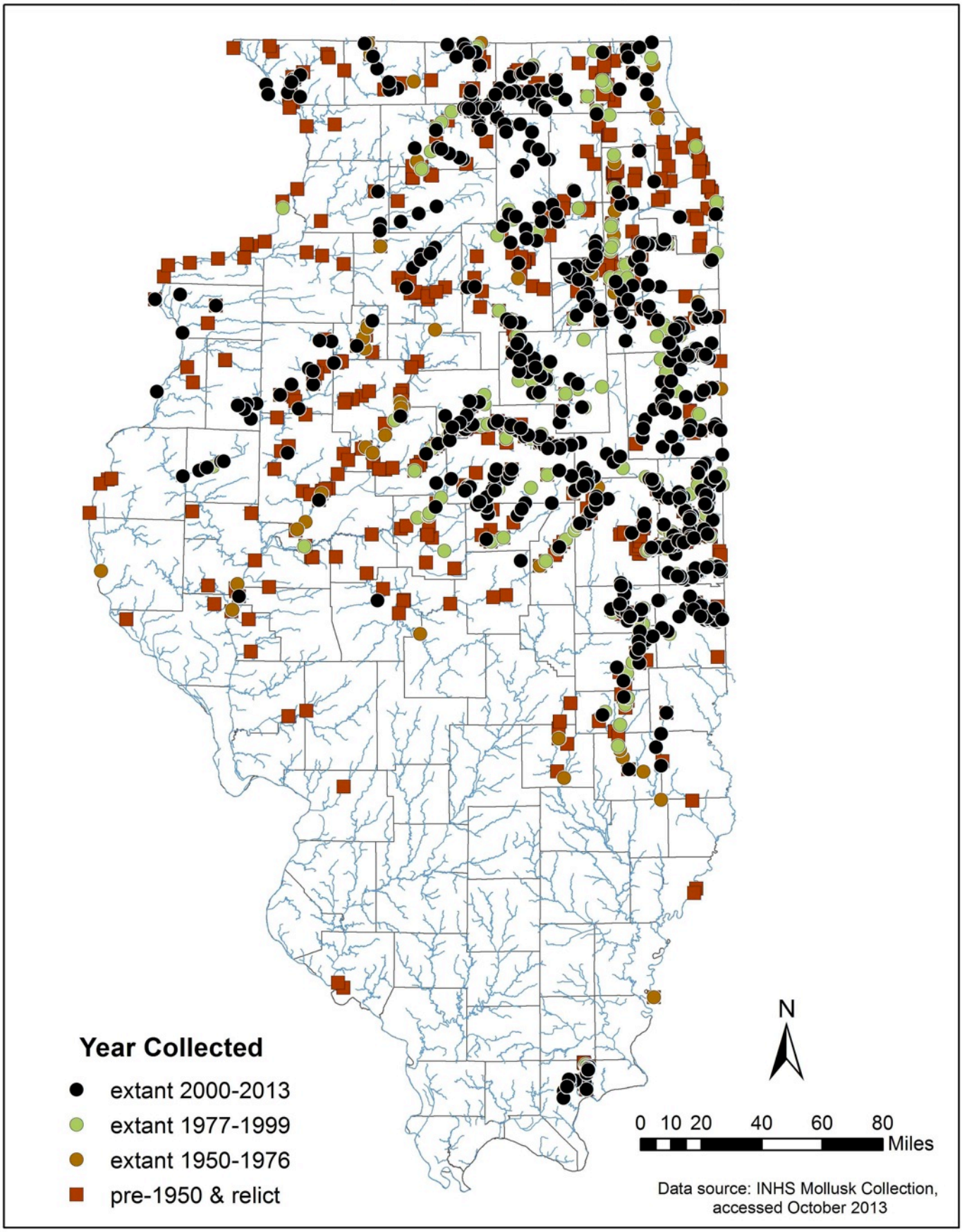
Louisiana fatmucket (*Lampsilis hydiana*)



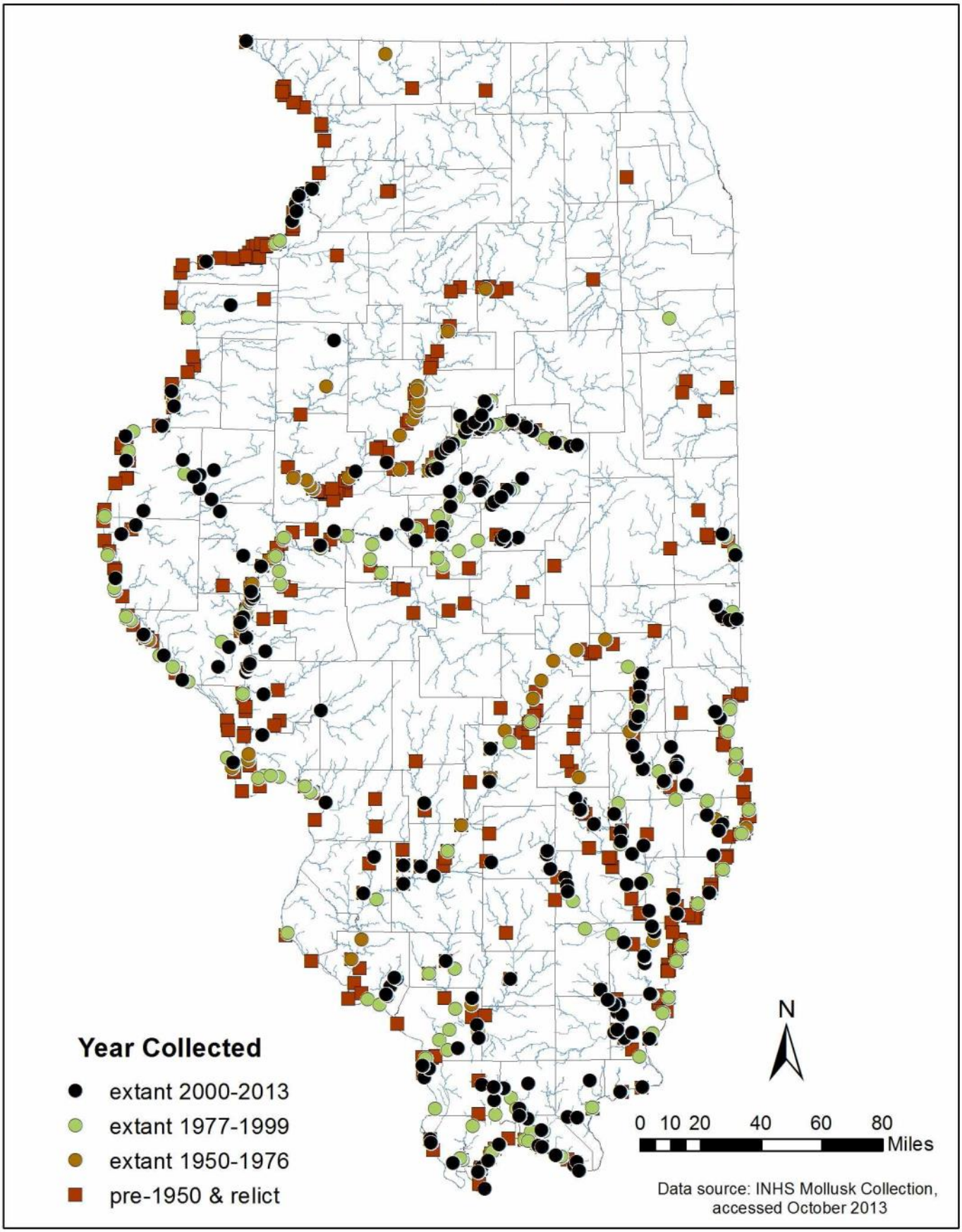
Pocketbook (*Lampsilis ovata*)



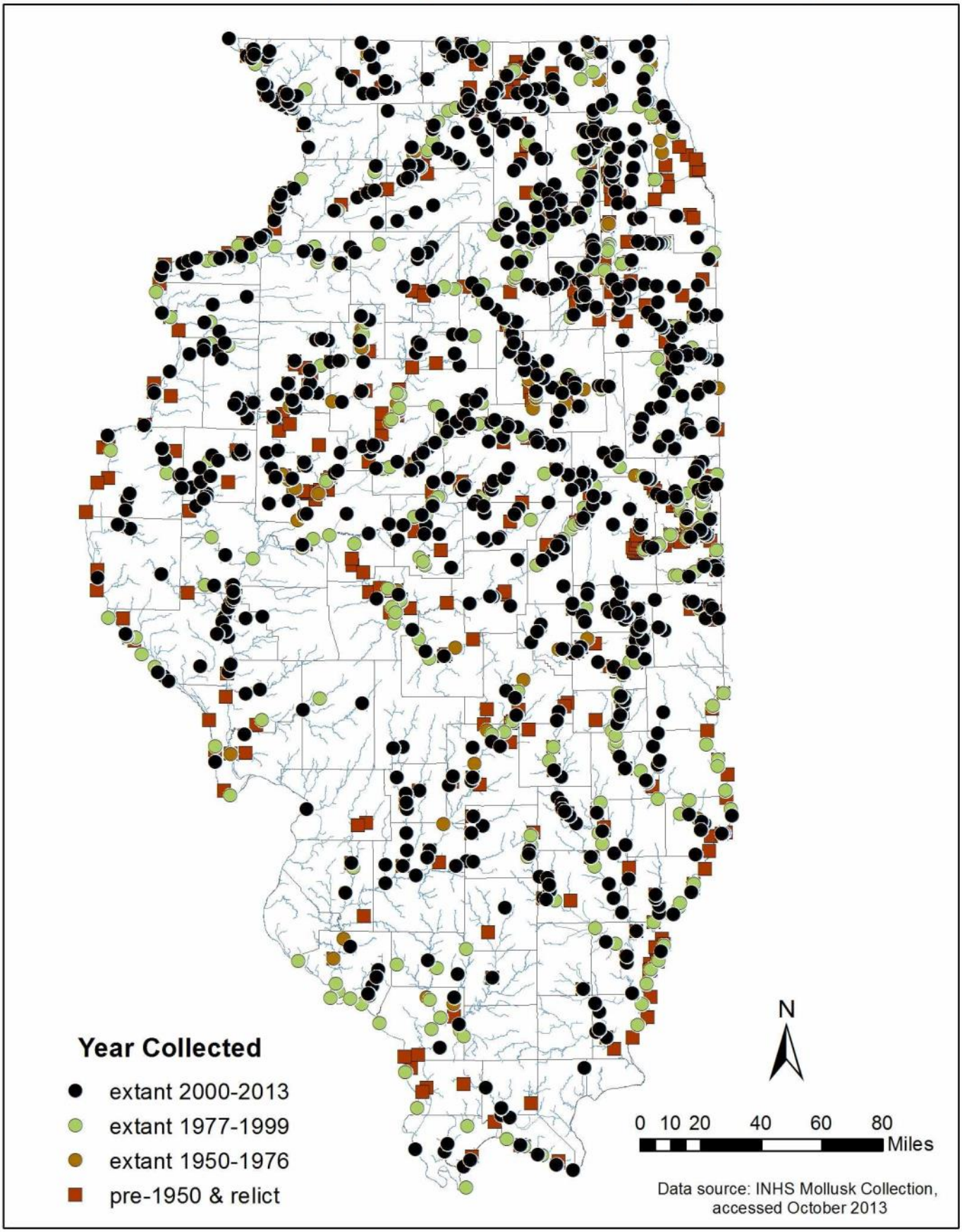
Fatmucket (*Lampsilis siliquoidea*)



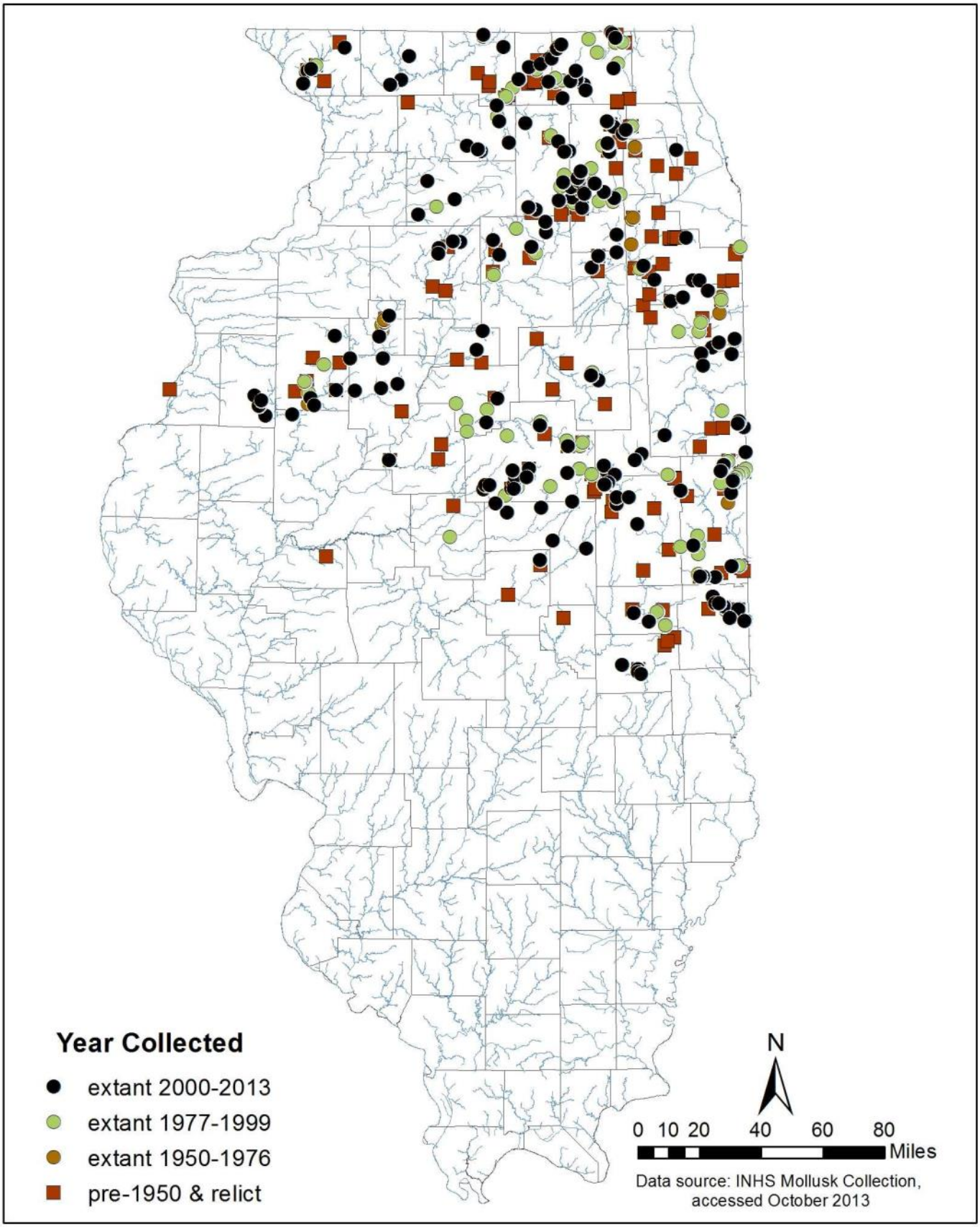
Yellow sandshell (*Lampsilis teres*)



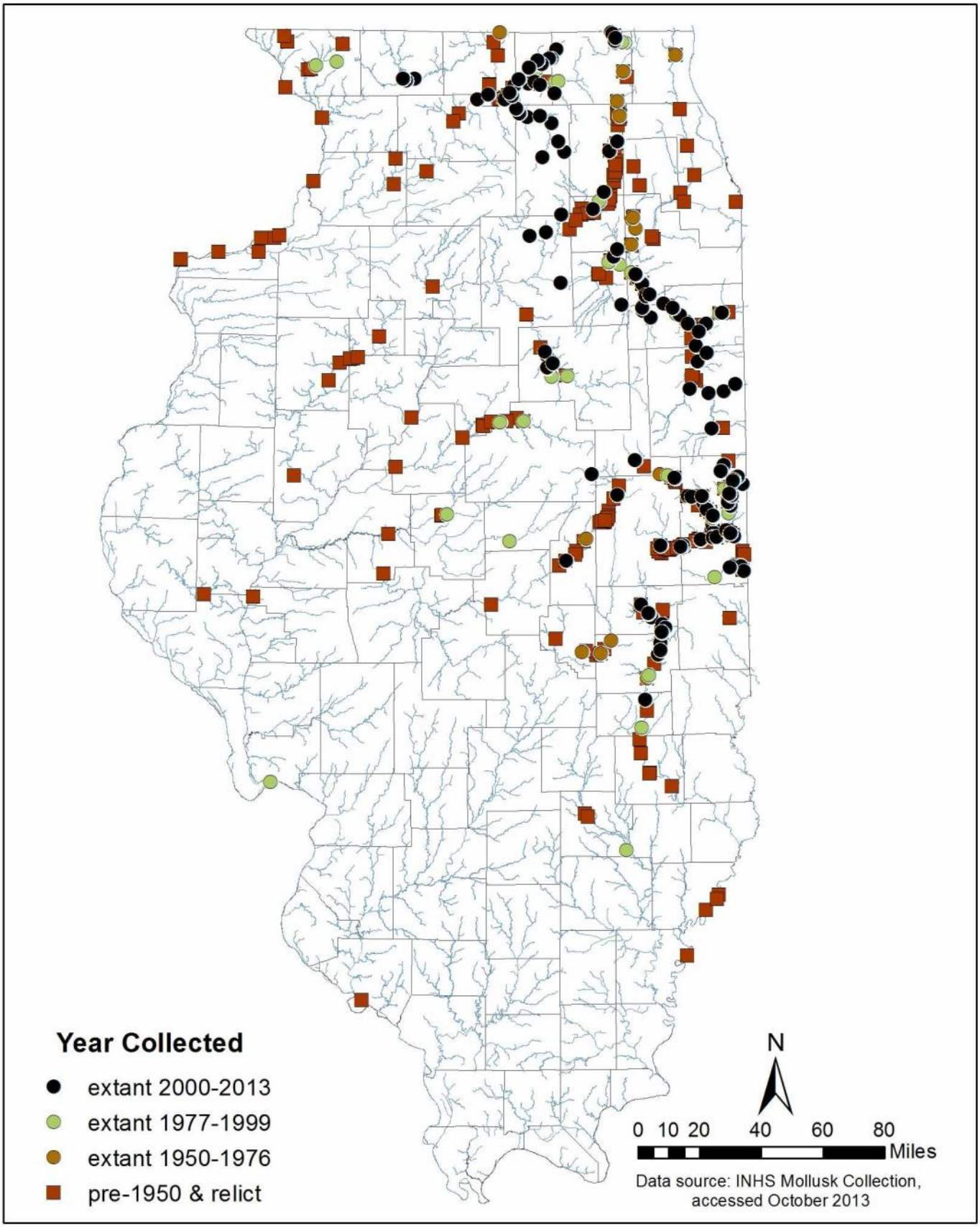
White heelsplitter (*Lasmigona complanata*)



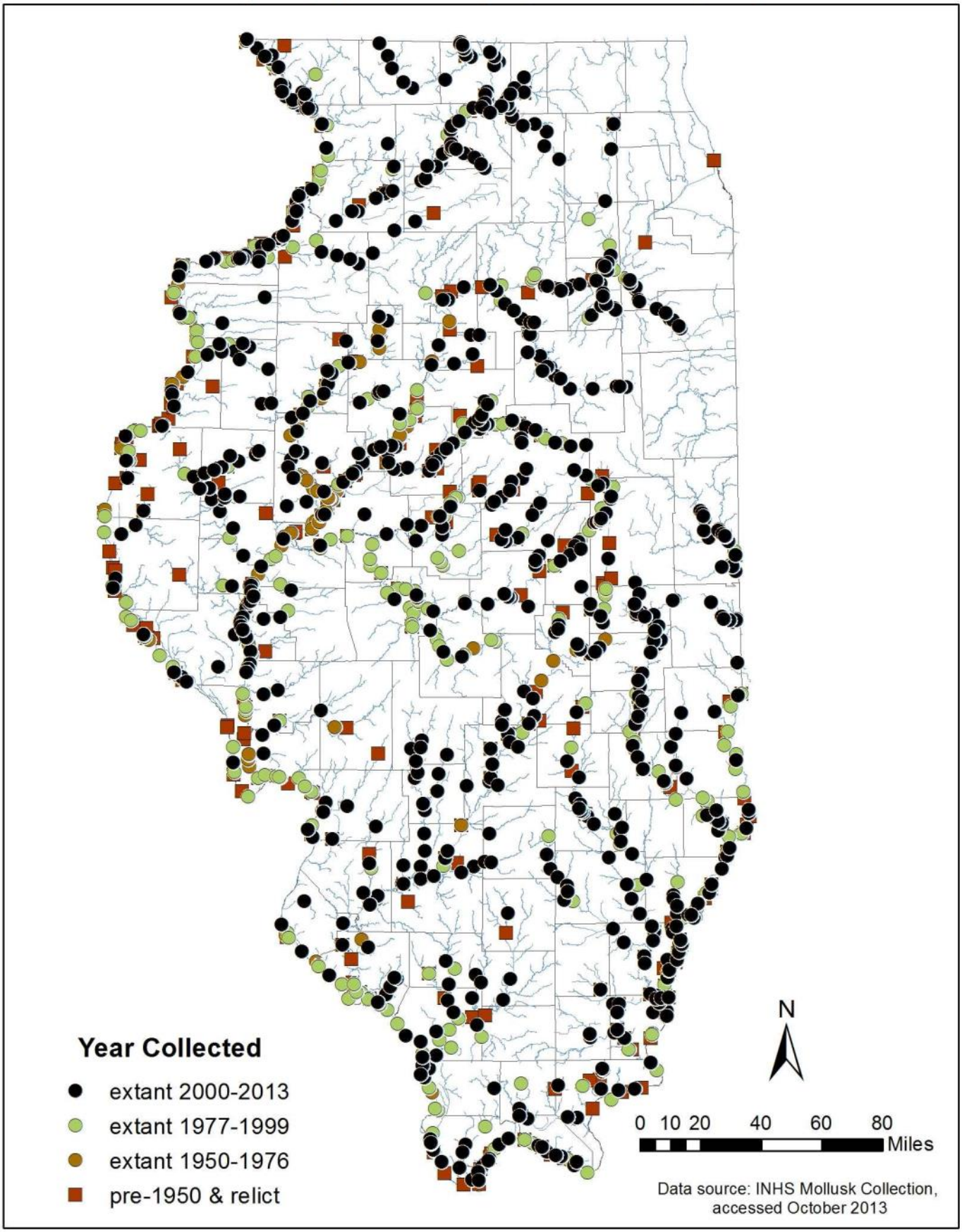
Creek heelsplitter (*Lasmigona compressa*)



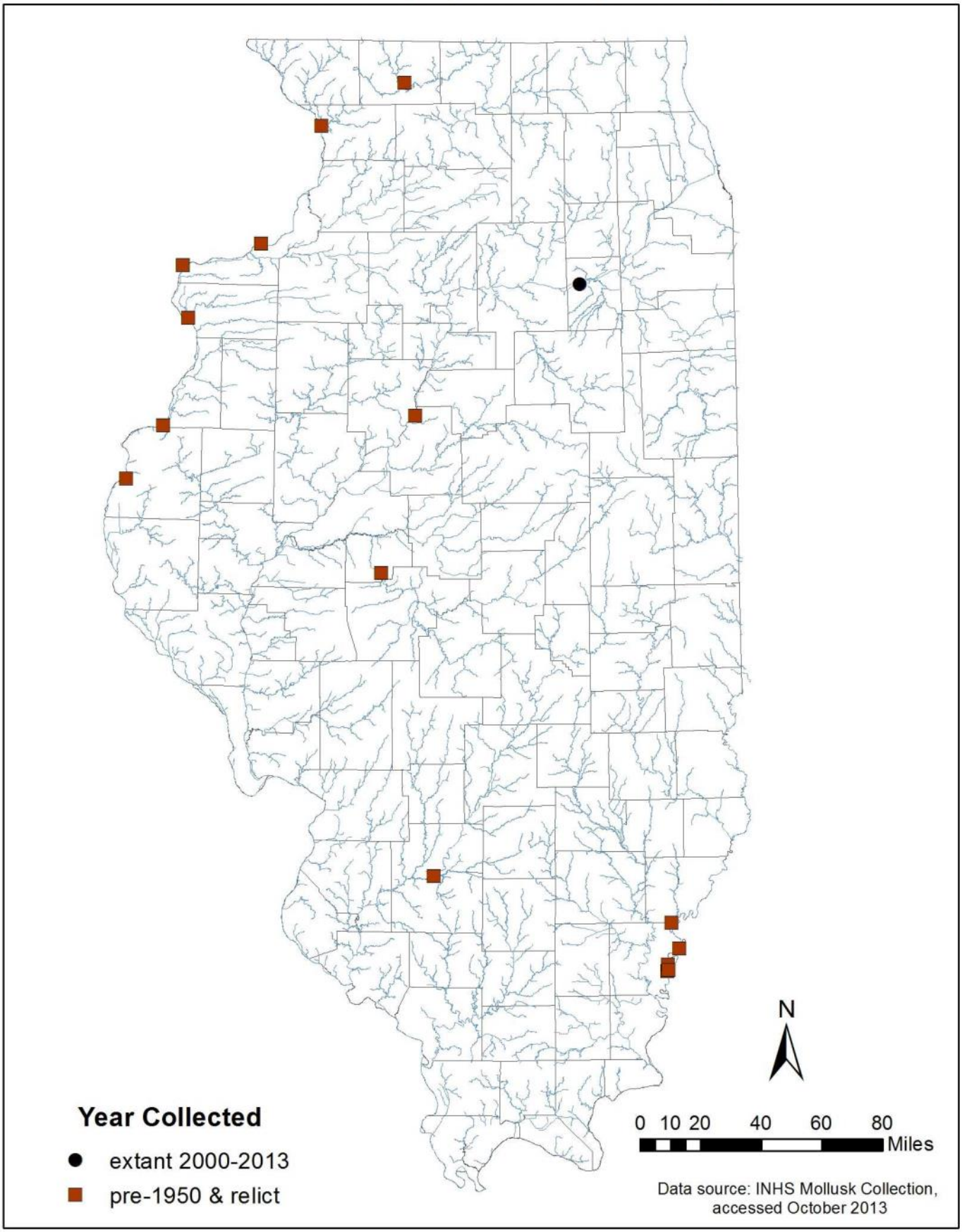
Flutedshell (*Lasmigona costata*)



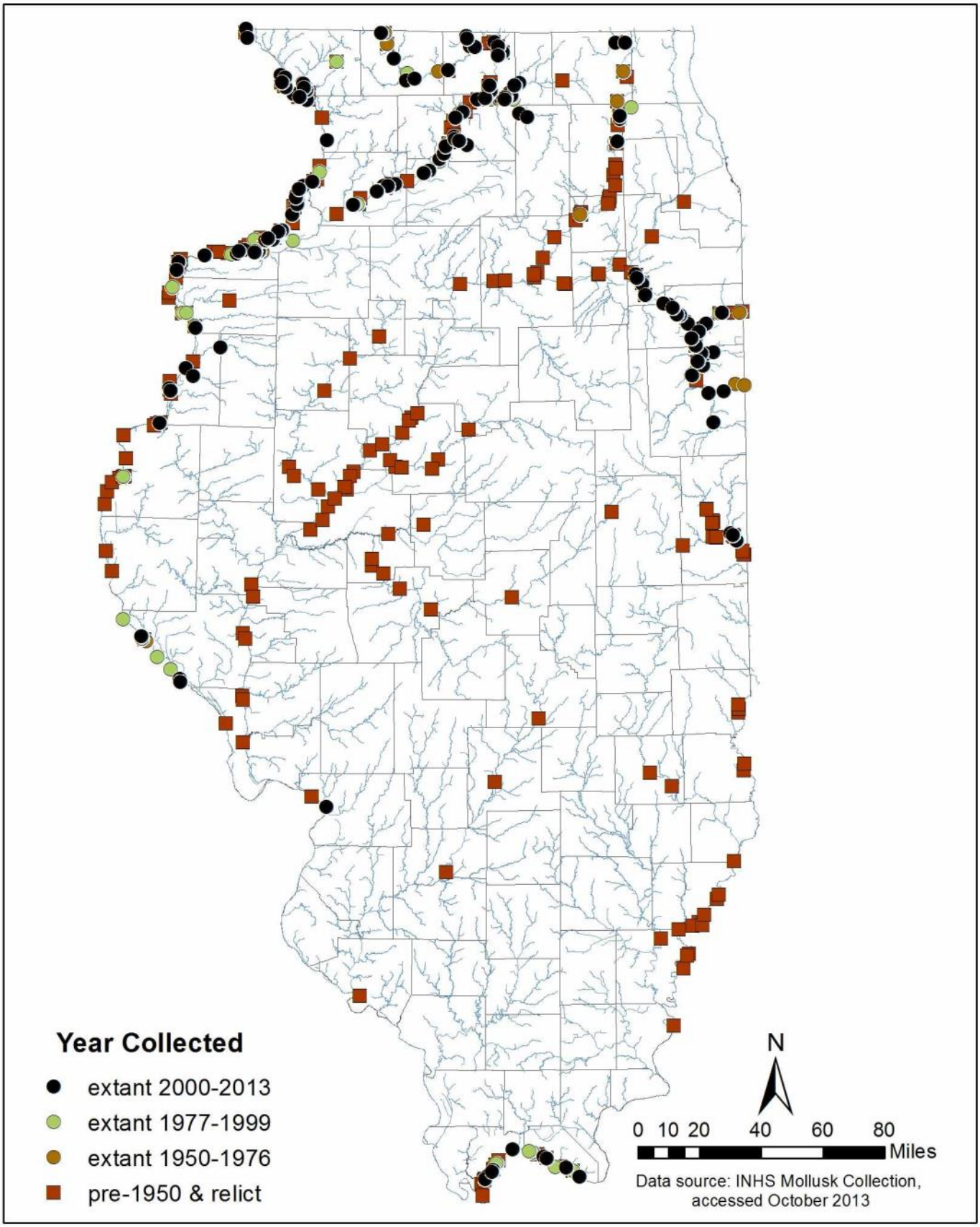
Fragile papershell (*Leptodea fragilis*)



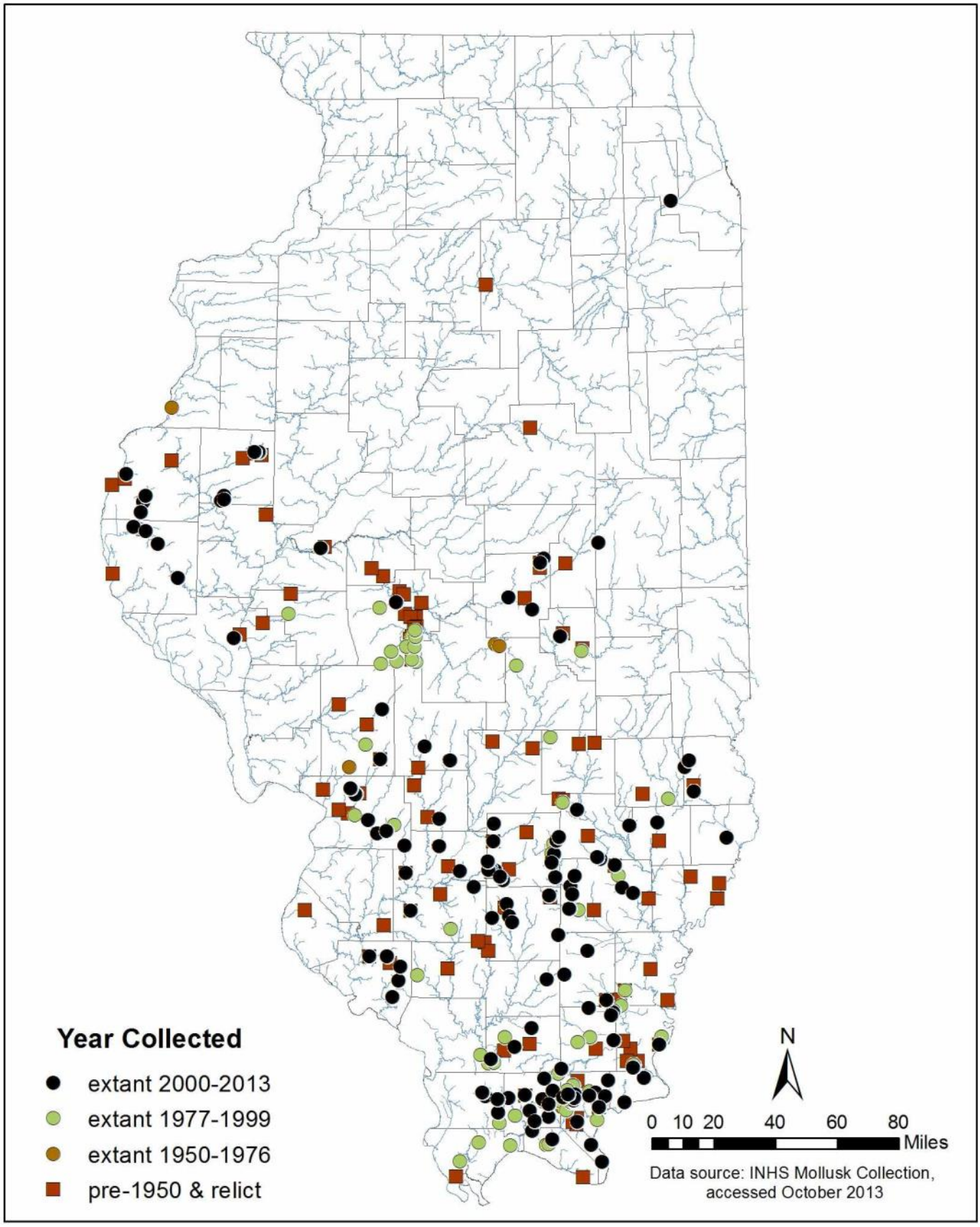
Scaleshell (*Leptodea leptodon*)



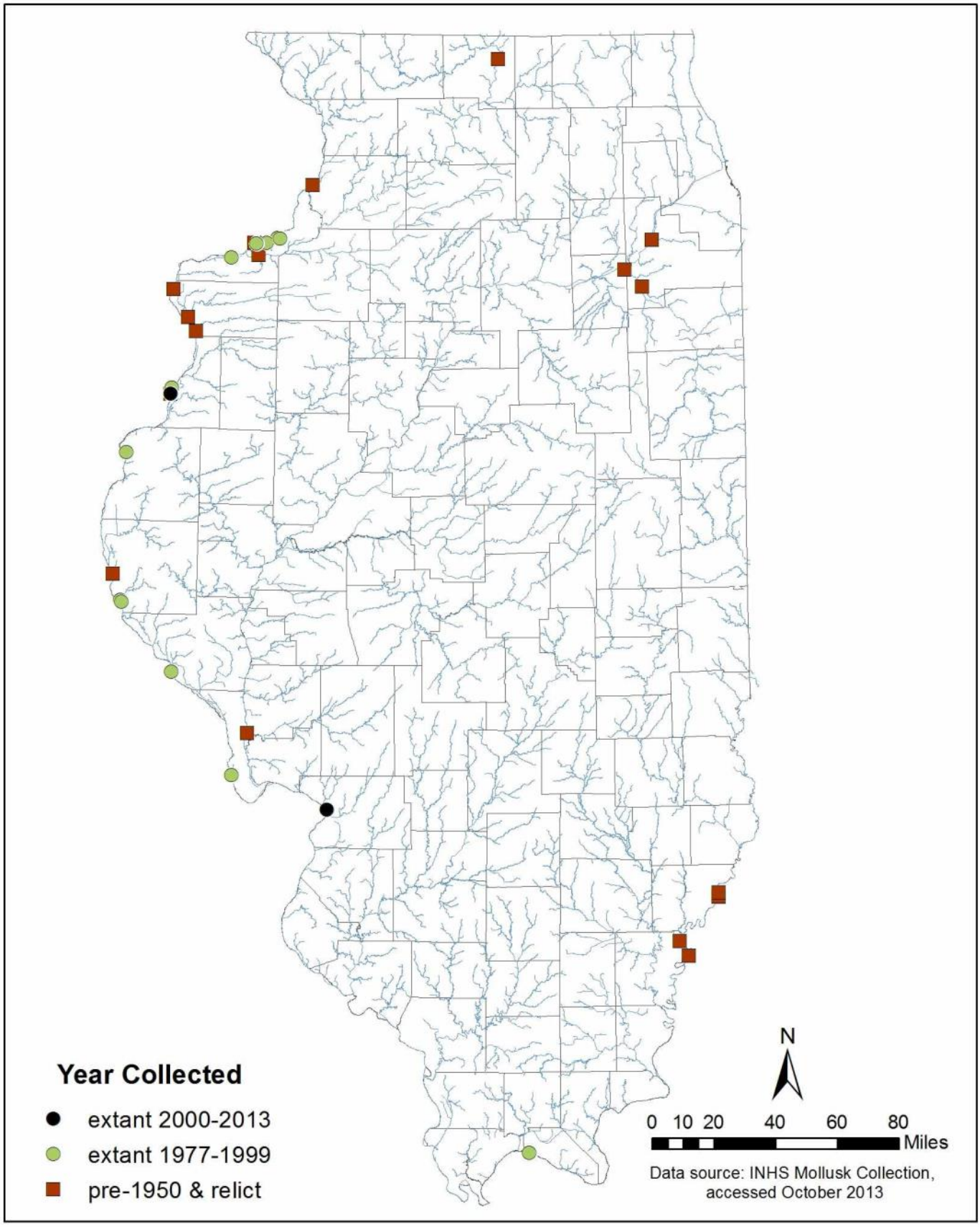
Black sandshell (*Ligumia recta*)



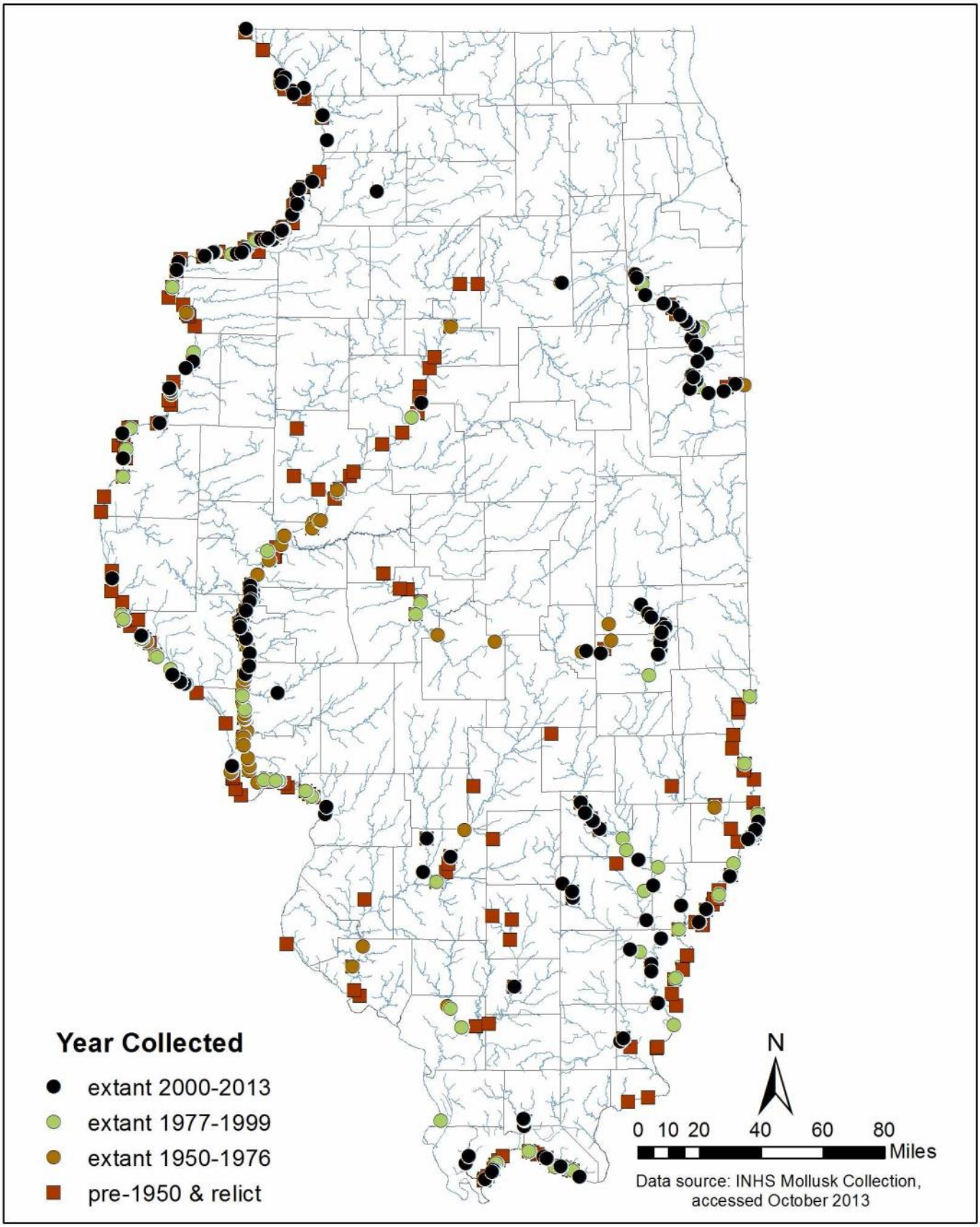
Pondmussel (*Ligumia subrostrata*)



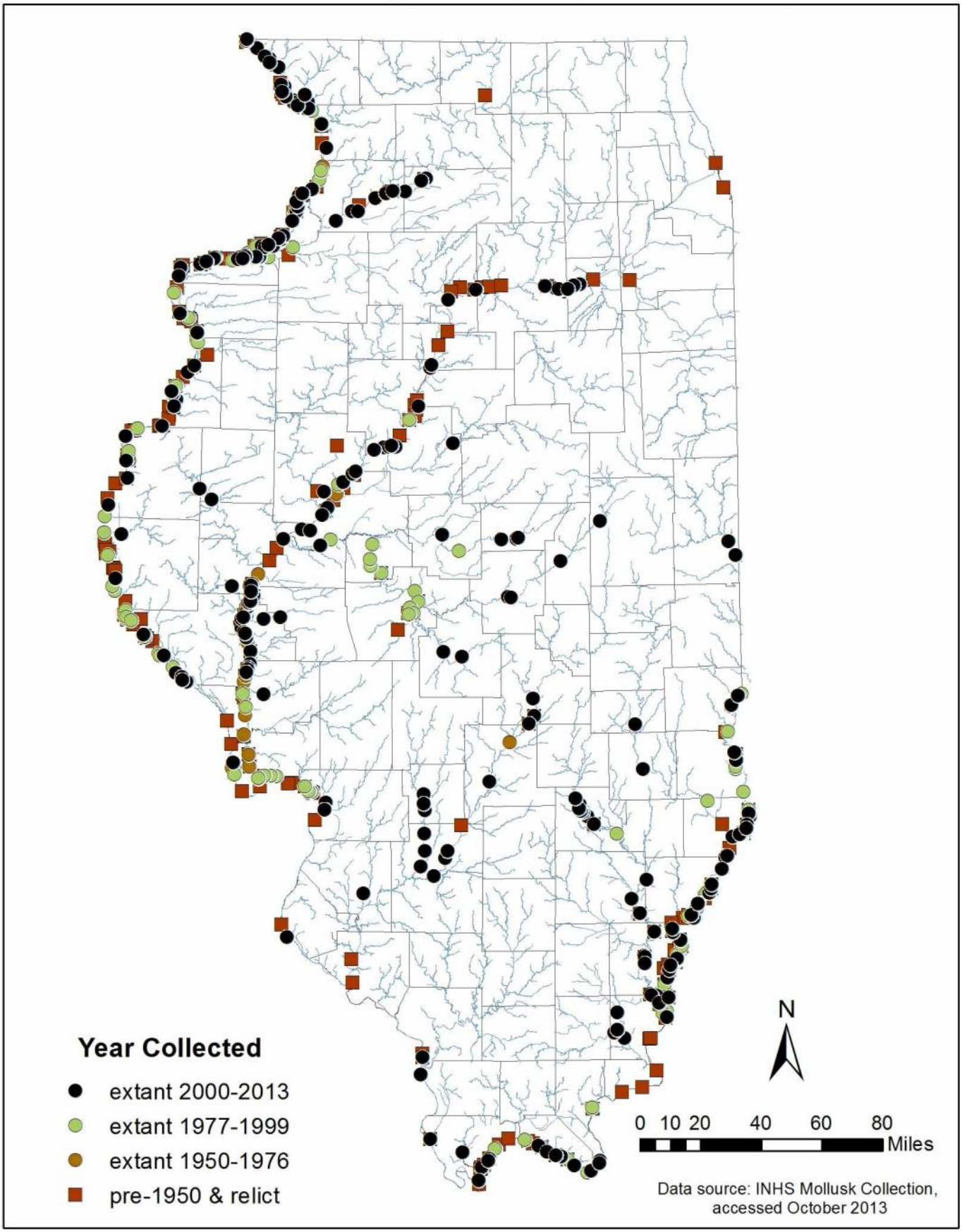
Spectaclecase (*Margaritifera monodonta*)



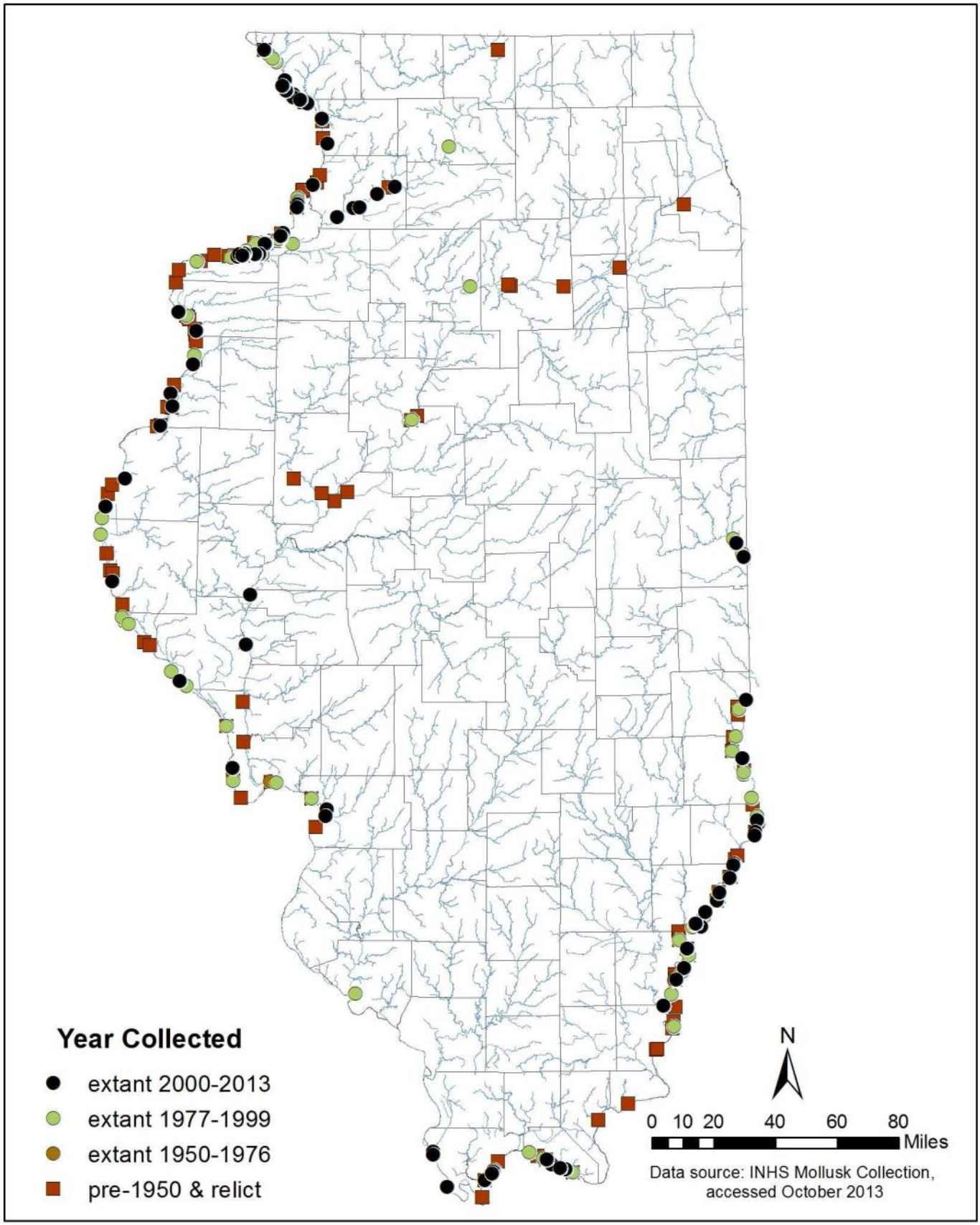
Washboard (*Megalonaias nervosa*)



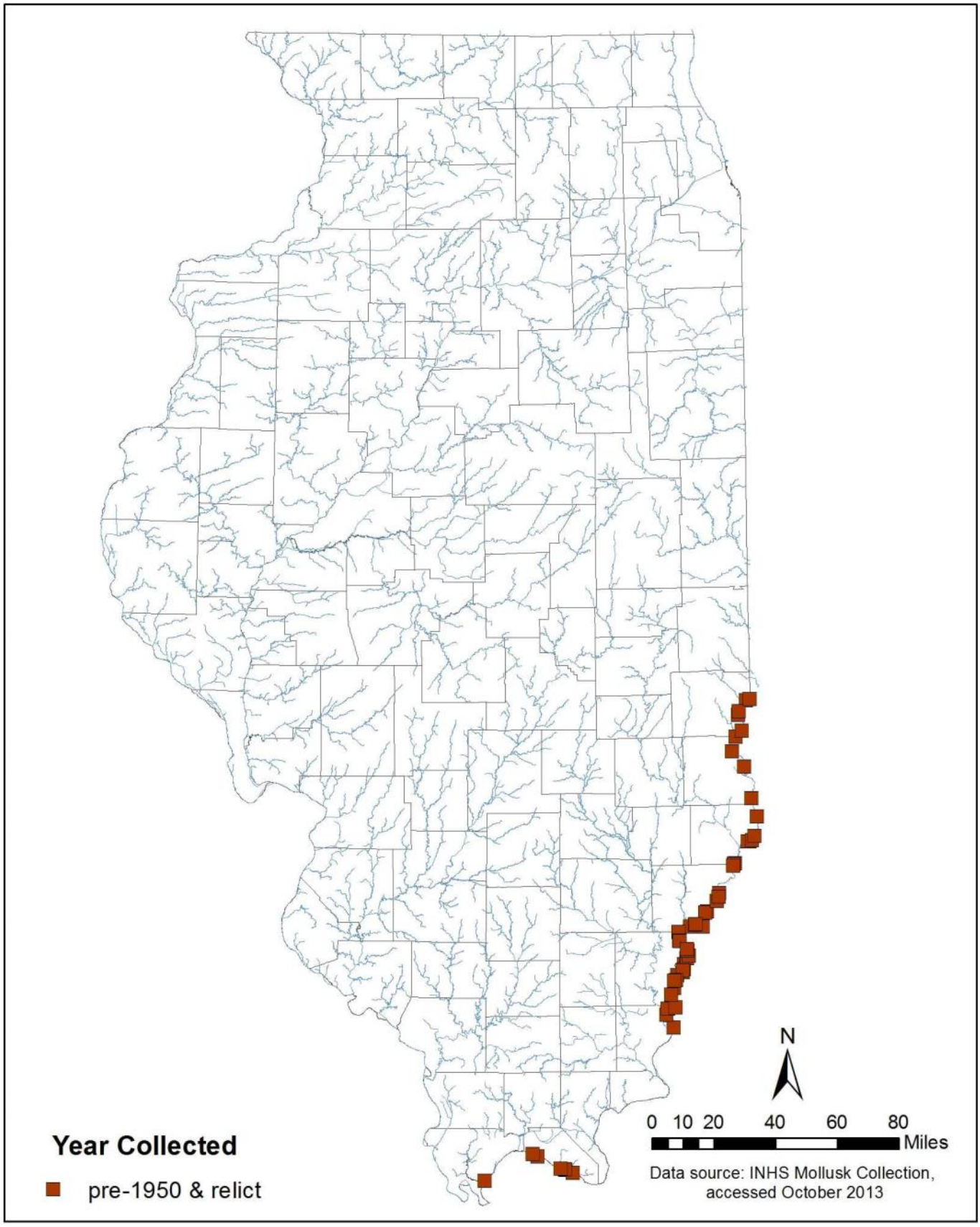
Threehorn wartyback (*Obliquaria reflexa*)



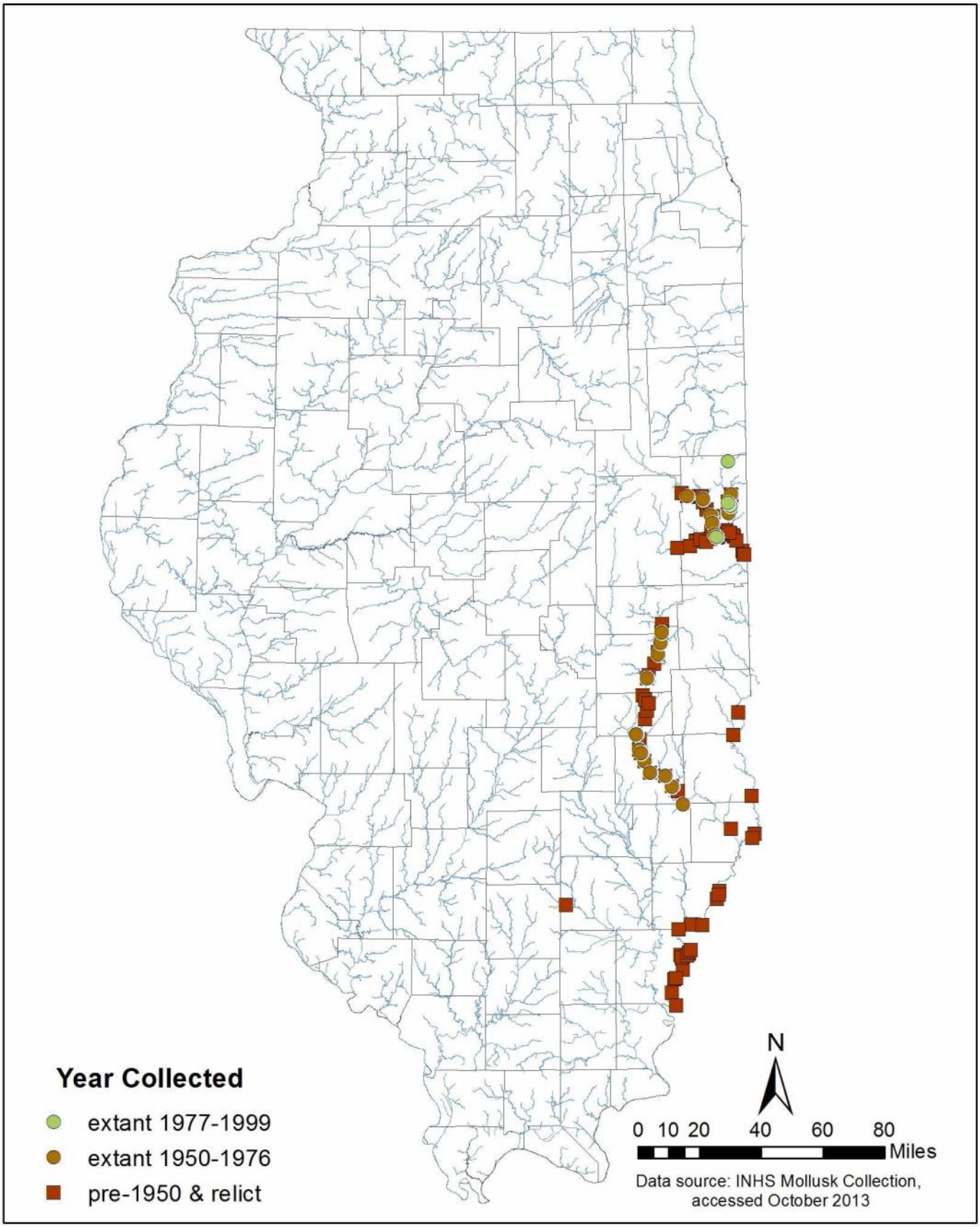
Hickorynut (*Obovaria olivaria*)



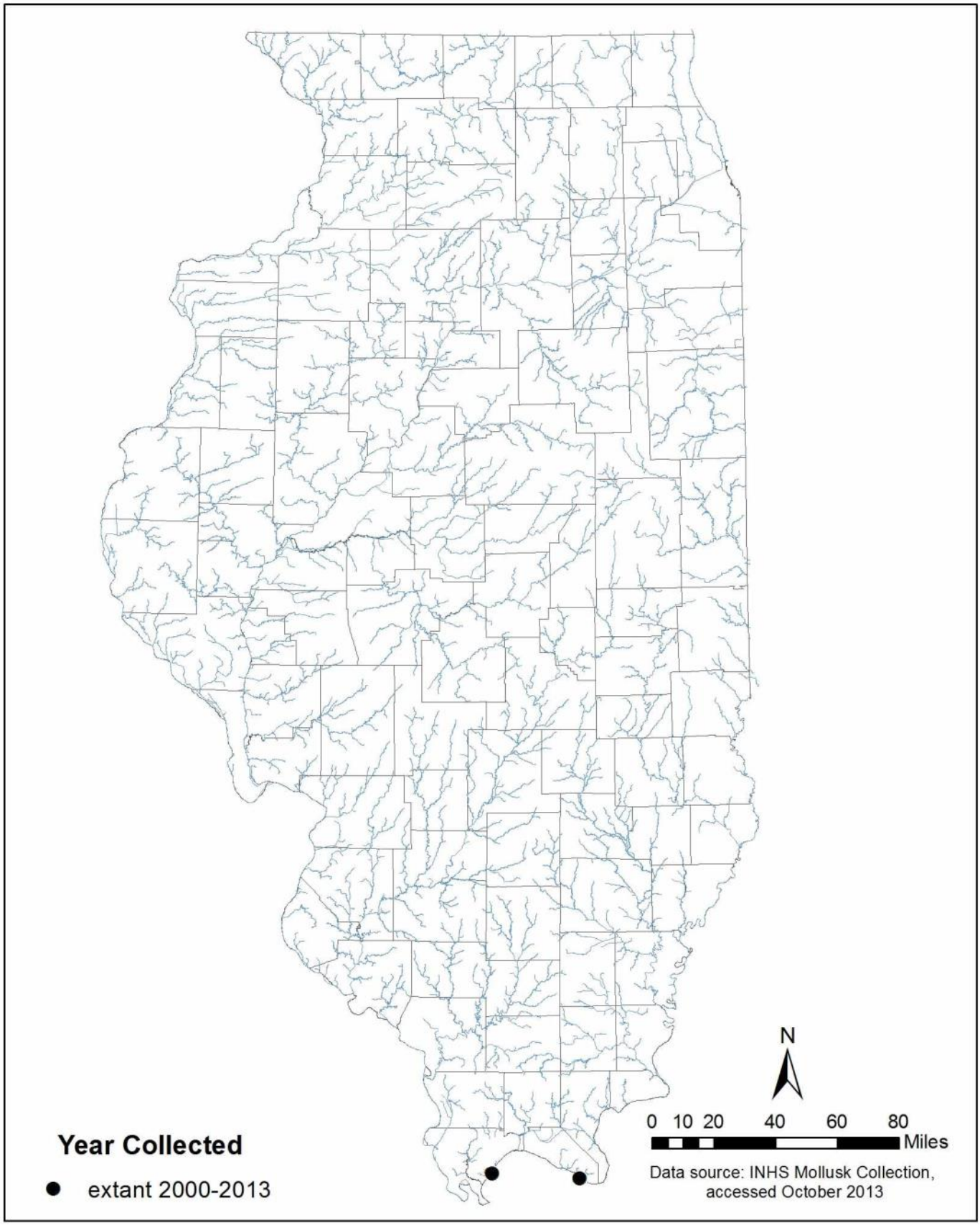
Ring pink (*Obovaria retusa*)



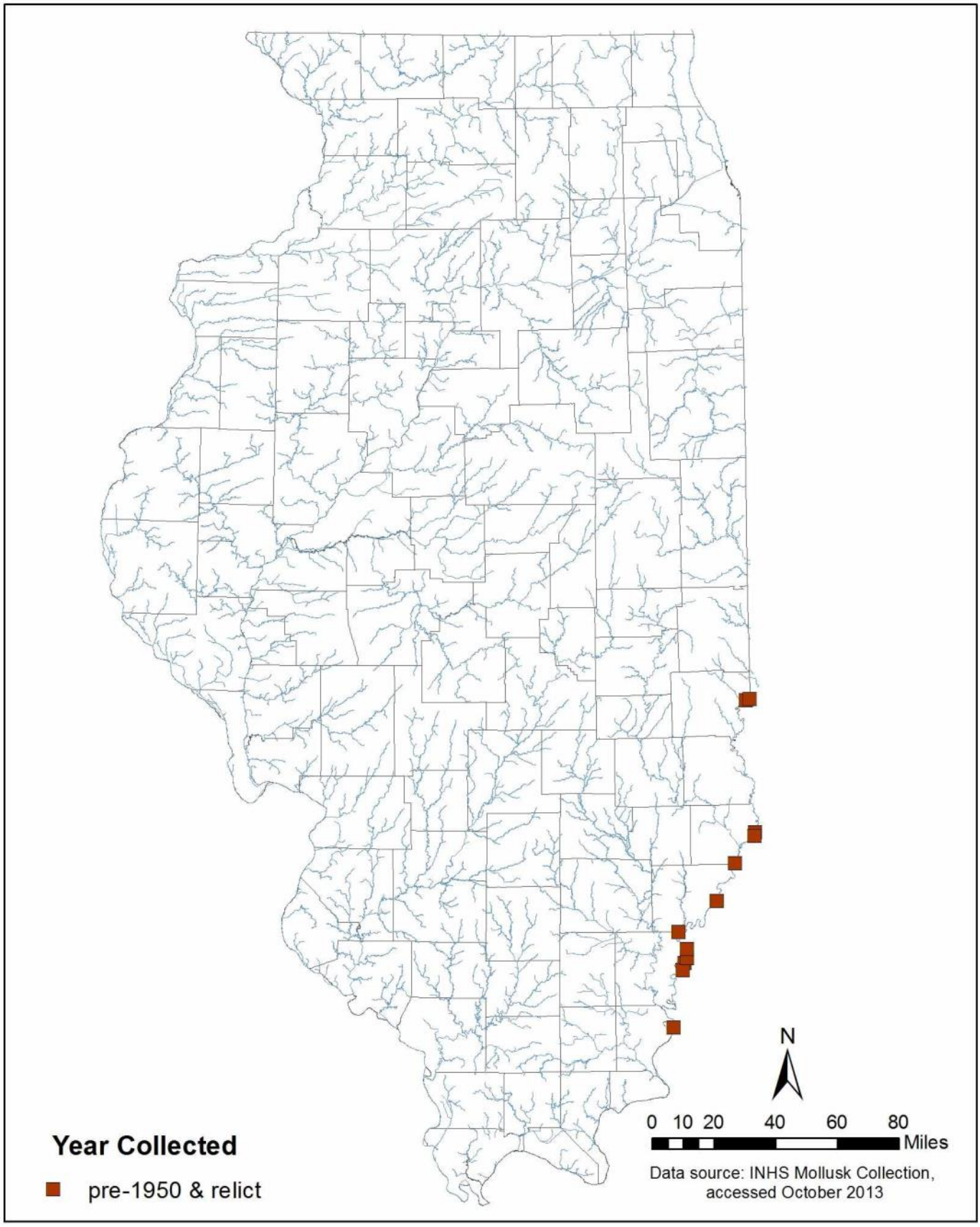
Round hickorynut (*Obovaria subrotunda*)



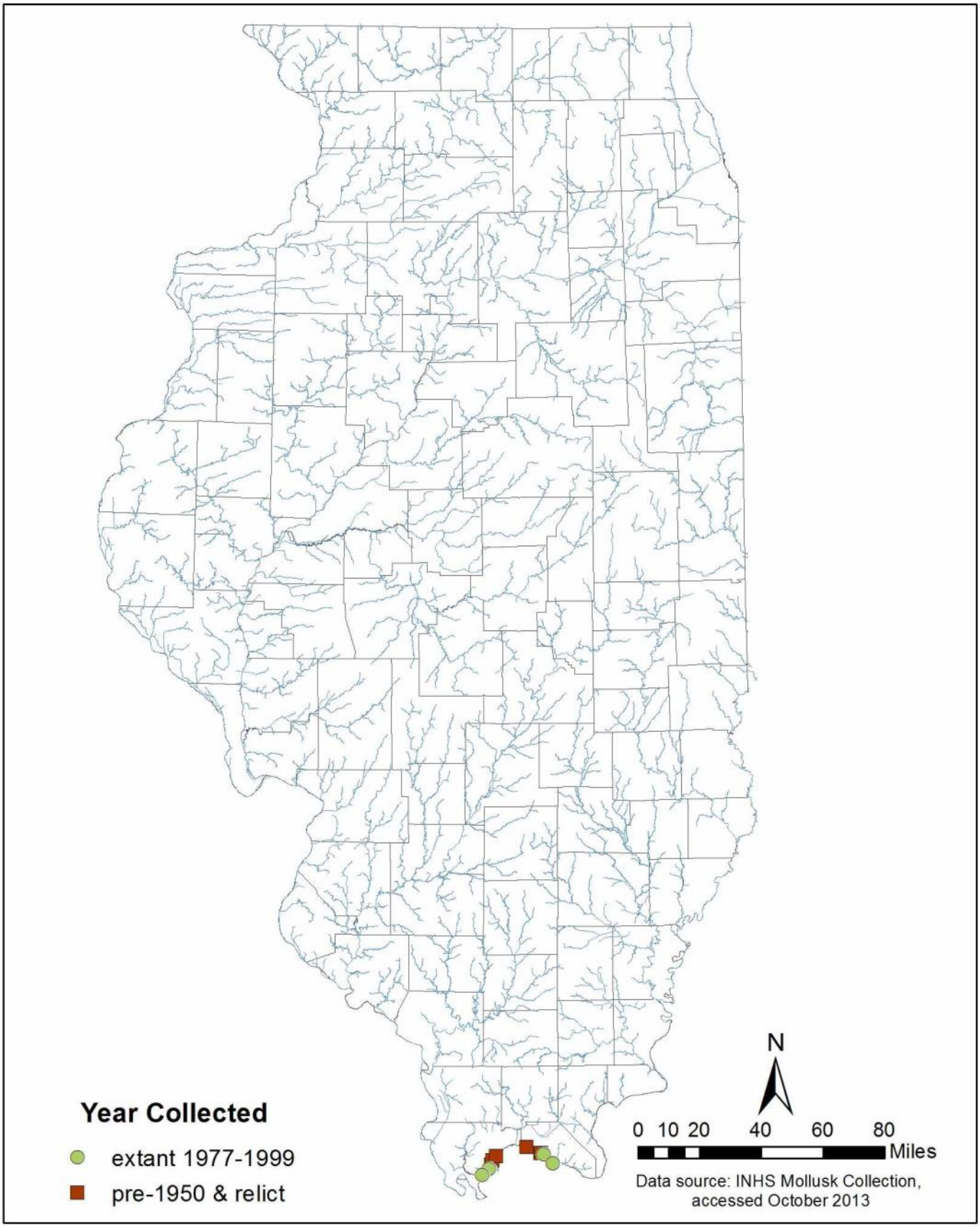
Bankclimber (*Plectomerus dombeyanus*)



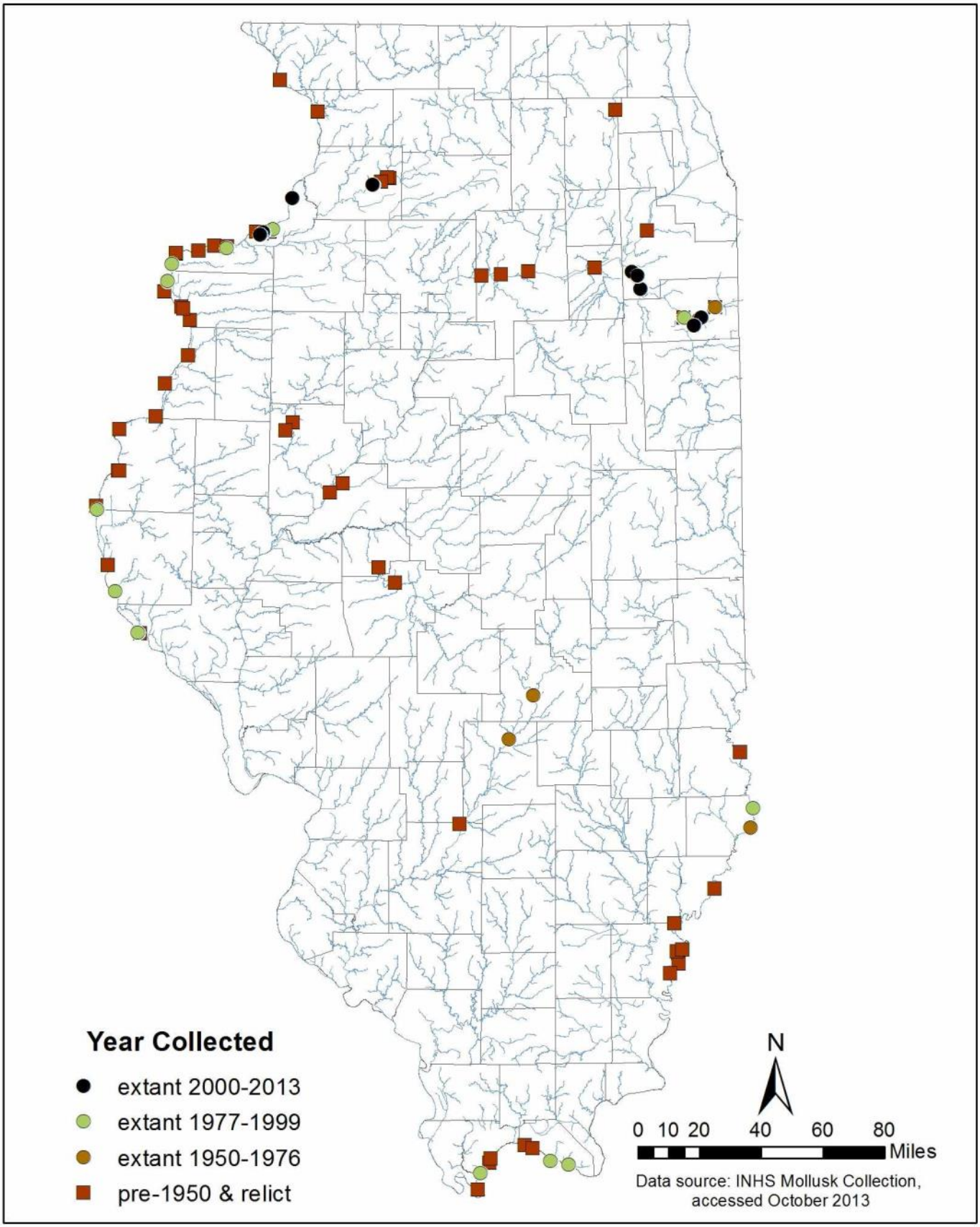
White wartyback (*Plethobasus cicatricosus*)



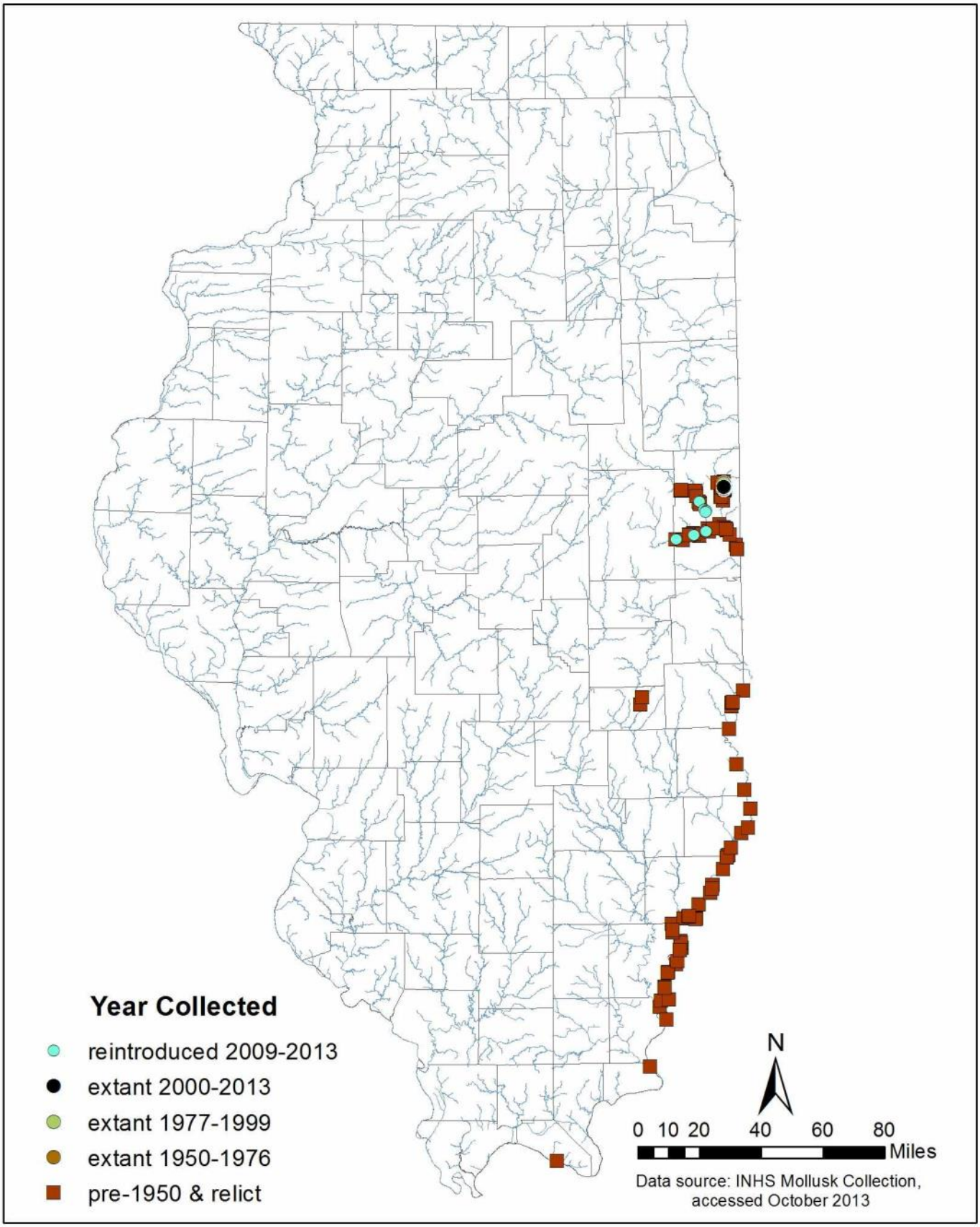
Orangefoot pimpleback (*Plethobasus cooperianus*)



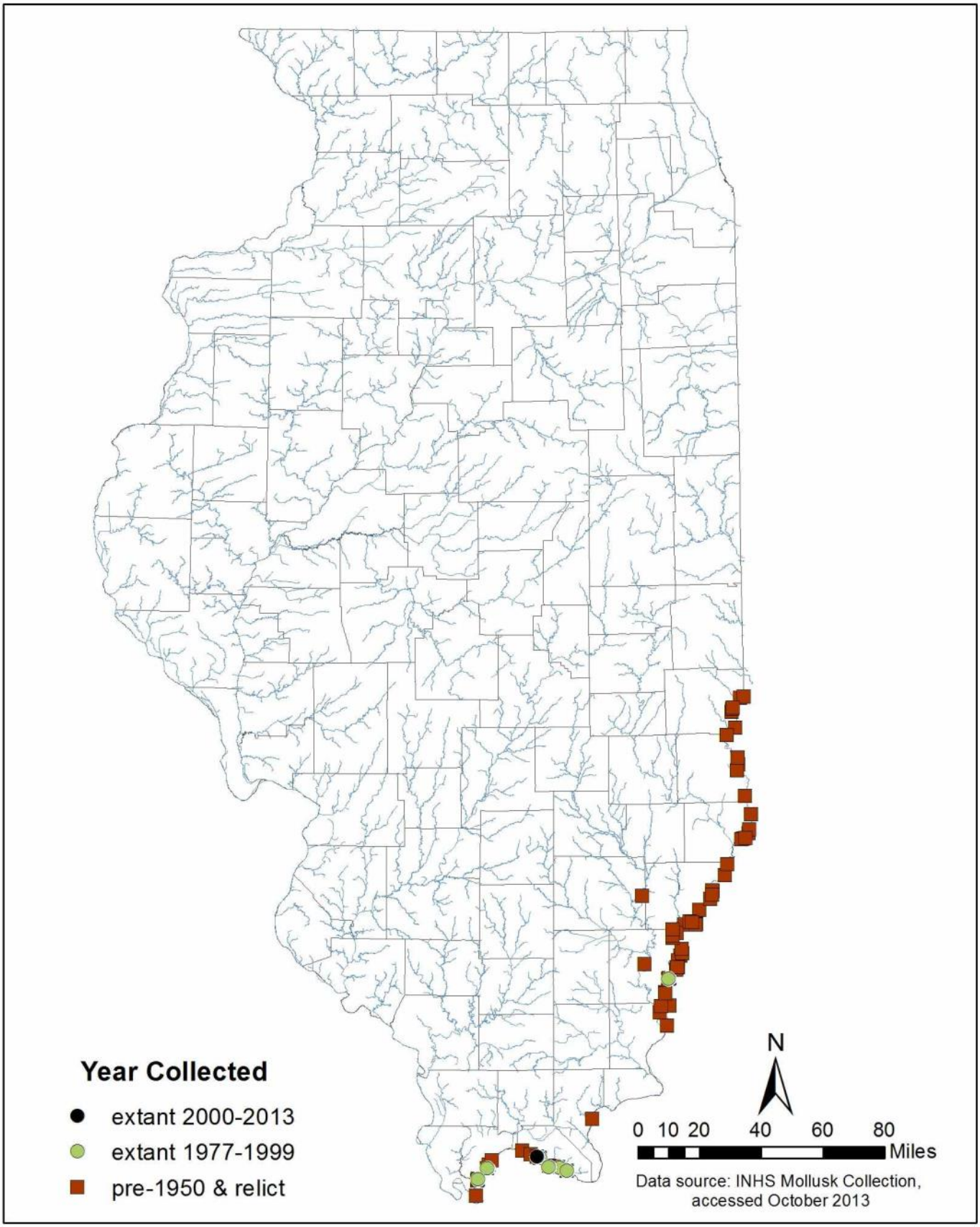
Sheepnose (*Plethobasus cyphyus*)



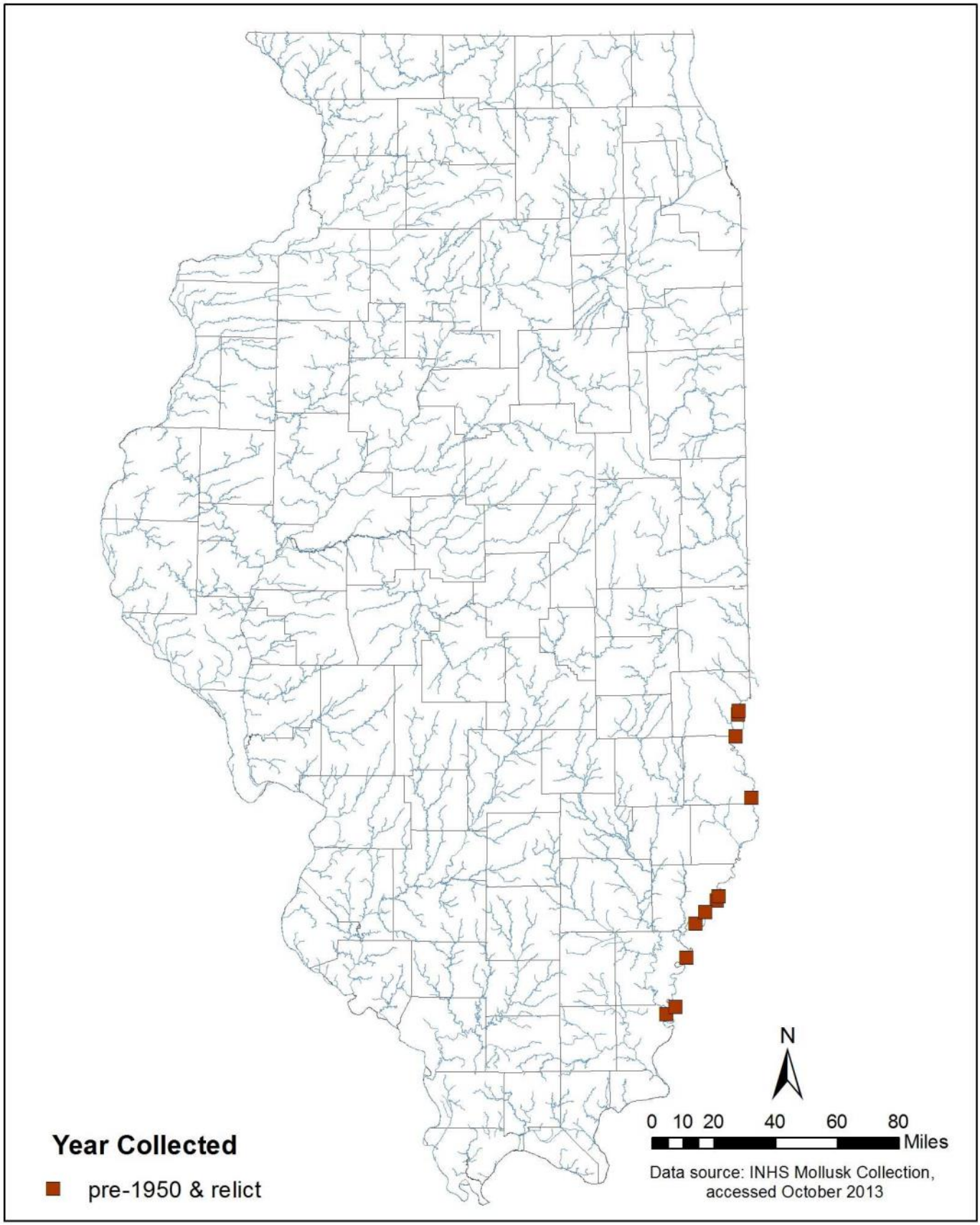
Clubshell (*Pleurobema clava*)



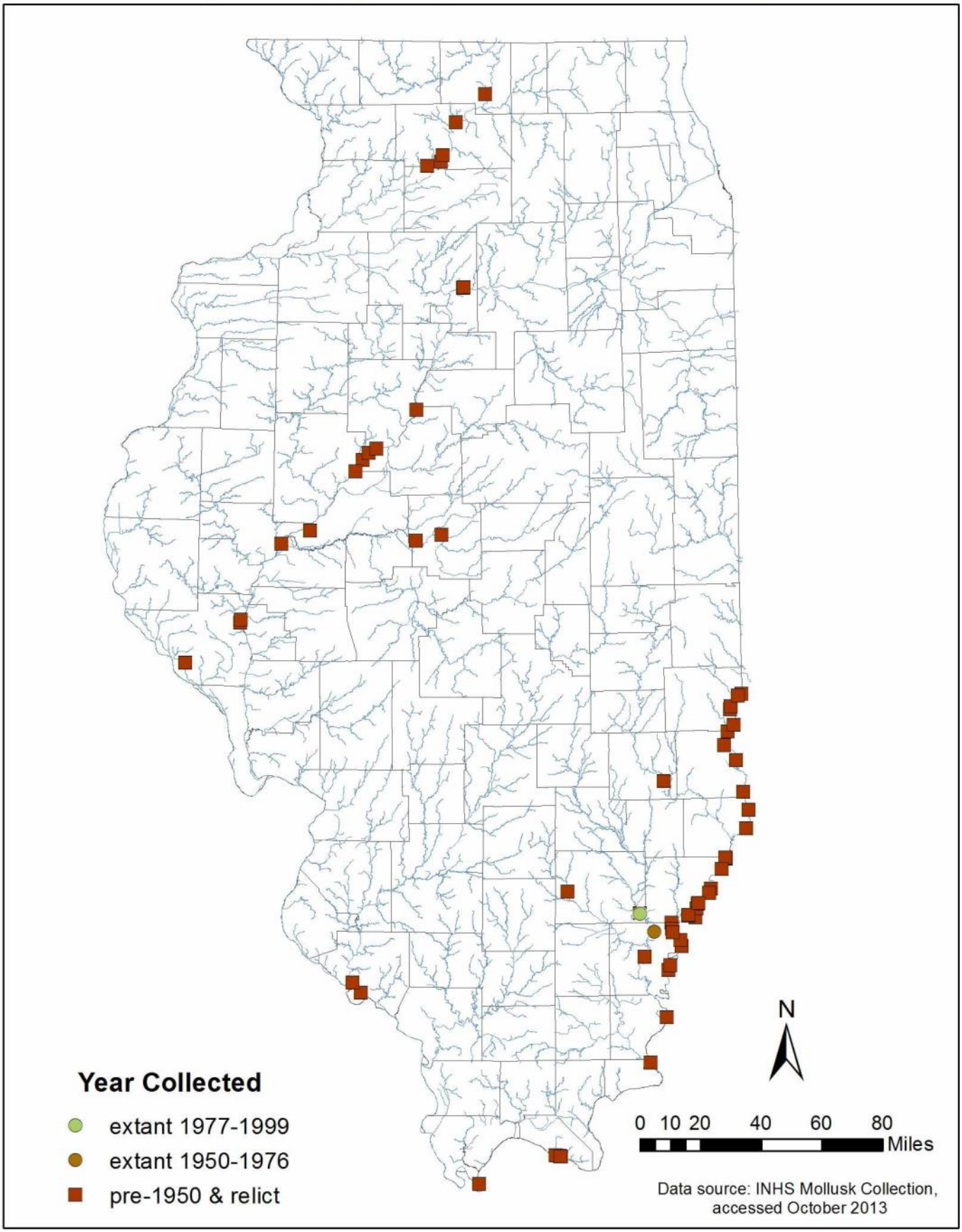
Ohio pigtoe (*Pleurobema cordatum*)



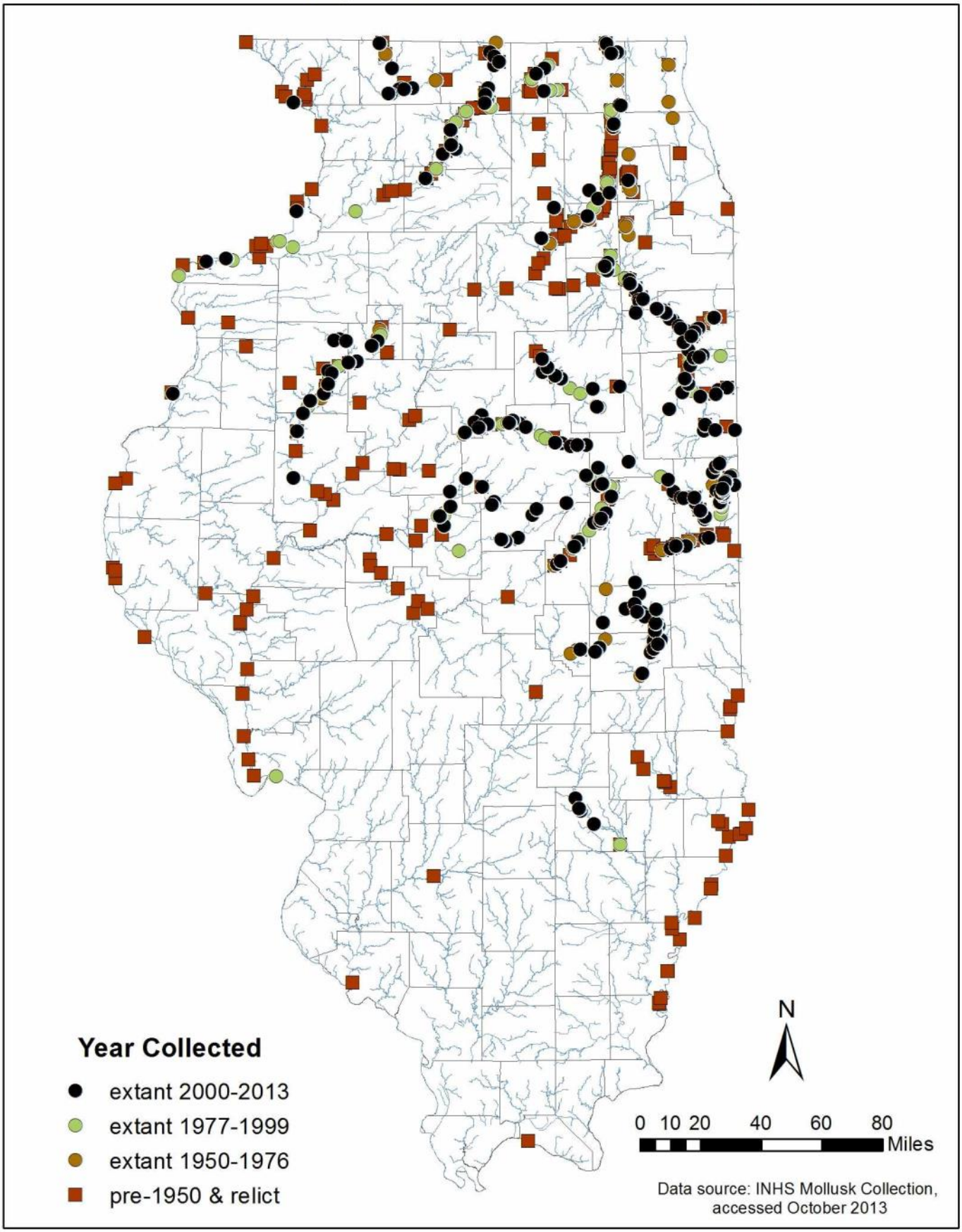
Rough pigtoe (*Pleurobema plenum*)



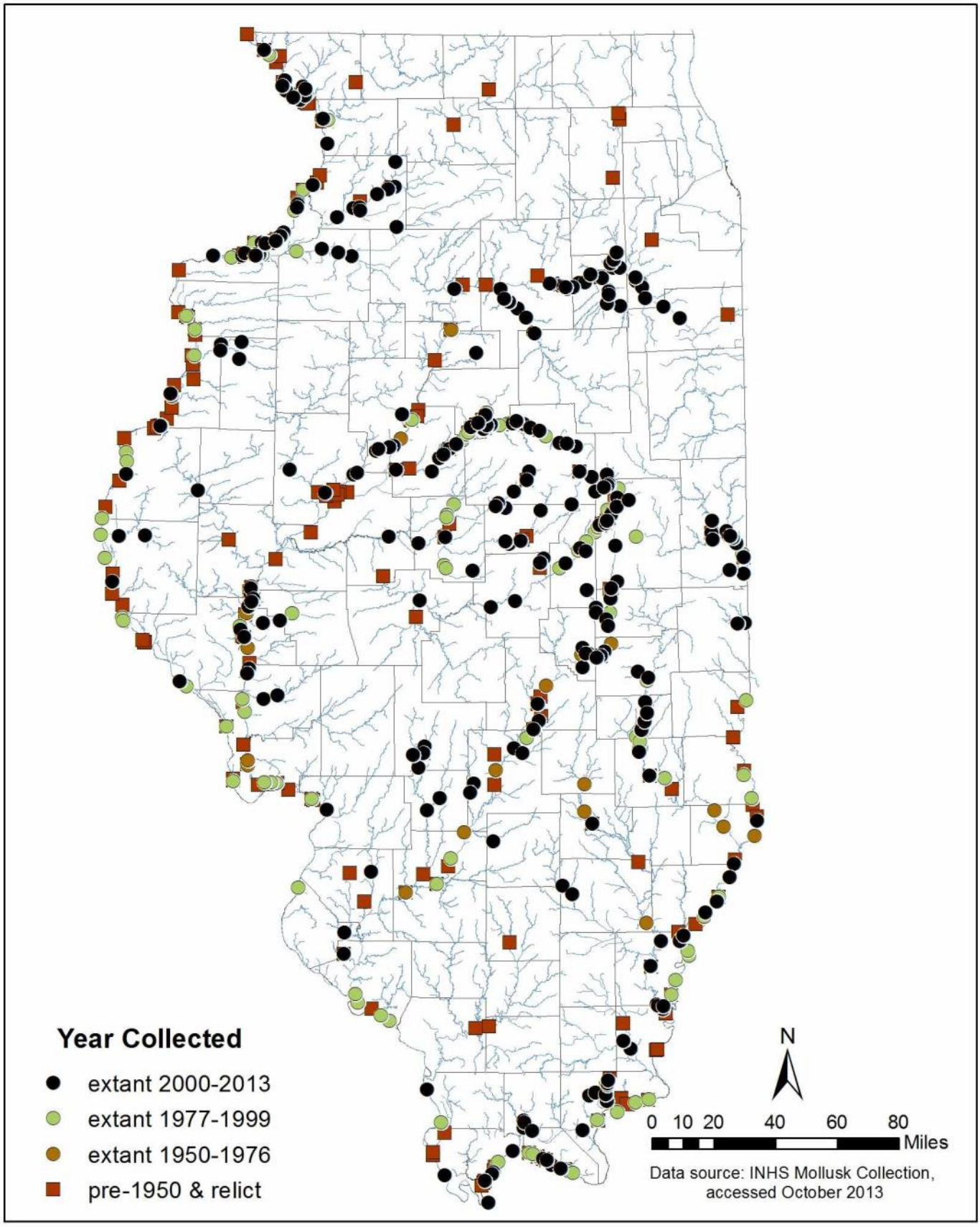
Pyramid pigtoe (*Pleurobema rubrum*)



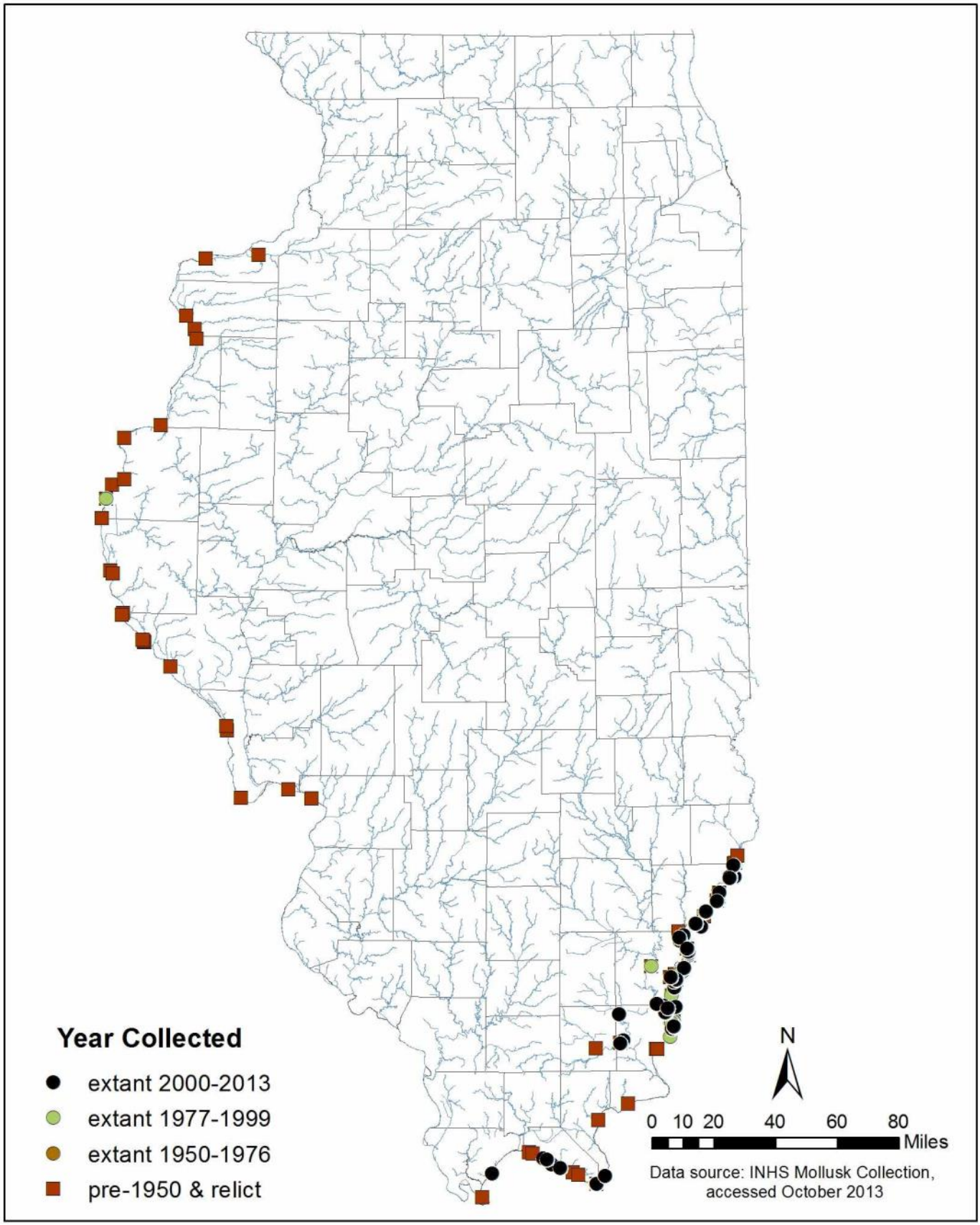
Round pigtoe (*Pleurobema sintoxia*)



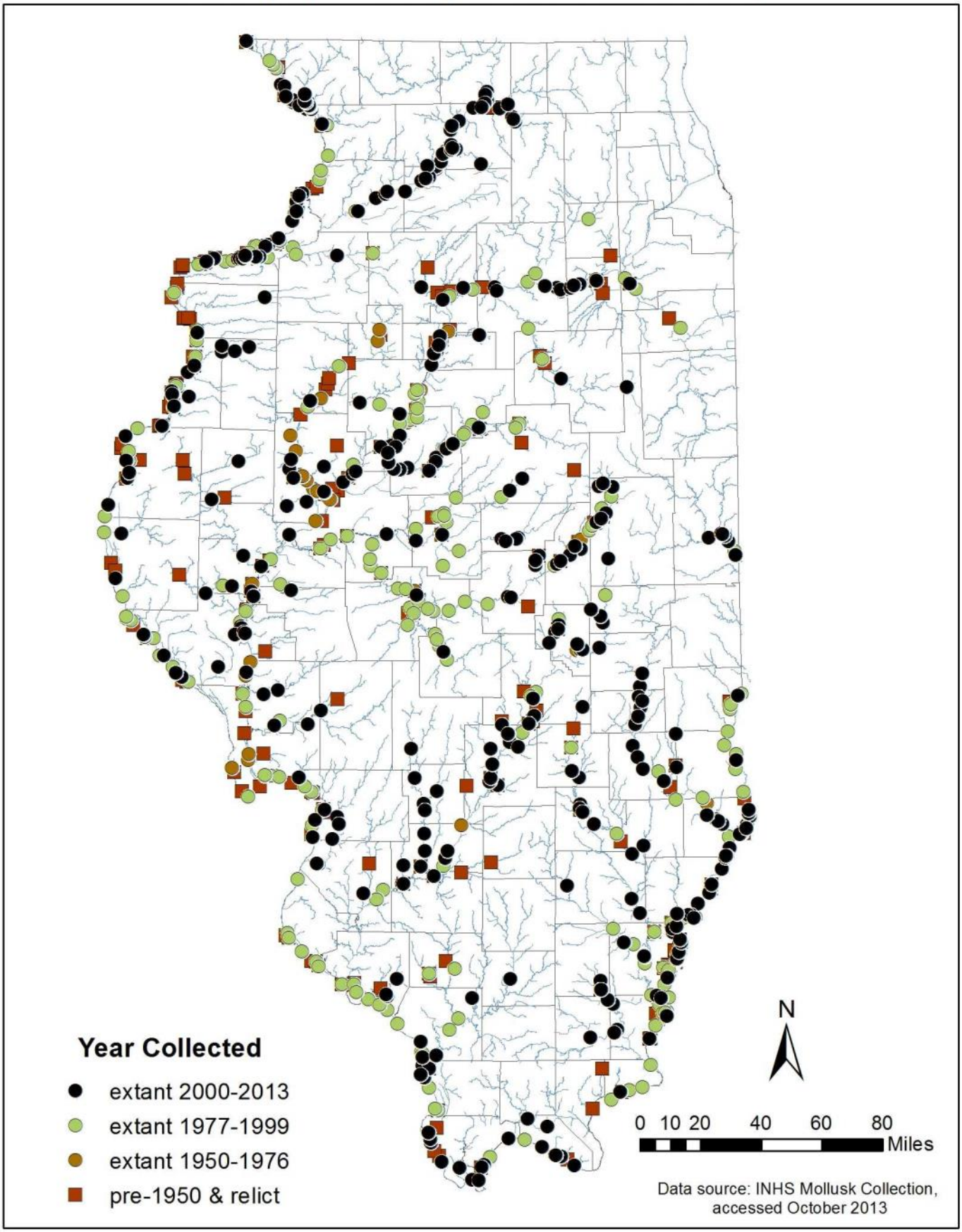
Pink heelsplitter (*Potamilus alatus*)



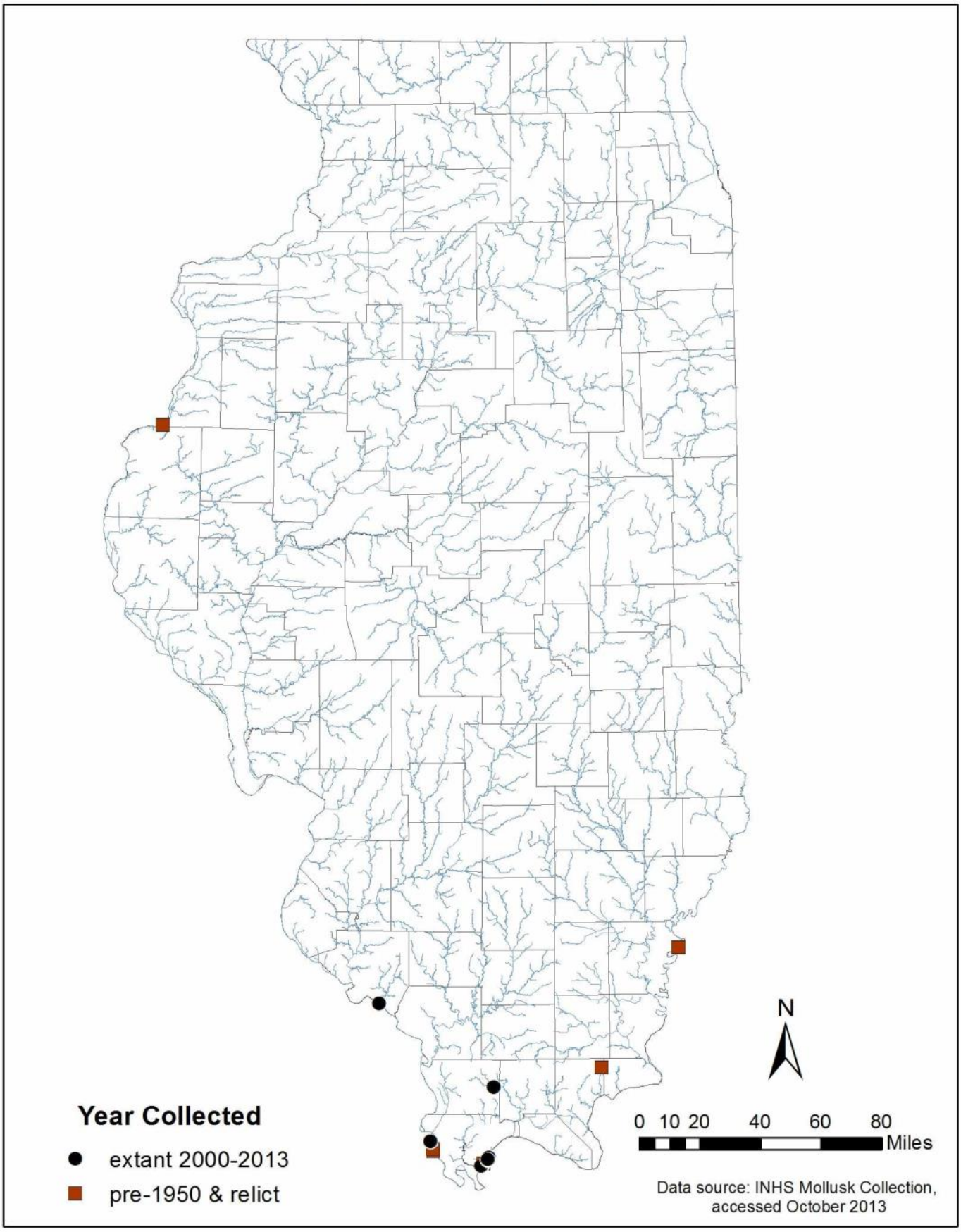
Fat pocketbook (*Potamilus capax*)



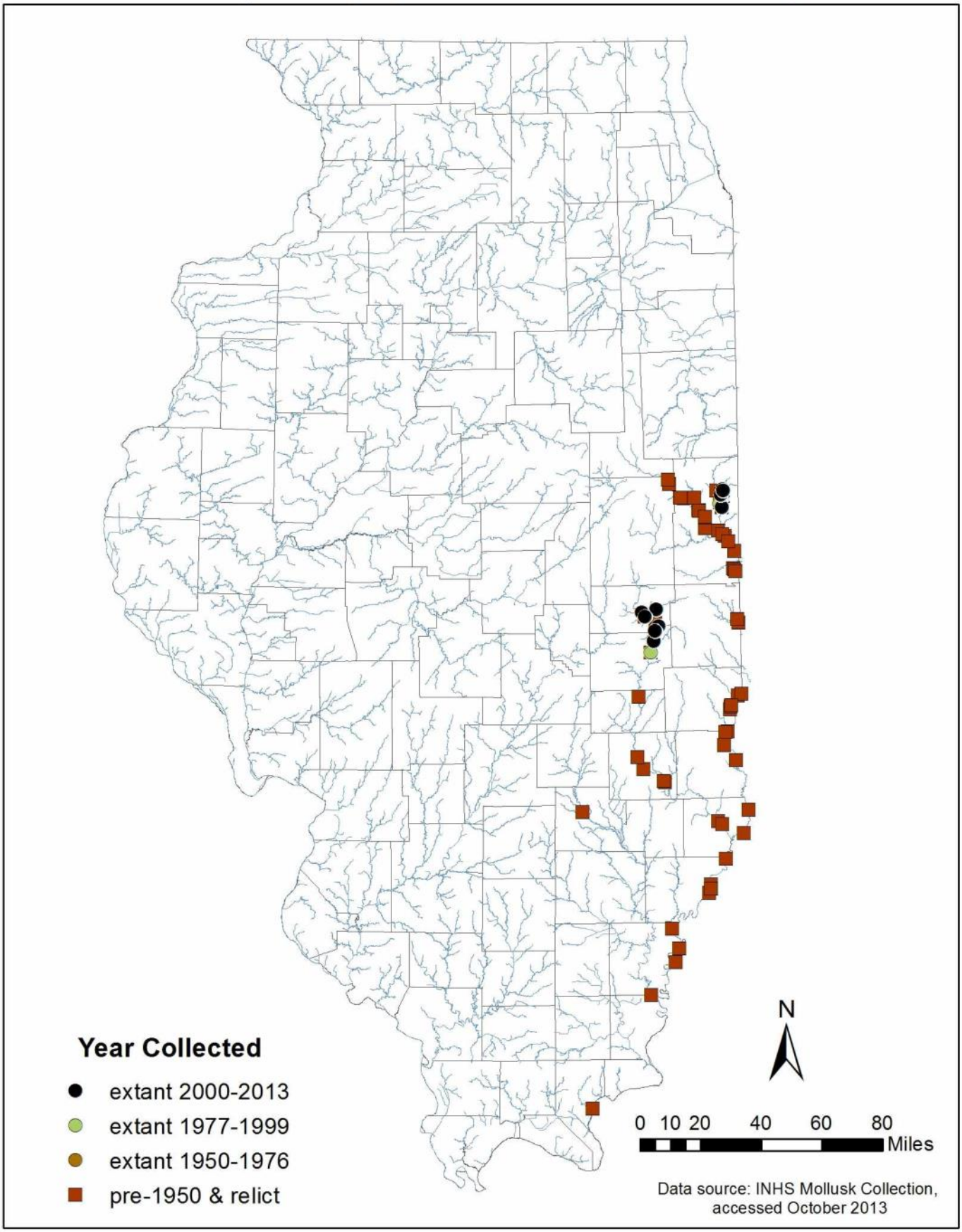
Pink papershell (*Potamilus ohiensis*)



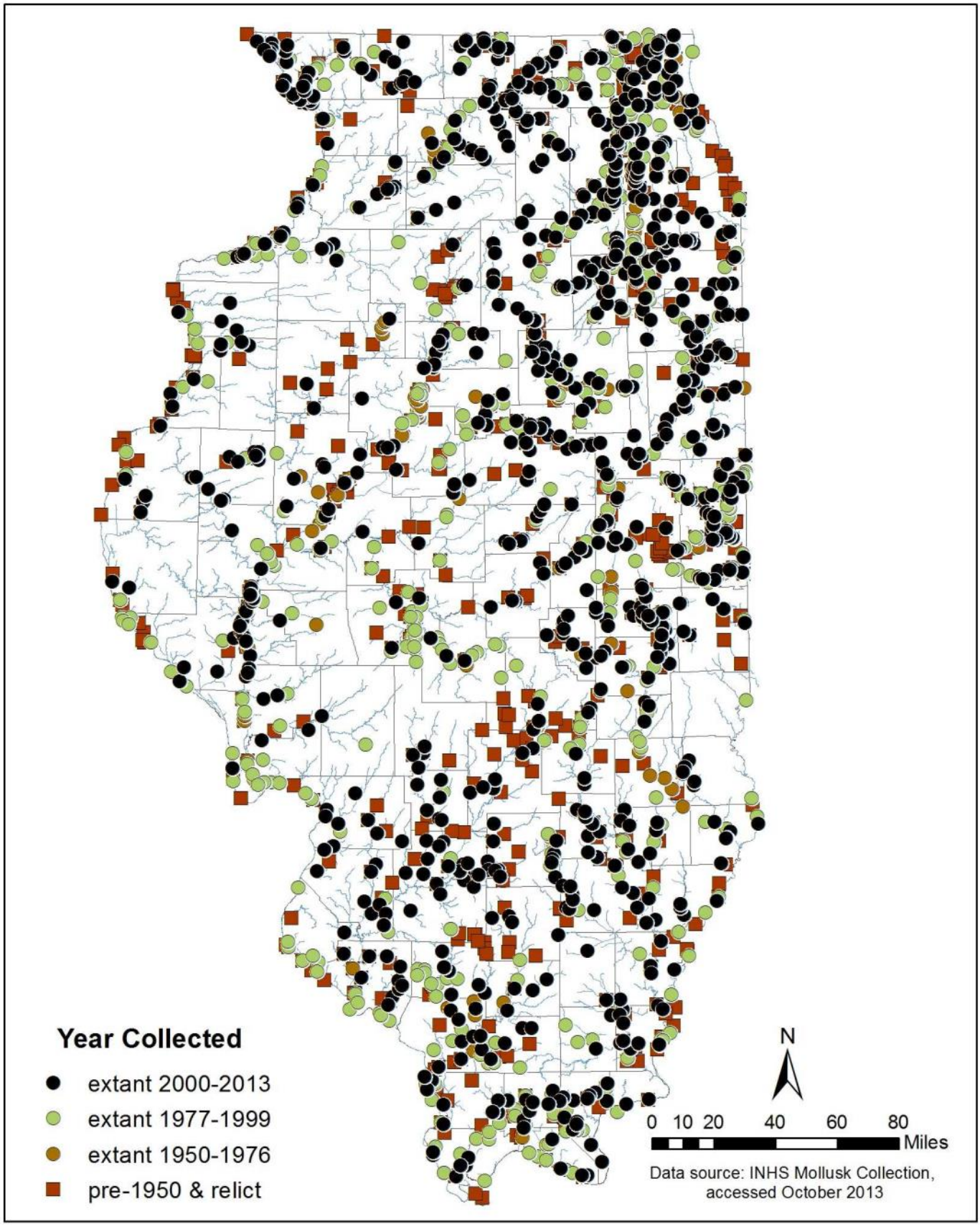
Bleufer (*Potamilus purpuratus*)



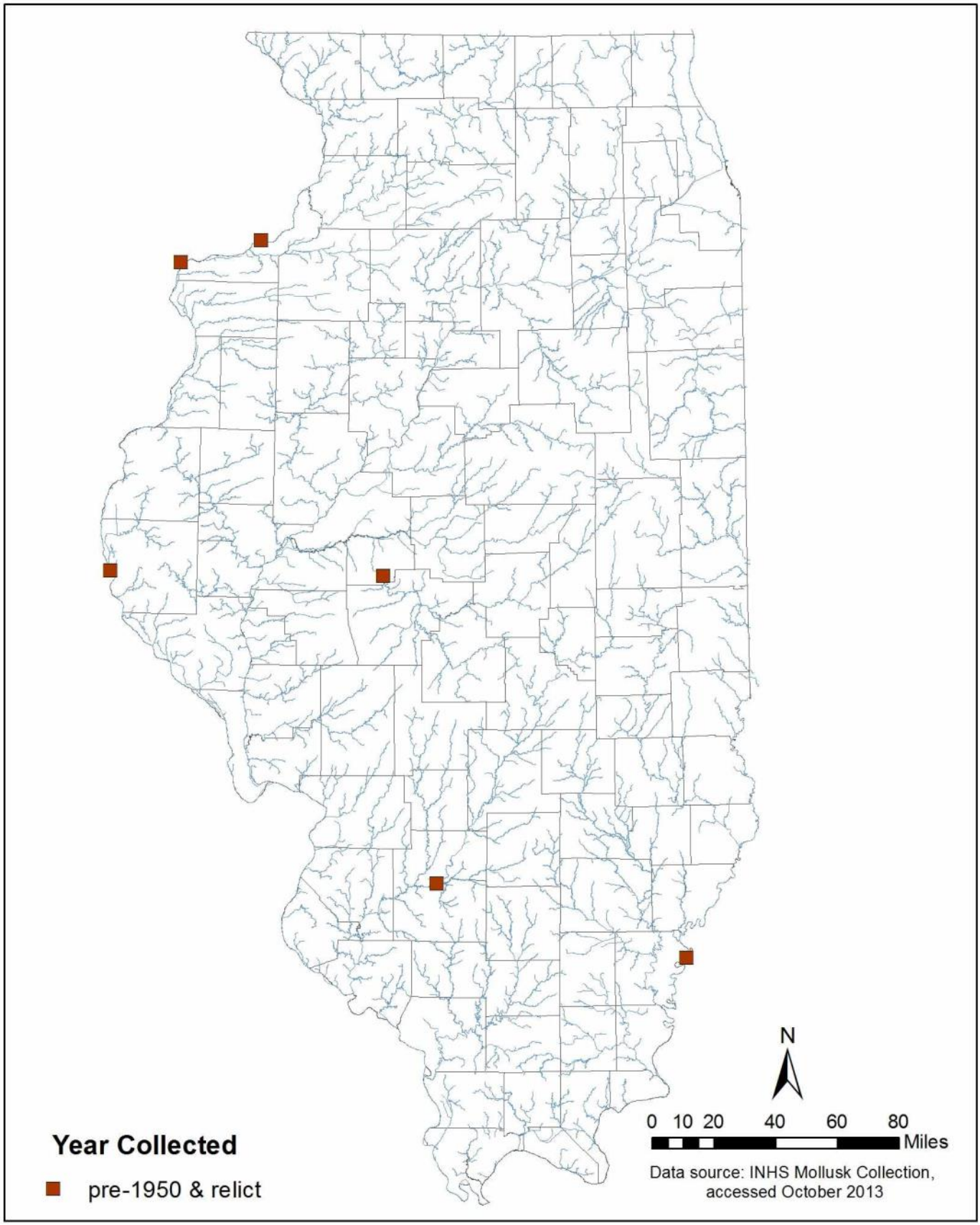
Kidneyshell (*Ptychobranchus fasciolaris*)



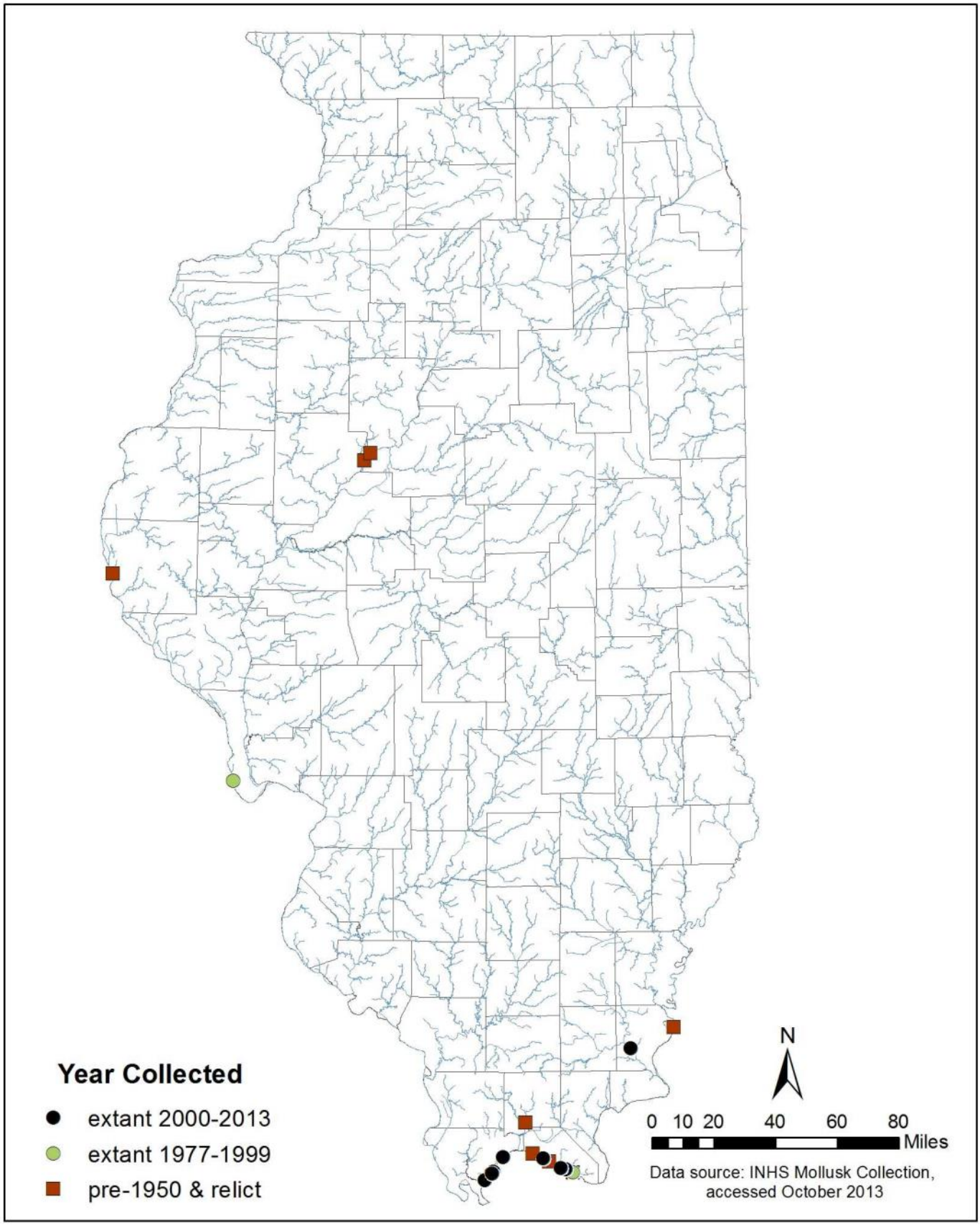
Giant floater (*Pyganodon grandis*)



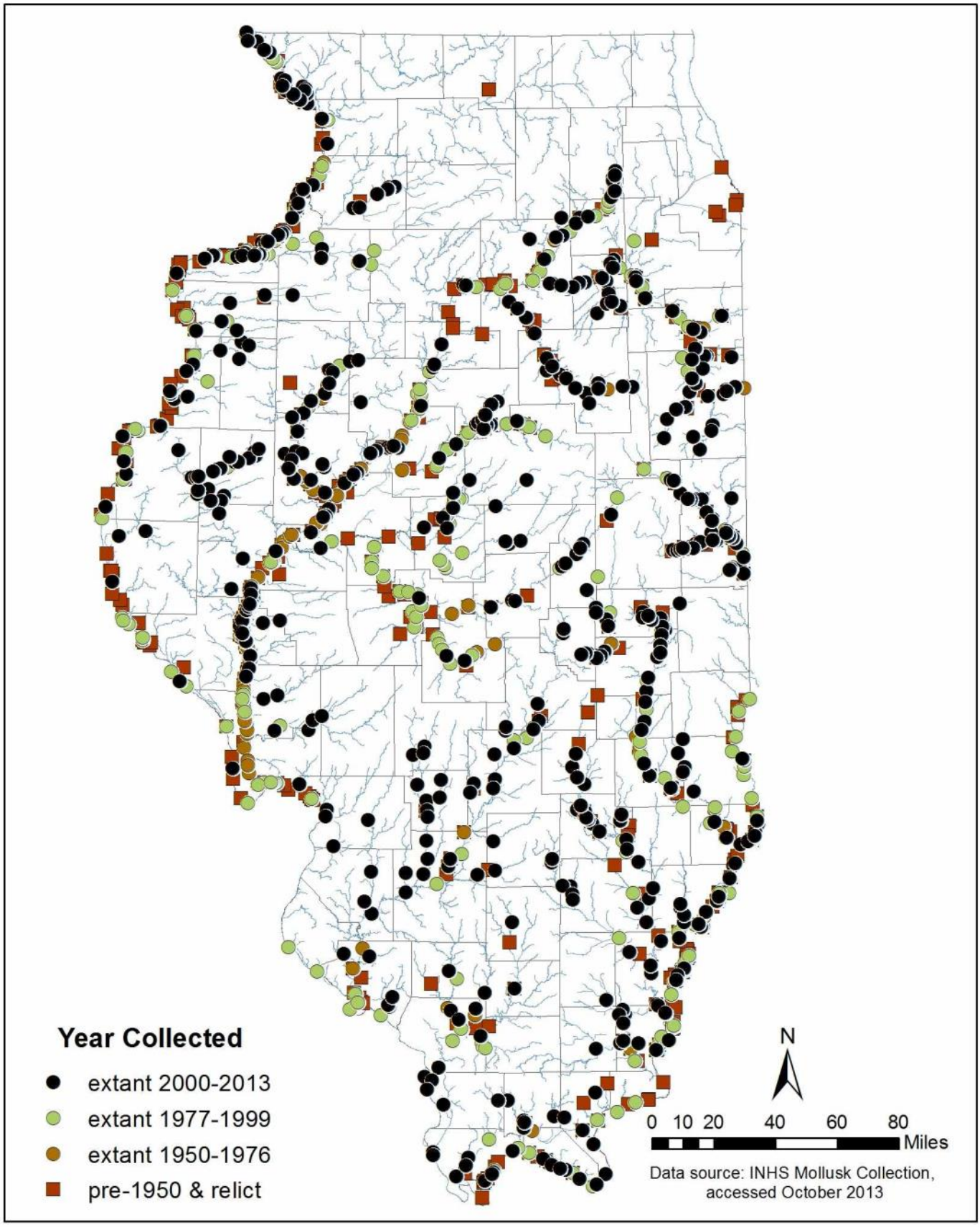
Winged mapleleaf (*Quadrula fragosa*)



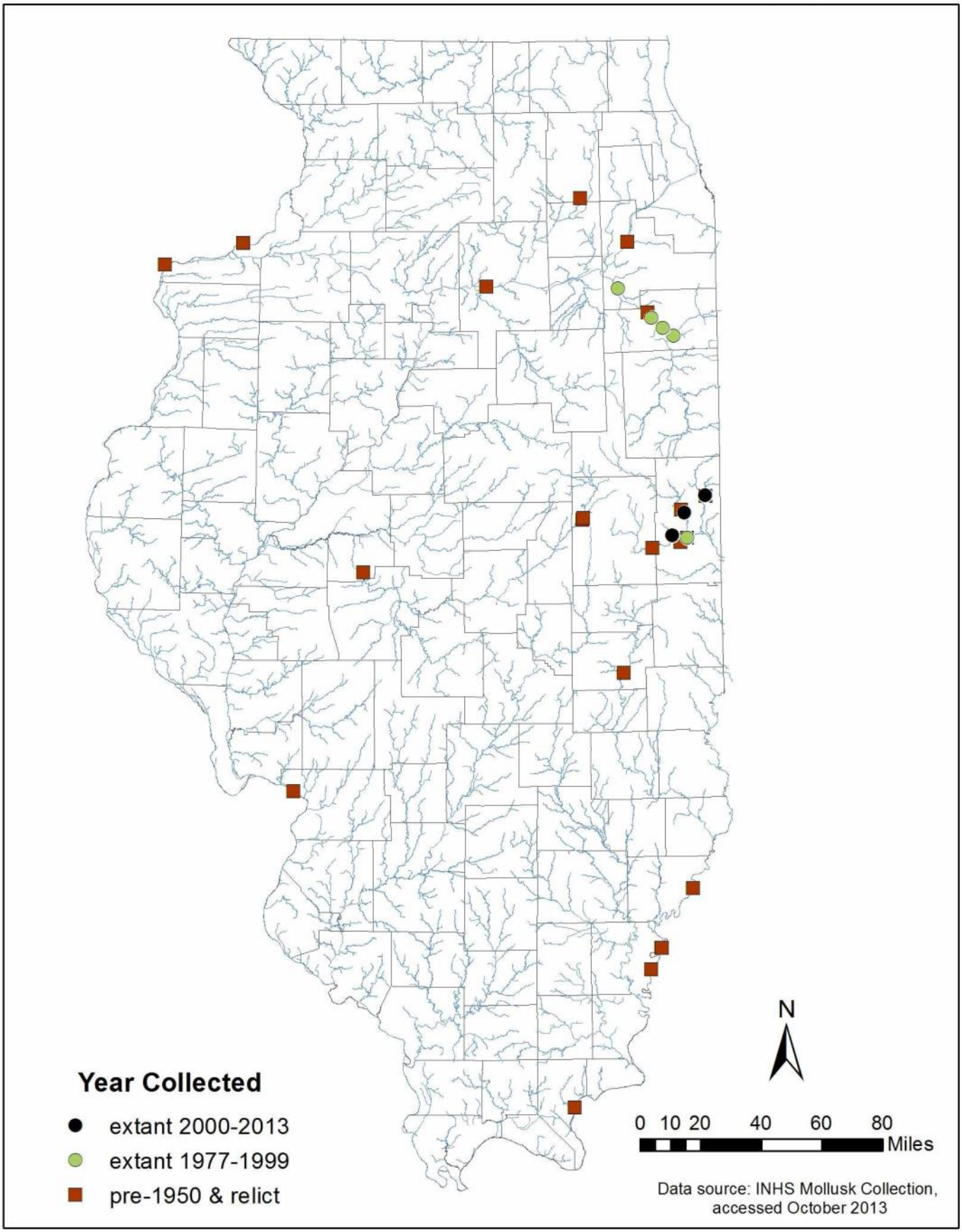
Gulf mapleleaf (*Quadrula nobilis*)



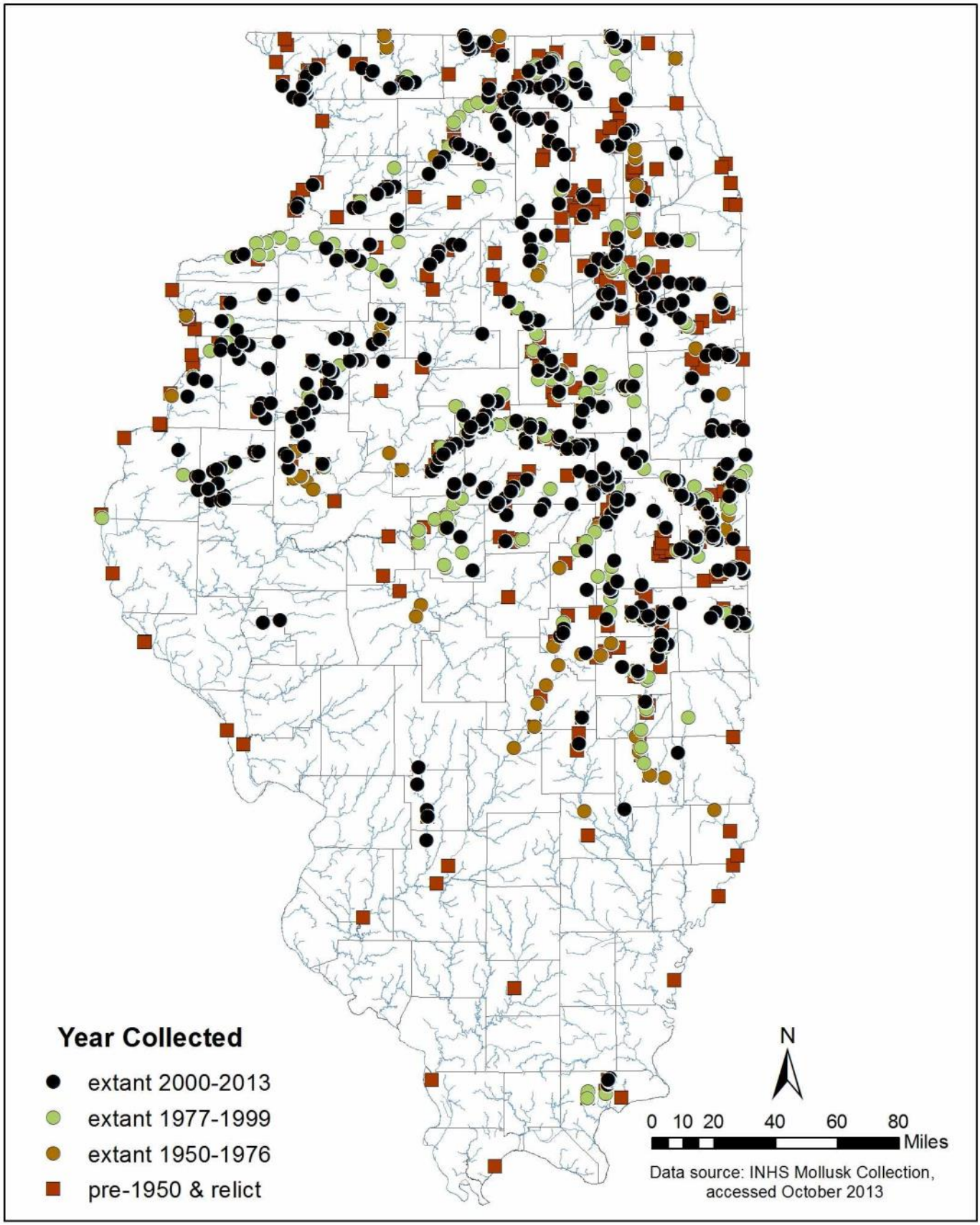
Mapleleaf (*Quadrula quadrula*)



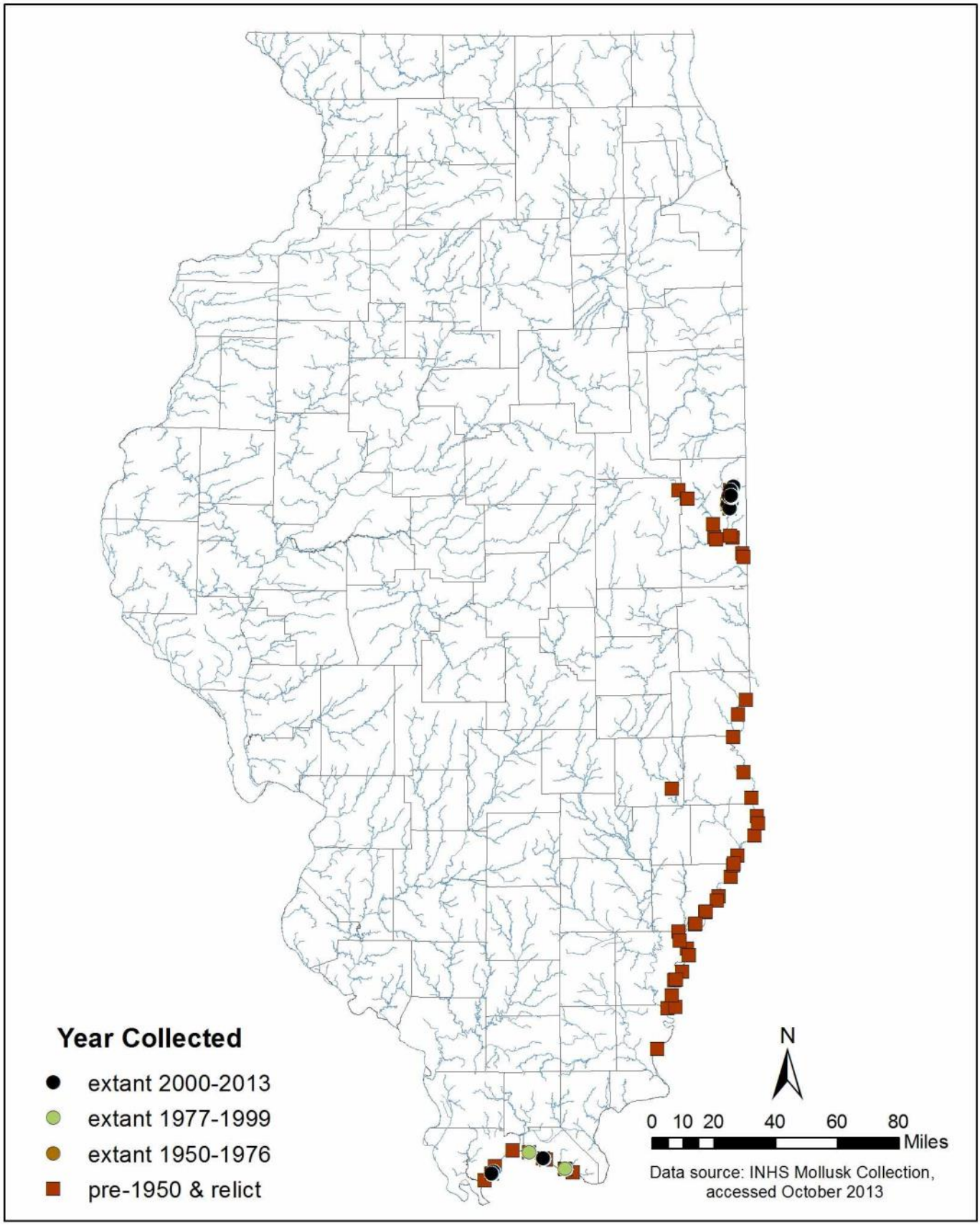
Salamander mussel (*Simpsonaias ambigua*)



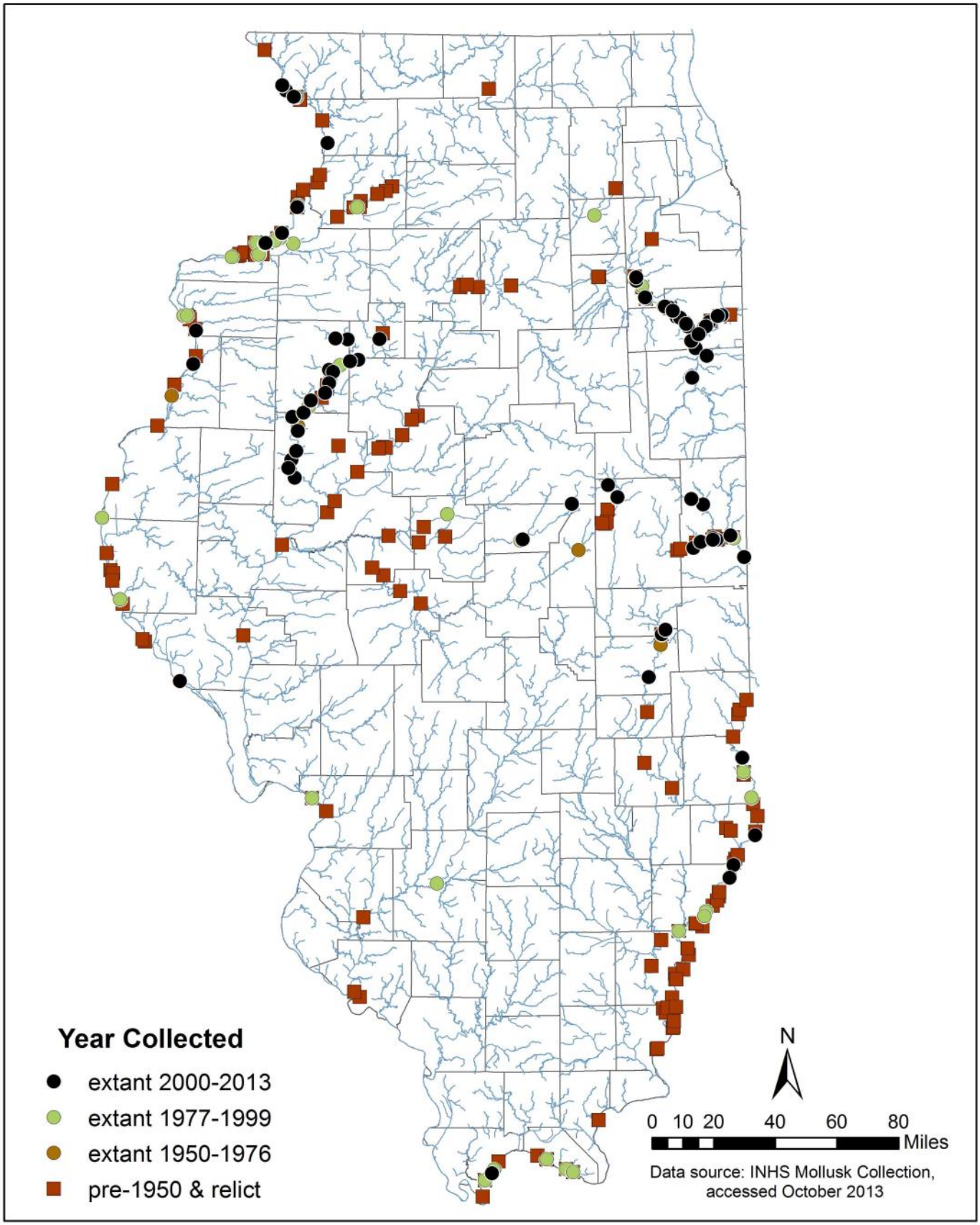
Creeper (*Strophitus undulatus*)



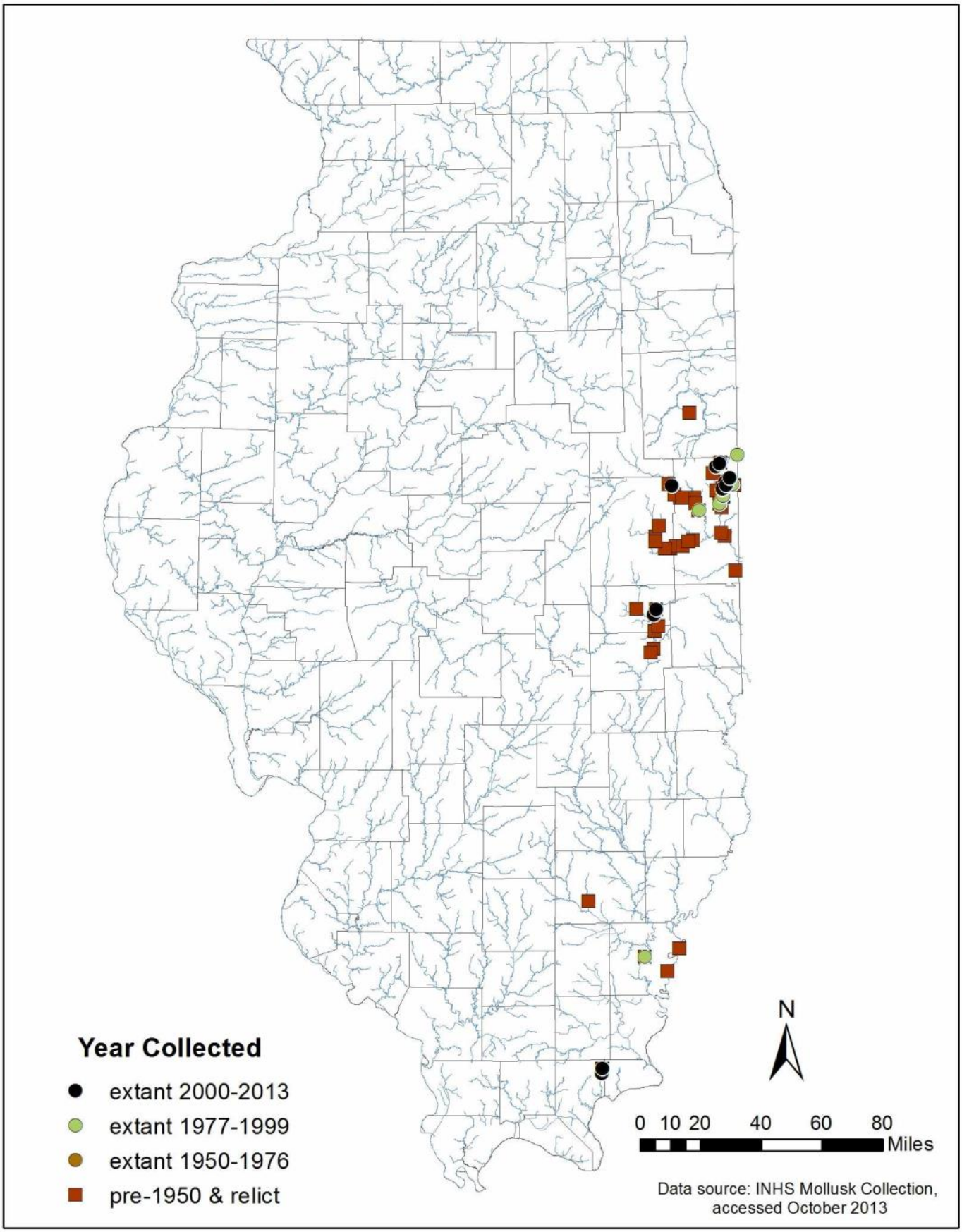
Rabbitsfoot (*Theliderma cylindrica*)



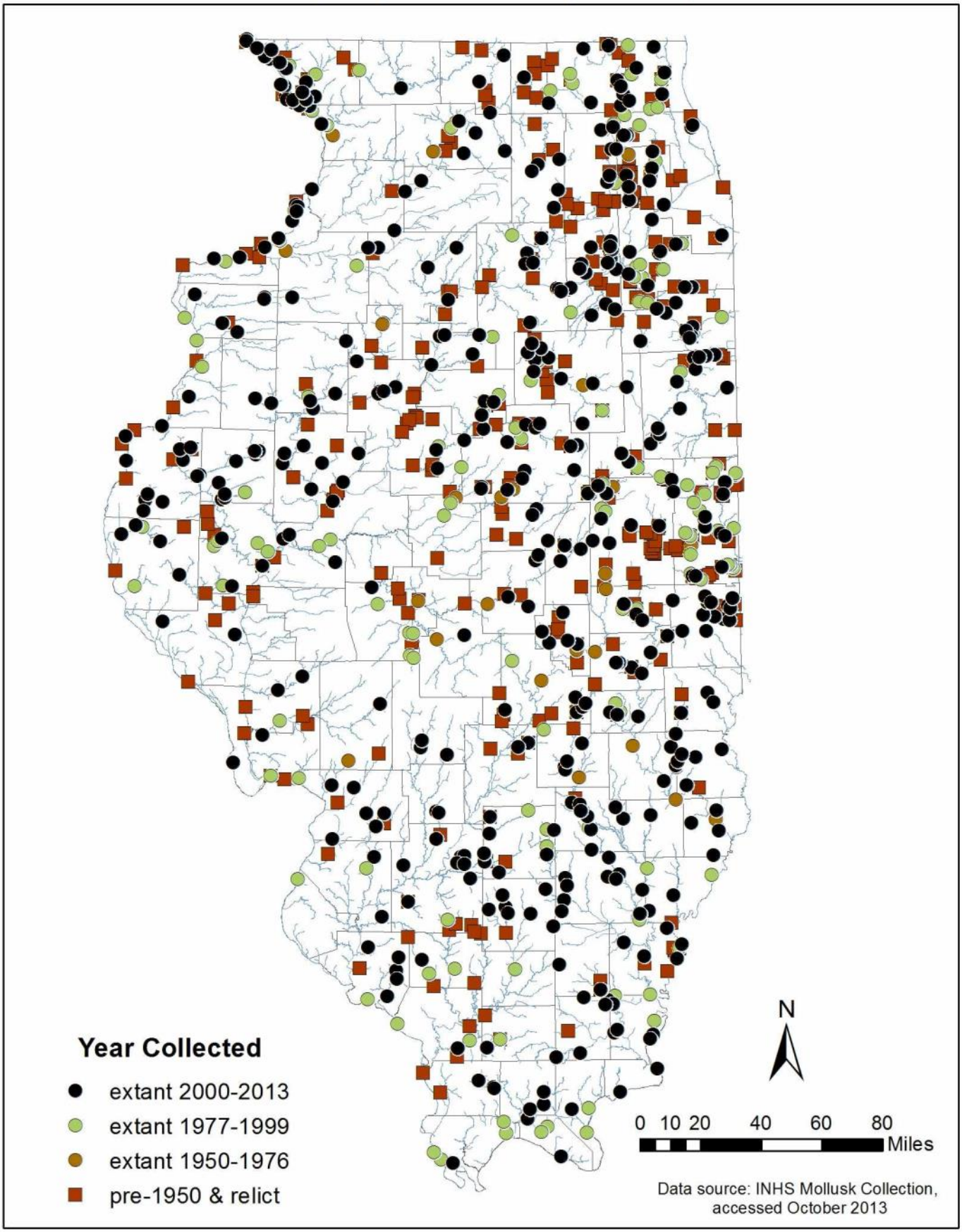
Monkeyface (*Theliderma metanevra*)



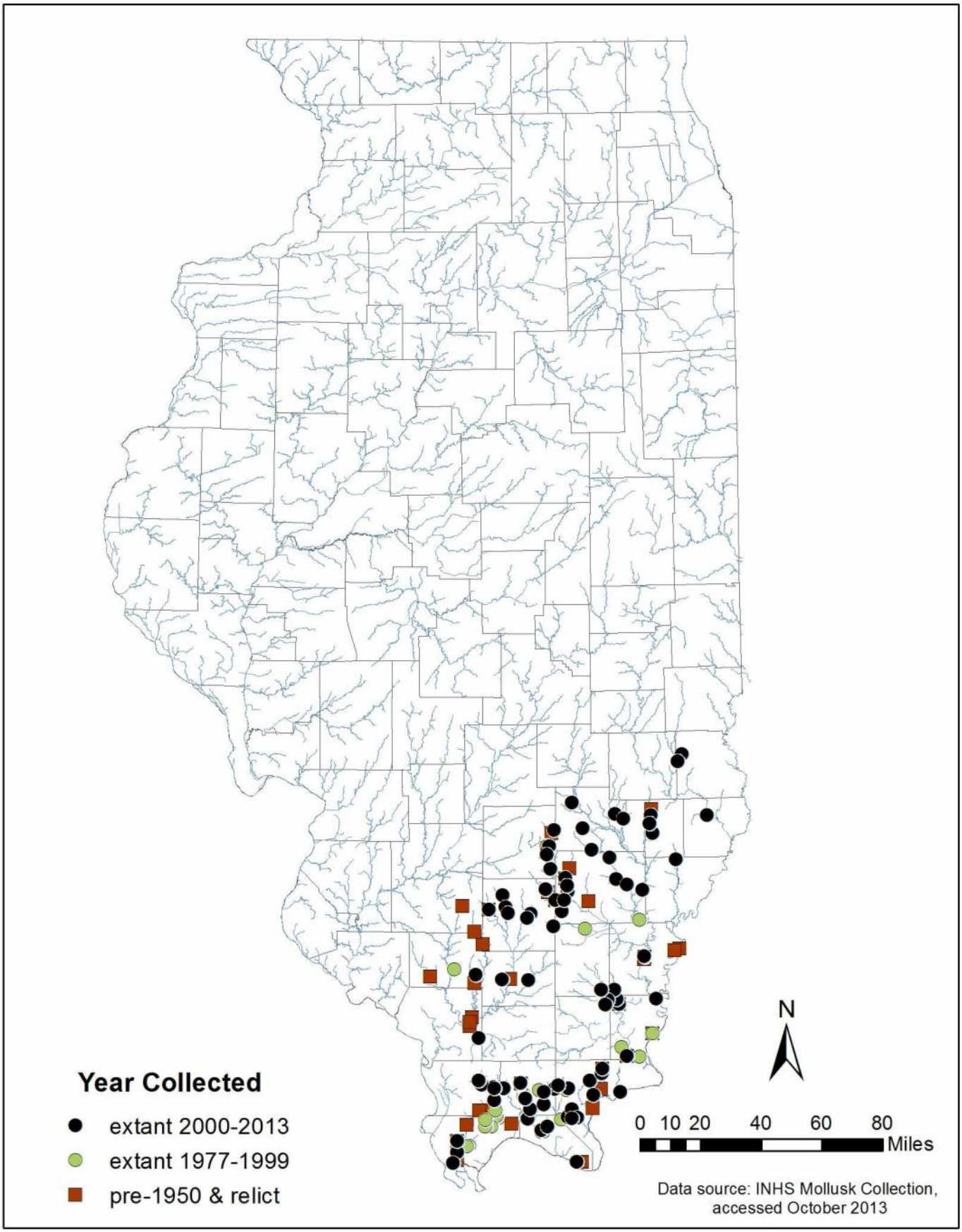
Purple lilliput (*Toxolasma lividum*)



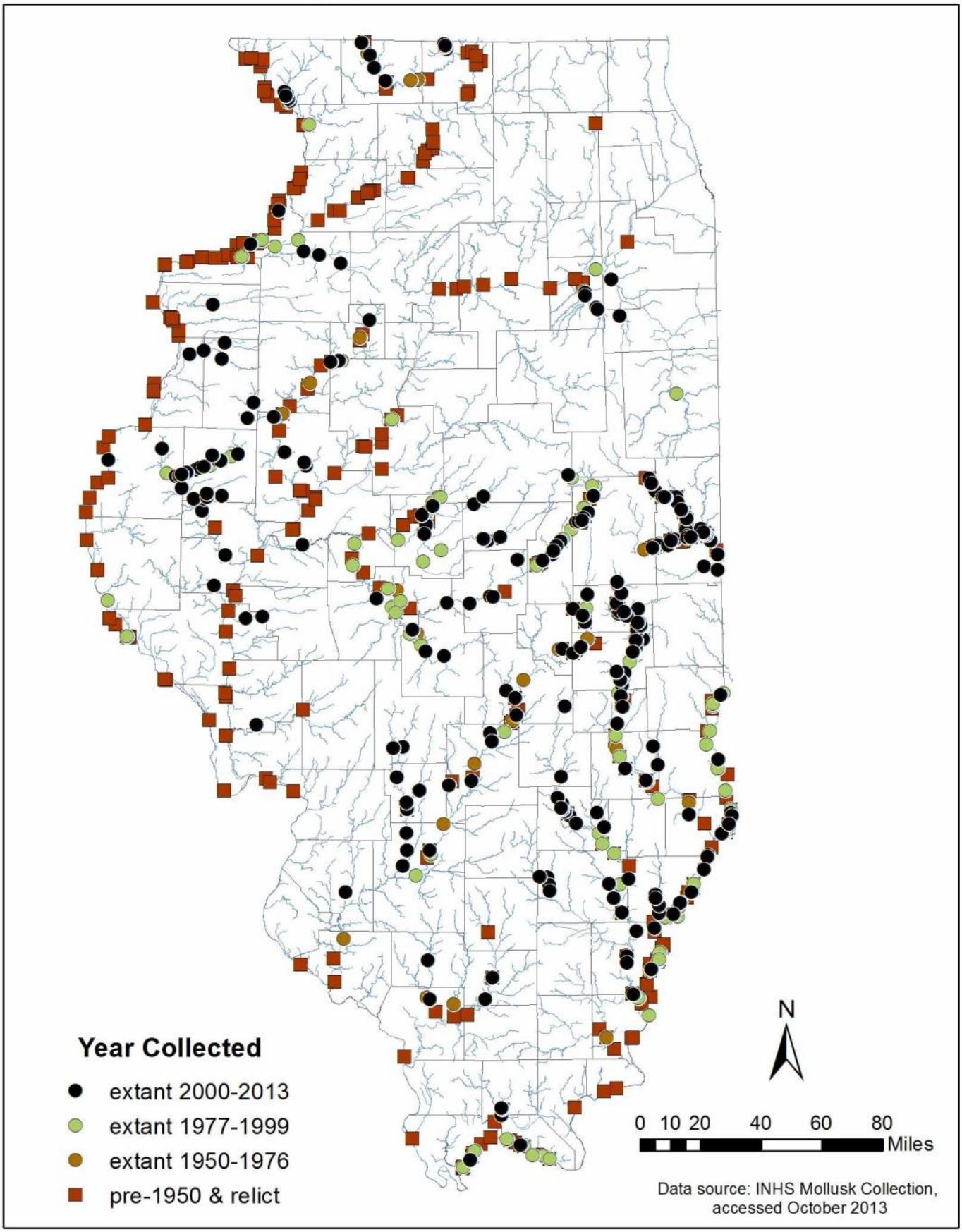
Lilliput (*Toxolasma parvum*)



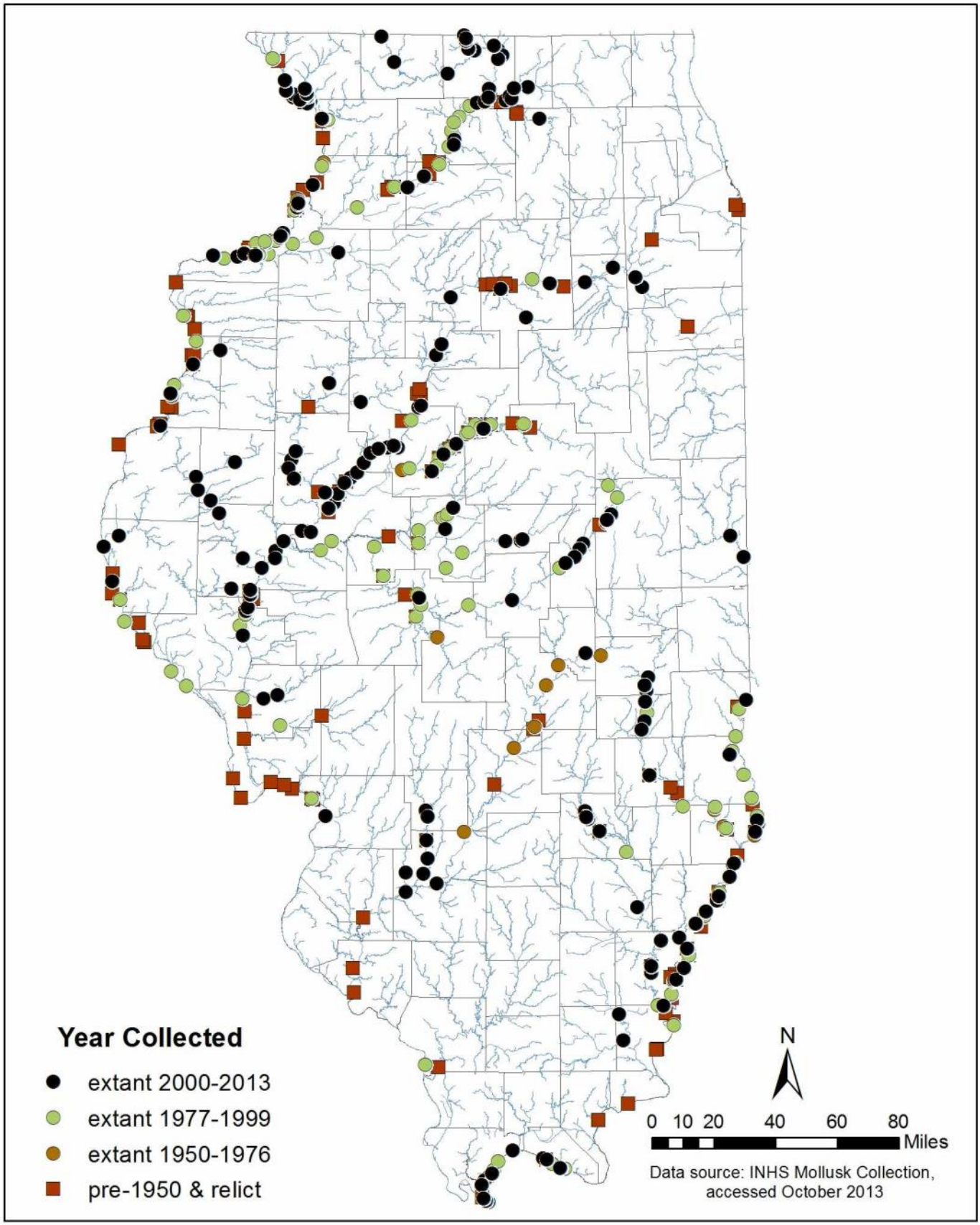
Texas lilliput (*Toxolasma texasense*)



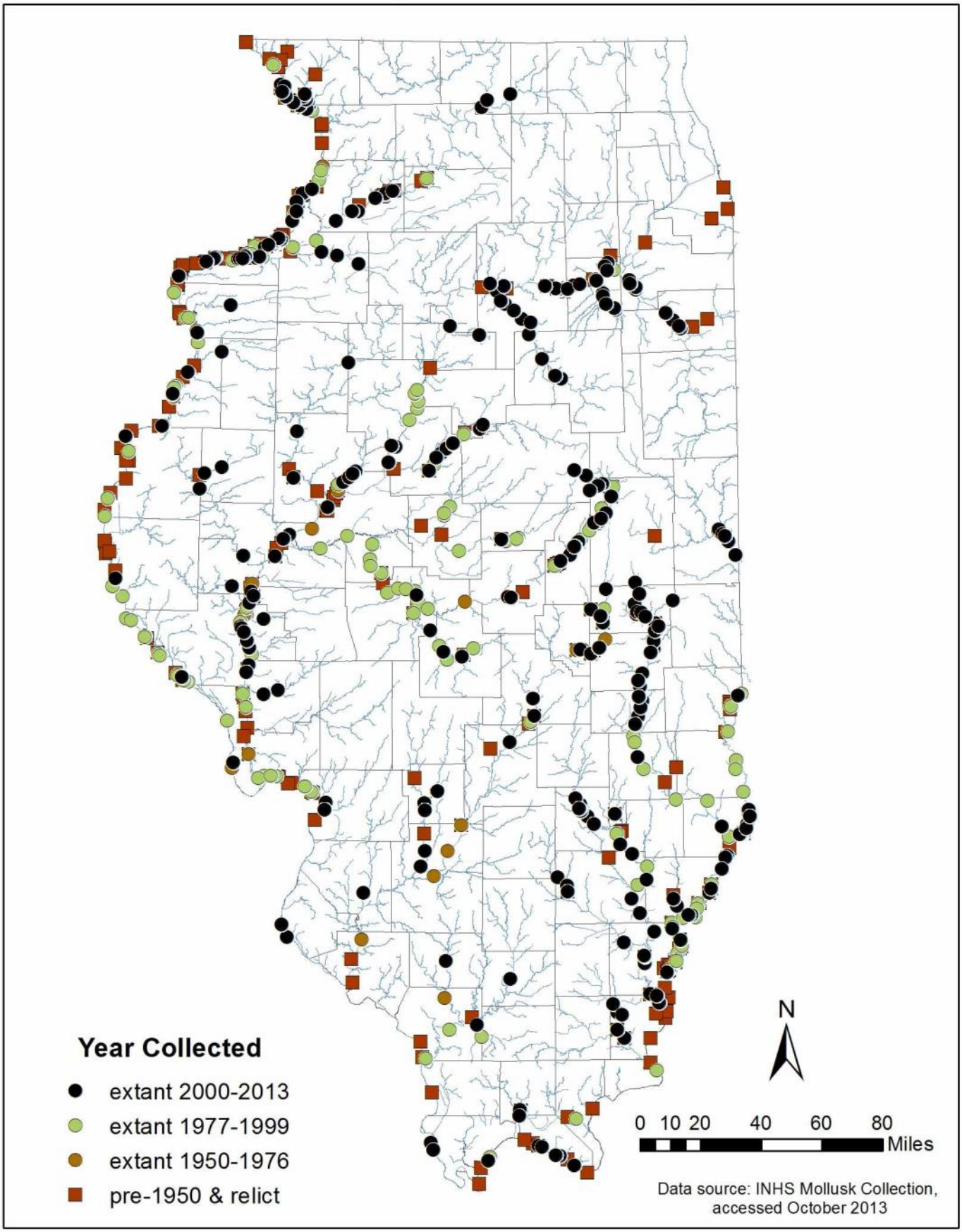
Pistolgrip (*Tritogonia verrucosa*)



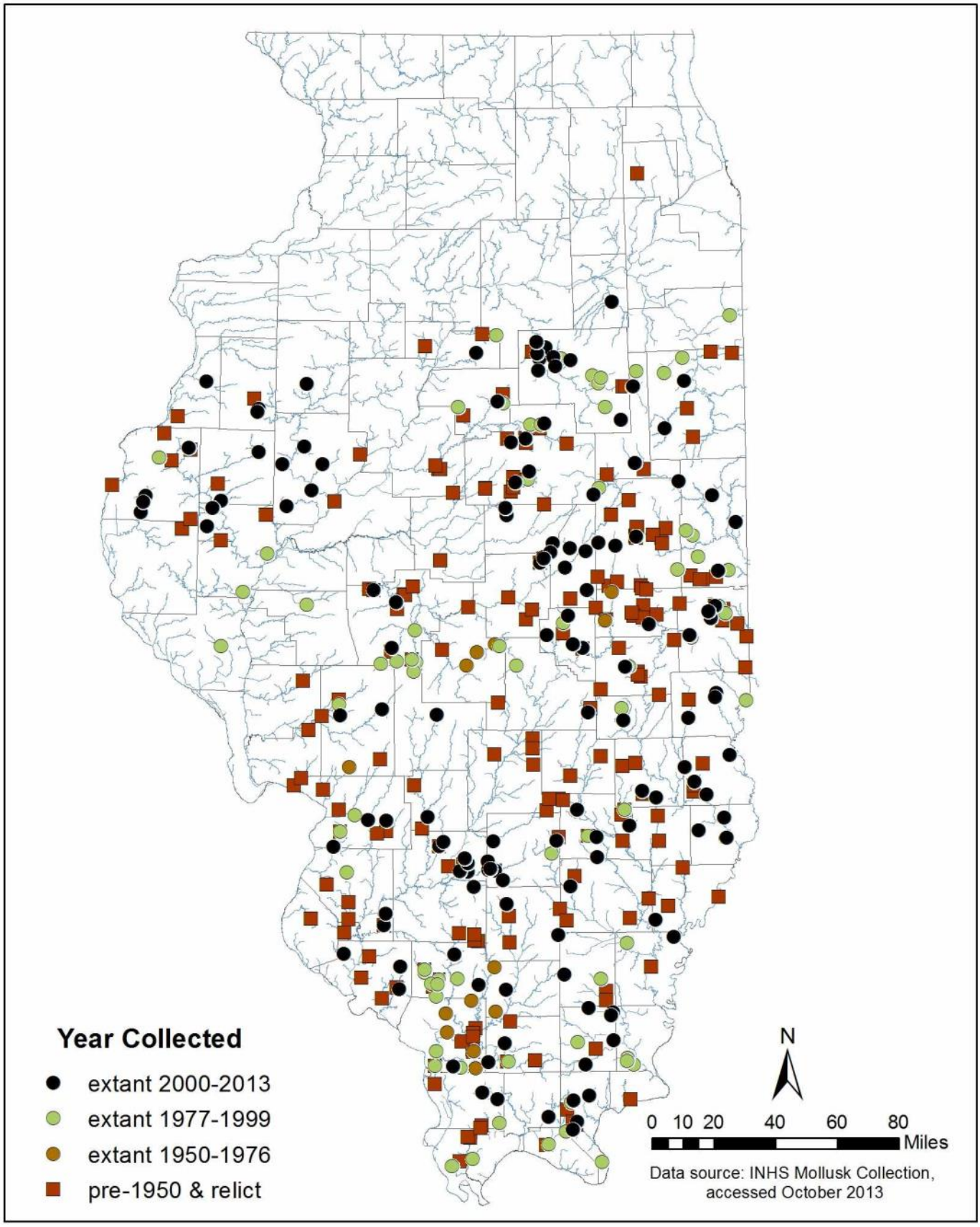
Fawnsfoot (*Truncilla donaciformis*)



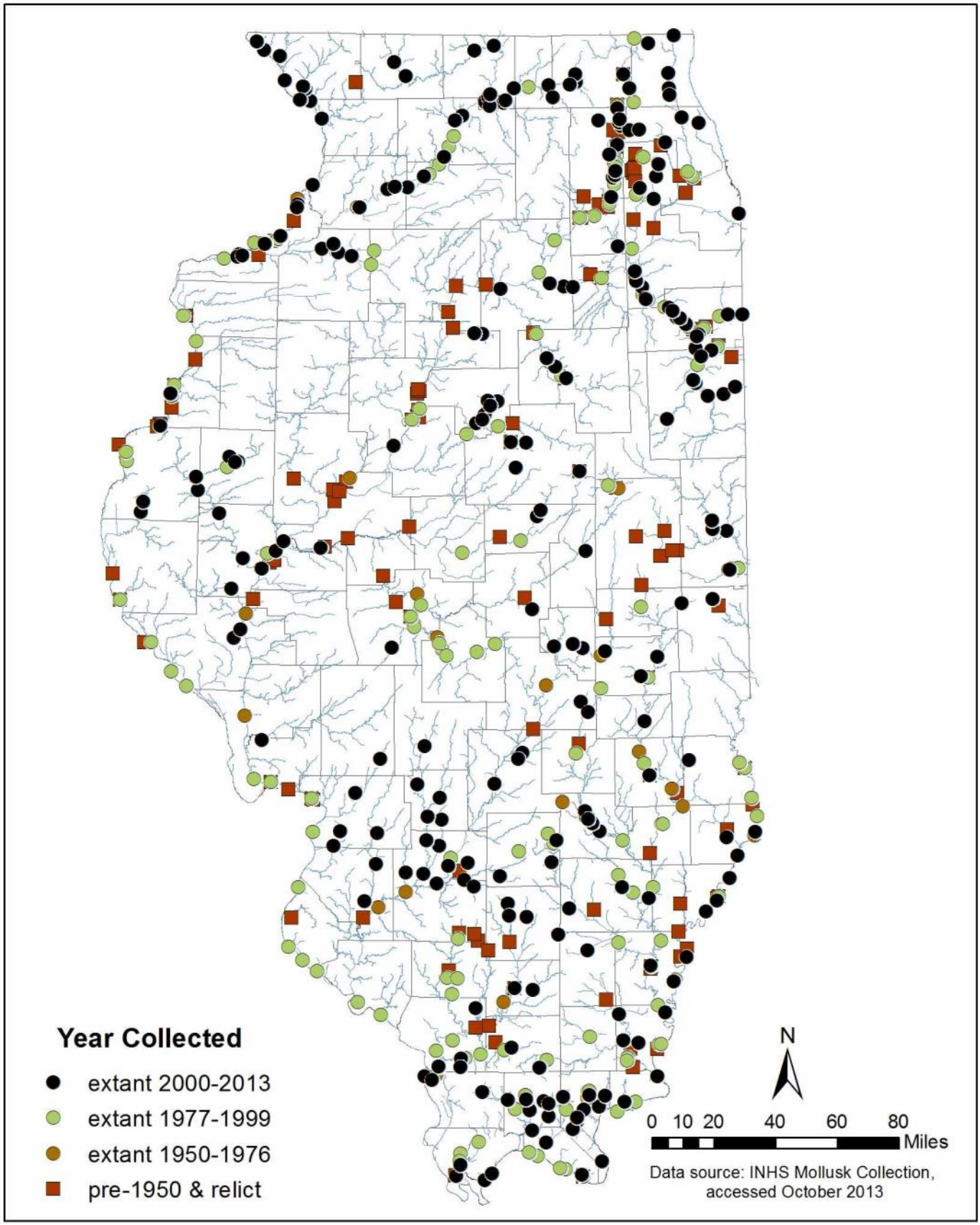
Deertoe (*Truncilla truncata*)



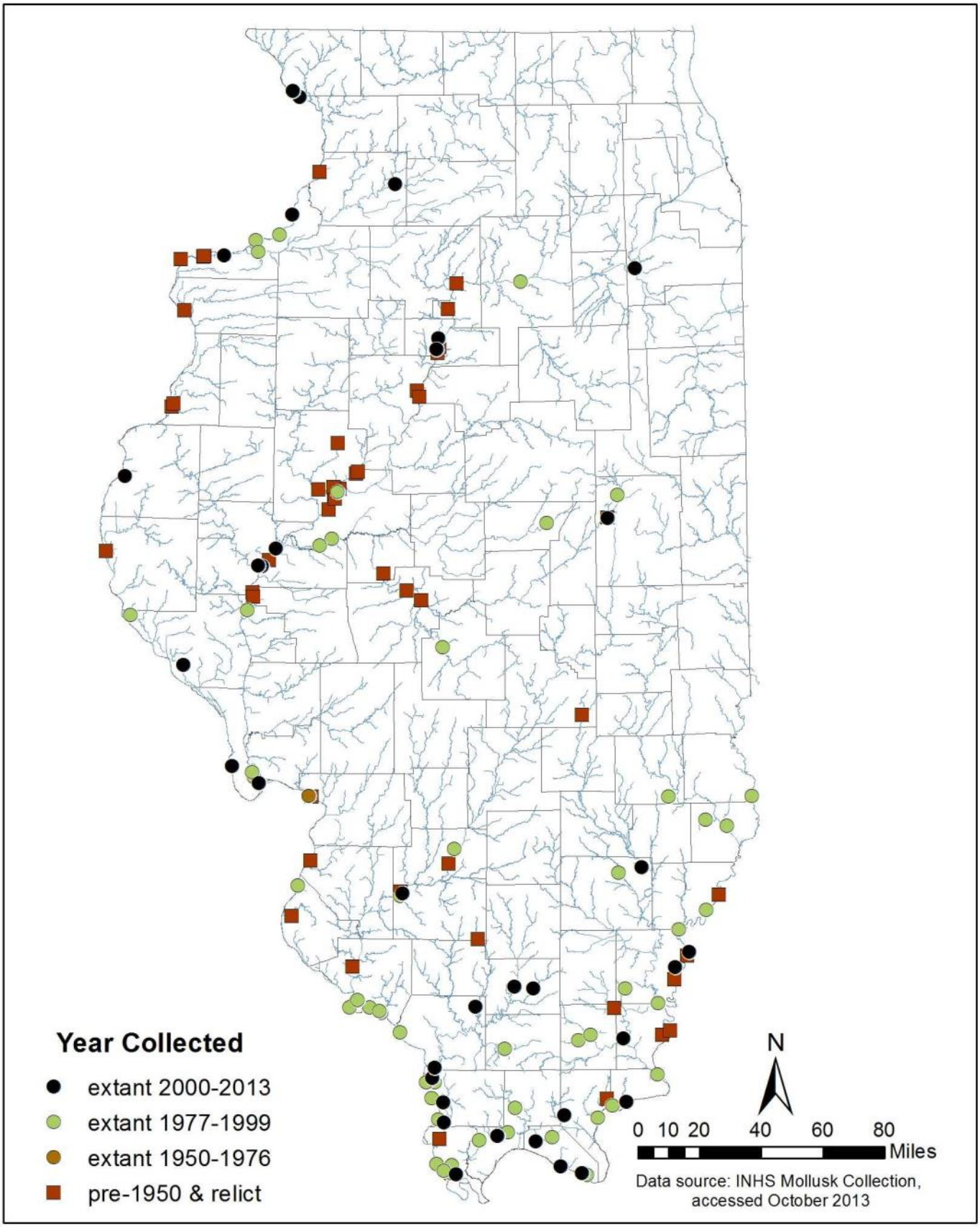
Pondhorn (*Uniomerus tetralasmus*)



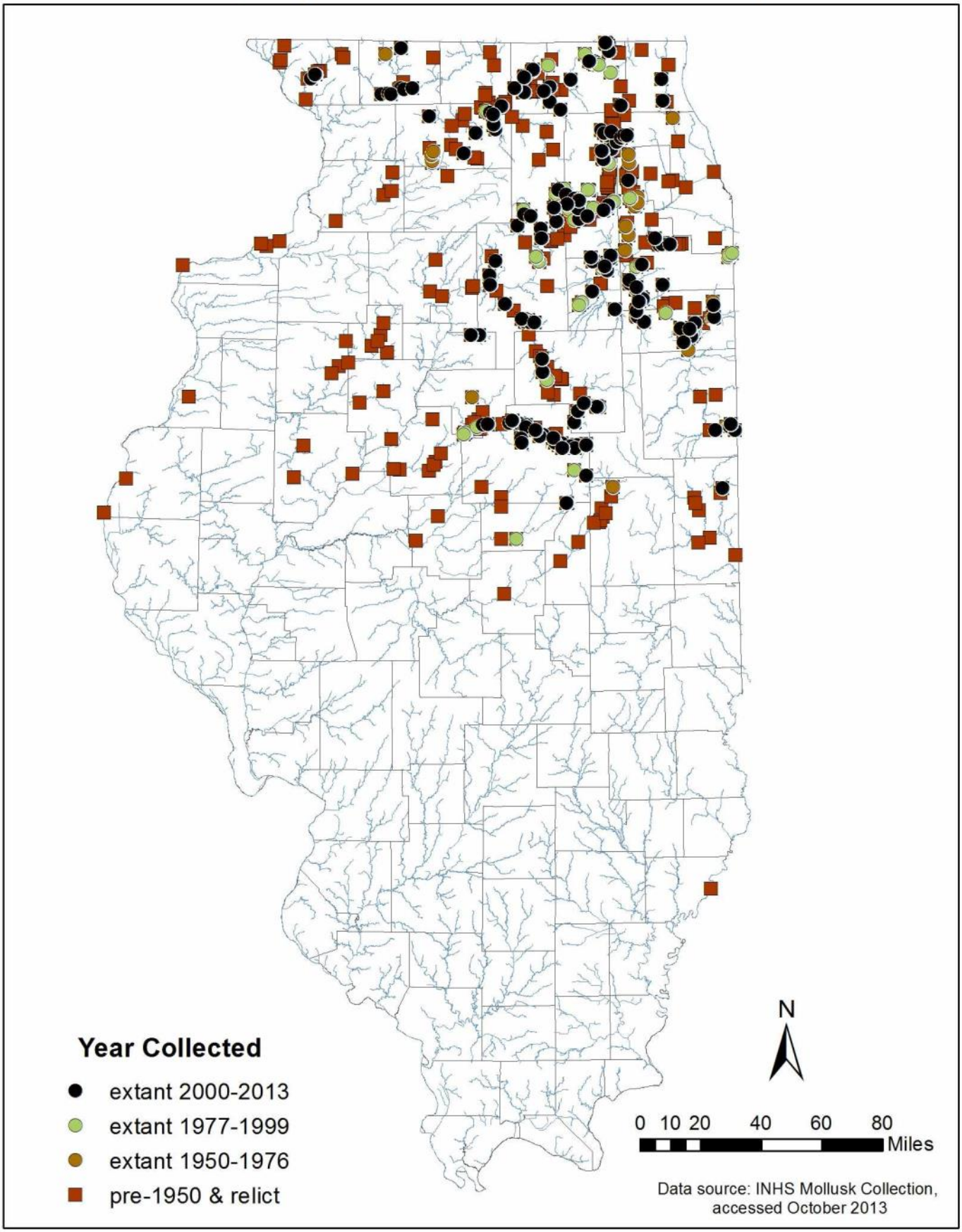
Paper pondshell (*Utterbackia imbecillis*)



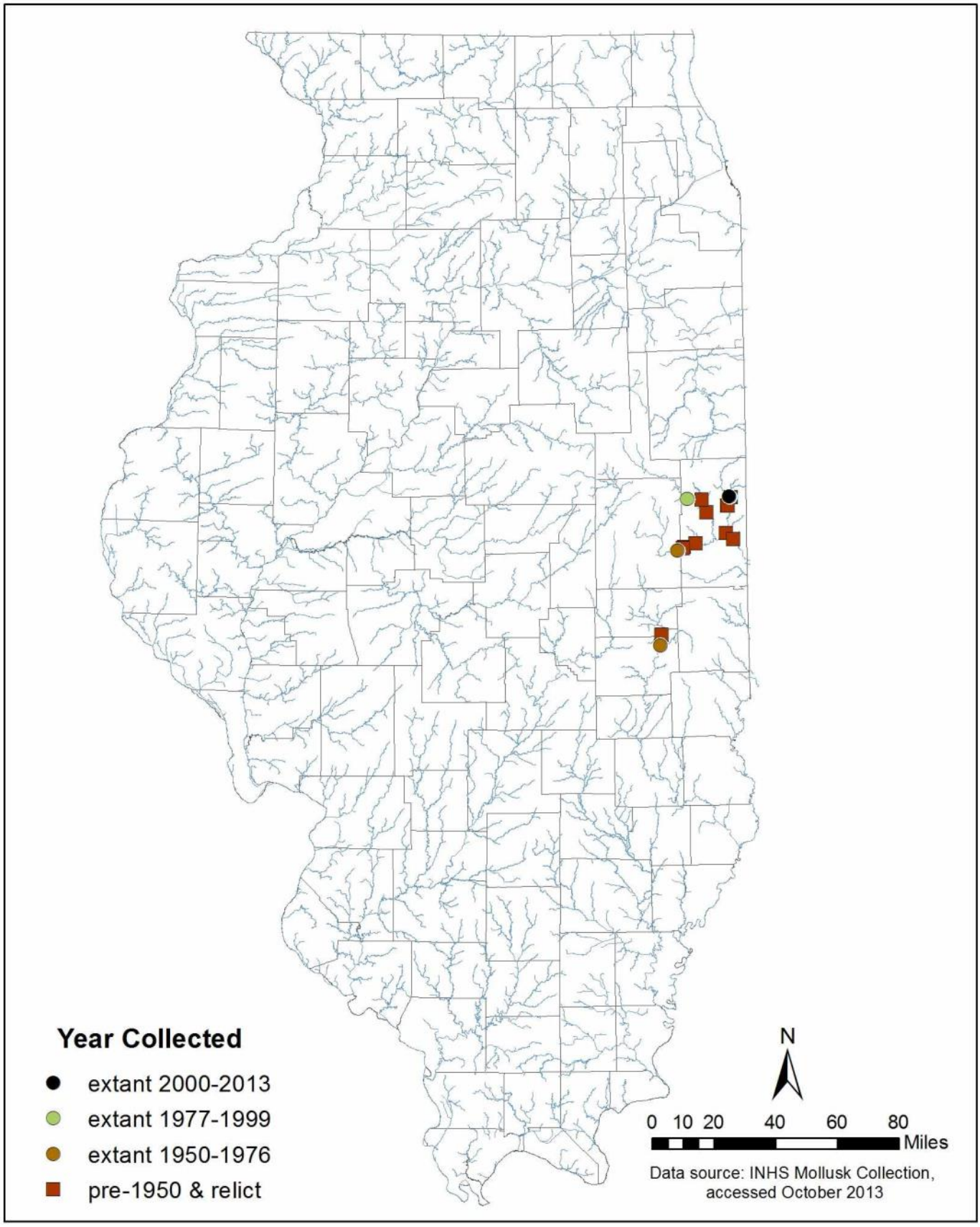
Flat floater (*Utterbackia suborbiculata*)



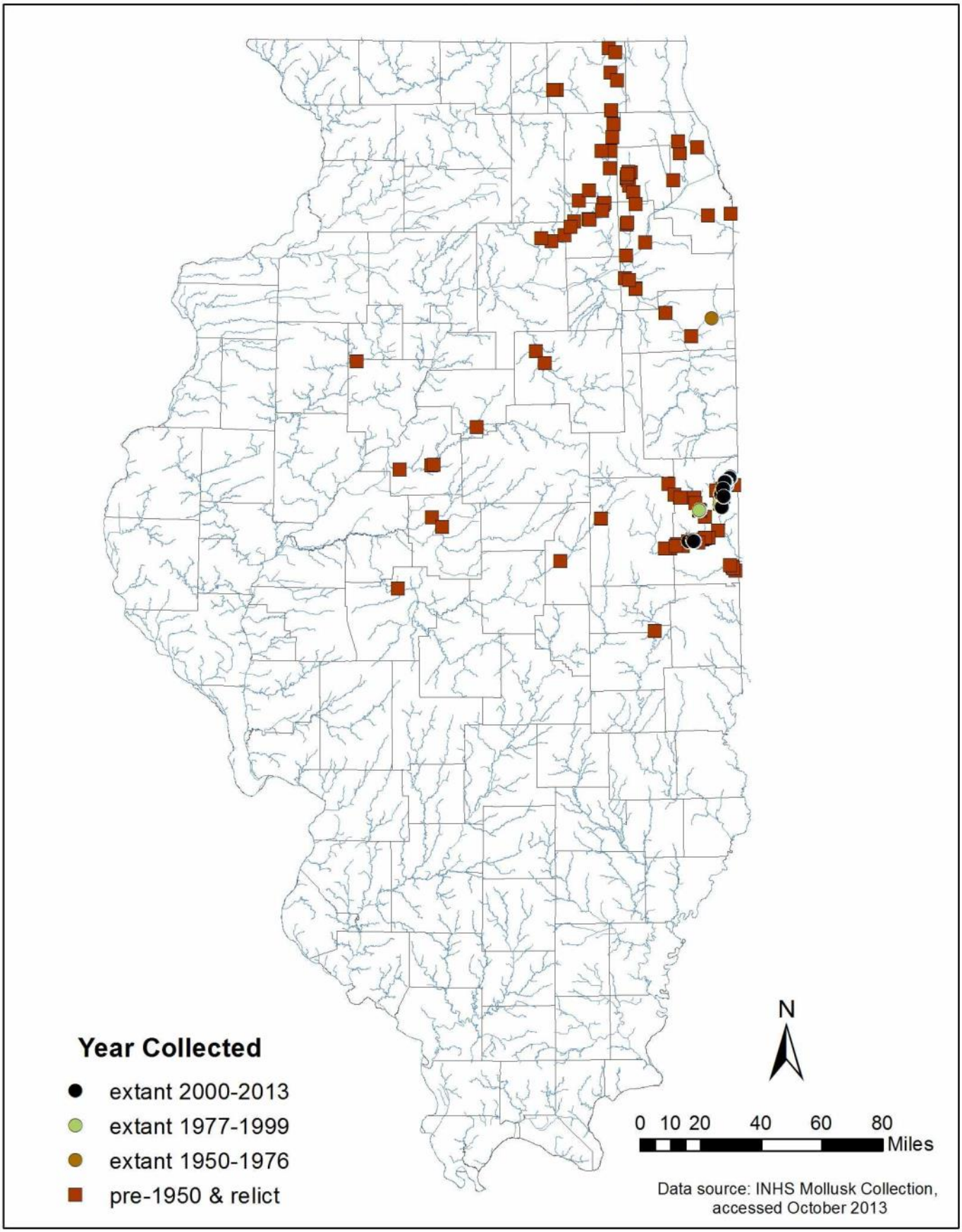
Ellipse (*Venustaconcha ellipsiformis*)



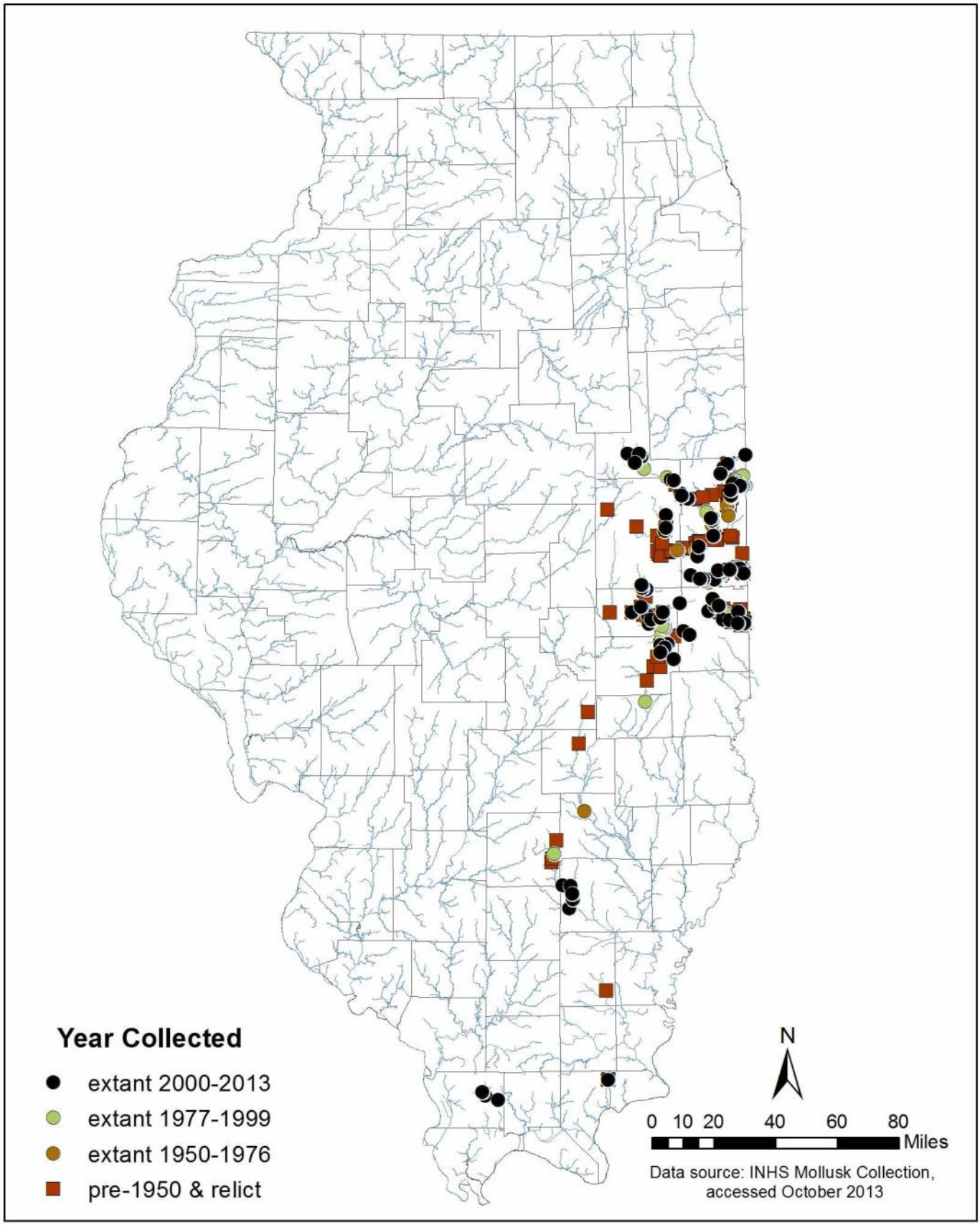
Rayed bean (*Villosa fabalis*)



Rainbow (*Villosa iris*)



Little spectaclecase (*Villosa lienosa*)



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Section 3:

Fish Host Information

Each fish-mussel relationship is summarized in the following tables. For each table, abbreviations are as explained below, with a full description located in Section 1 (Methods).

NS: not stated
NI: natural infestation
NT: natural transformation
LI: lab infestation
LT: lab transformation

Table 1: Fish host information as of October 2014 for mussel species believed to be extirpated in Illinois.

Fish Species			Mussel Species								
Family	**Scientific Name**	**Common Name**	***Epioblasma obliquata***	***Epioblasma torulosa***	***Fusconaia subrotunda***	***Hemistena lata***	***Obovaria retusa***	***Plethobasus cicatricosus***	***Pleurobema plenum***	***Pleurobema rubrum***	***Quadrula fragosa***
N/A	N/A	N/A		hosts unknown	hosts unknown	hosts unknown	hosts unknown	hosts unknown	hosts unknown		
Centrarchidae	*Ambloplites rupestris*	Rock Bass	LT [139]								
Cottidae	*Cottus bairdi*	Mottled Sculpin	LT [139]								
Cyprinidae	*Cyprinella spiloptera*	Spotfin Shiner								LT [27]	
Ictaluridae	*Ictalurus furcatus*	Blue Catfish									LT [69,120]
	Ictalurus punctatus	Channel Catfish									LT, NT [69] LT [61,66,120,112]
	Noturus flavus	Stonecat	LT [139]								
Percidae	*Percina maculata*	Blackside Darter	LT [139]								
	Etheostoma blennioides	Greenside Darter	LT [139]								
	Percina caprodes	Logperch	LT [139]								

Table 2: Fish host information as of October 2014 for mussel species believed to be stable in Illinois.

Fish Species			Mussel Species								
Family	**Scientific Name**	**Common Name**	***Actinonaias ligamentina***	***Amblema plicata***	***Amphinaias pustulosa***	***Anodontoides ferussacianus***	***Arcidens confragosus***	***Fusconaia flava***	***Lampsilis cardium***	***Lampsilis siliquoidea***	***Lampsilis teres***
Acipenceridae	*Scaphirhynchus platorynchus*	Shovelnose Sturgeon			NI [22]						NI [122,154]
Ambystomatidae	*Ambystoma tigrinum*	Tiger Salamander							LT [147]		
Anguillidae	*Anguilla rostrata*	American Eel	NI [22]				NI [154]				
Catostomidae	*Carpoides cyprinus*	Quillback					LT [134]				
	Catostomus commersonii	White Sucker				NS [40]	LT [67,134]			NS [40]	
	Hypentelium nigricans	Northern Hog Sucker		NI [152]							
	Ictiobus bubalus	Smallmouth Buffalo					LT [134]				
	Moxostoma duquesnei	Black Redhorse		NI [152]							
	Moxostoma erythrurum	Golden Redhorse		NI [152]							
	Moxostoma macrolepidotum	Shorthead Redhorse					LT [67,134]				
Centrarchidae	*Ambloplites rupestris*	Rock Bass	LT [91,92,148]	LT [119]			NI [122,154]			LT [151] LI [36,37]	LI [92]
	Lepomis cyanellus	Green Sunfish	LT [92,161] NI [22,154]	LT [119]		LT [32]	LT [134]		LT [137]	LT [143]	NI [22,122]
	Lepomis gibbosus	Pumpkinseed		LT [119] NI [22,154]				LI [73]	LT [30]	NI [127]	
	Lepomis gulosus	Warmouth									NI [154]
	Lepomis humilis	Orangespotted Sunfish	LT [161]				LT [134]				NI [22,122]
	Lepomis macrochirus	Bluegill	NI [154] NILI [22]	LT [73,119,152]		LT [32,135]		LI [73]	LT [22]	LI [36] NILT [22] NI [37,127] LT [30,76,101,145,151]	LI [92] LT [79]
	Lepomis megalotis	Longear Sunfish								LT [101,145]	
	Lepomis microlophus x L. cyanellus	Hybrid Sunfish									LT [79]
	Micropterus dolomieu	Smallmouth Bass	NI [22,78]			LT [32]			LT [22]	NS [24] LT [22,101,145]	
	Micropterus salmoides	Largemouth Bass	NILT [22] NI [154] LT [91,92,129,148,161]	LT [73,92] NILT [22]		LT [32,101,135]		LI [73]	LT [22,30,92,107, 132,143,147]	NI [127] LT [2,22,30,71, 76,101,107,143,145]	NI [22,154] NS [21]
	Pomoxis annularis	White Crappie	LT [92,161] NI [154] NILT [22]	NILT [73] LT [119] NI [22,122,154]	LI [70] NI [122,154]		NI [122,154]	LI [73] NI [22,154]	NI [154] NILT [22]	LT [22] NI [76,127]	LI [92] NI [22,122,154]
	Pomoxis nigromaculatus	Black Crappie	LT [22]	NILT [73] LT [22]		LT [32,55]		LI [73] NI [22,122,154]	LT [30]	NI [127] LT [22,76]	LI [92] NI [22,122]
Clupeidae	*Dorosoma cepedianum*	Gizzard Shad					NI [122,154]				
Cottidae	*Cottus bairdi*	Mottled Sculpin	LT [129]			NS [19]					
Cyprinidae	*Campostoma anomalum*	Central Stoneroller	LT [148]								
	Cyprinella spiloptera	Spotfin Shiner		NI [152]		LT [55]		NT [17]			
	Cyprinella whipplei	Steelcolor Shiner		NI [152]							
	Cyprinus carpio	Common Carp	LI [92]				LT [67]				
	Ericymba buccata	Silverjaw Minnow	LT [148]								
	Erimyzon oblongus	Creek Chubsucker					LT [134]				
	Luxilus chrysocephalus	Striped Shiner					LT [134]			LT [145]	
	Luxilus cornutus	Common Shiner				NS [40]				NS [40]	
	Notemigonus crysoleucas	Golden Shiner					LT [134]				
	Notropis atherinoides	Emerald Shiner		NI [152]							
	Notropis heterolepis	Blacknose Shiner				NS [40]					
	Notropis stramineus	Sand Shiner								LT [101]	
	Pimephales notatus	Bluntnose Minnow				NS [40]				LT [101,145]	
	Pimephales promelas	Fathead Minnow				NS [40] LT [32]					
	Rhinichthys cataractae	Longnose Dace					LT [134]				
	Semotilus atromaculatus	Creek Chub					LT [67,134]	LT [101,144]			
	Umbra limi	Central Mudminnow					LT [134]				
Esocidae	*Esox lucius*	Northern Pike		NI [22,154]							
Fundulidae	*Fundulus diaphanus*	Banded Killifish	LT [161]				LT [67,134]				
	Fundulus olivaceus	Blackspotted Topminnow					LT [134]				
Gasterosteidae	*Culaea inconstans*	Brook Stickleback				NS [40] LT [32]	LT [67]				
Gobiidae	*Neogobius melanostomus*	Round Goby	LT [129]								
Hiodontidae	*Hiodon tergisus*	Mooneye		NI [152]							
Ictaluridae	*Ameiurus melas*	Black Bullhead			LI [70] LT [73] NILT [22]						
	Ameiurus nebulosus	Brown Bullhead			LT [22,73]						
	Ameiurus sp.	Bullhead sp.		LI [73]							
	Ictalurus punctatus	Channel Catfish		LI [73] NI [152]	NTLI [70] NILT [22] LT [73] NI [78,152]		LT [79,134]				
	Noturus gyrinus	Tadpole Madtom	NI [22]							NI [22]	
	Pylodictis olivaris	Flathead Catfish		LI [73]	NILI [70] LT [73] NI [22,154]						
Lepisosteidae	*Atractosteus spatula*	Alligator Gar									LT [22] NI [72,154]
	Lepisosteus osseus	Longnose Gar									NI [22,72,154] LT [2,87,107]
	Lepisosteus platostomus	Shortnose Gar		LT [22] LI [78]							LI [72] NI [154] LT [22,34,78,87,107]
Moronidae	*Morone chrysops*	White Bass	NI [154] NILT [22]	NI [22,154]						NS [24] LT [22]	
Percidae	*Etheostoma exile*	Iowa Darter				NS [40]					
	Perca flavescens	Yellow Perch	LT [91] LI [92] NILT [22]	NI [103] LT [22,73,119]			LT [67]		LT [22]	NS [24] NILT [22] LT [30] NI [103,127]	LI [92]
	Percina caprodes	Logperch		NI [152]							
	Sander canadensis	Sauger	LT [22] NI [103]	NI [22,73,122,154]					NI [22,154]	NS [24] LT [22]	
	Sander vitreus	Walleye	NT [17]				LT [134]		LT [132] NT [17]	NILT [22] NI [127] LT [24,25,133]	
Petromyzontidae	*Petromyzon marinus*	Sea Lamprey				NI [155]					
Sciaenidae	*Aplodinotus grunniens*	Freshwater Drum		NI [152]			NI [154]				

Table 2 (continued)

Fish Species			Mussel Species								
Family	**Scientific Name**	**Common Name**	***Lasmigona complanata***	***Leptodea fragilis***	***Ligumia subrostrata***	***Obliquaria reflexa***	***Obovaria olivaria***	***Pleurobema sintoxia***	***Potamilus alatus***	***Potamilus ohiensis***	***Pyganodon grandis***
Acipenceridae	*Acipenser fulvescens*	Lake Sturgeon					LT [18]				
	Scaphirhynchus platorynchus	Shovelnose Sturgeon					NI [72] NILT [22]				
Atherinidae	*Labidesthes sicculus*	Brook Silverside									NILT [128]
Catostomidae	*Carpiodes carpio*	River Carpsucker									NS [19]
	Catostomus commersonii	White Sucker	LT [90]								NS [40]
	Ictiobus sp.	Buffalo sp.				LT [16]					
	Moxostoma carinatum	River Redhorse	NI [152]								
Centrarchidae	*Ambloplites rupestris*	Rock Bass									NI [91, 128] LT [130,128]
	Lepomis cyanellus	Green Sunfish	LT [161,92]		LT [92,121]						LT [130] NI [128,154]
	Lepomis gibbosus	Pumpkinseed									LT [128,143]
	Lepomis gulosus	Warmouth			LT [121]						
	Lepomis humilis	Orangespotted Sunfish	LT [161]		NI [92]						LT [3]
	Lepomis macrochirus	Bluegill			NI [121]			LT [143] NI [22,122]			NS [19] NI [91,128,154] LT [104,128,143]
	Lepomis megalotis	Longear Sunfish	LT [138]								LT [104]
	Micropterus salmoides	Largemouth Bass	LI [91] LT [161]		LT [92]	LT [16]					NS [19] NI [128,154] LT [104,143]
	Pomoxis annularis	White Crappie	LT [92,161]							NI [154]	NS [19] LT [143] NI [91,154]
	Pomoxis nigromaculatus	Black Crappie	LT [138]								NI [154] NILT [128]
Clupeidae	*Alosa chrysochloris*	Skipjack Herring				NI [22,154]					NI [122,154]
	Dorosoma cepedianum	Gizzard Shad	NI [152]			LT [16]					NI [154]
Cyprinidae	*Campostoma anomalum*	Central Stoneroller						LT [68,143]			NILT [128]
	Carassius auratus	Goldfish									LT [143]
	Chrosomus erythrogaster	Southern Redbelly Dace						LT [143]			
	Cyprinella lutrensis	Red Shiner						LT [68]			
	Cyprinella spiloptera	Spotfin Shiner						LT [48, 57] NT [17]			
	Cyprinella venusta	Blacktail Shiner						LT [68]			
	Cyprinus carpio	Common Carp	LT [91] LI [92]								NILT [91] NS [19]
	Luxilus chrysocephalus	Striped Shiner									LT [128] NI [91,106]
	Luxilus cornutus	Common Shiner				LT [139,150]		LT [68]			NILT [128] NS [40]
	Lythrurus umbratilis	Redfin Shiner									LT [128]
	Notemigonus crysoleucas	Golden Shiner									LT [128]
	Notropis boops	Bigeye Shiner						LT [68]			
	Notropis buccata	Silverjaw Minnow				LT [150,139]					
	Notropis heterodon	Blackchin Shiner									NILT [128]
	Notropis heterolepis	Blacknose Shiner									NILT [128]
	Pimephales notatus	Bluntnose Minnow						LT [48,57,68]			NILT [128]
	Pimephales vigilax	Bullhead Minnow									NI [46]
	Rhinichthys atratulus	Blacknose Dace						LT [68]			LT [128]
	Rhinichthys cataractae	Longnose Dace				LT [139,150]					
	Semotilus atromaculatus	Creek Chub						LT [68]			NS [40] LT [128,143]
Fundulidae	*Fundulus diaphanus*	Banded Killifish	LT [161]								LT [128]
Gasterosteidae	*Culaea inconstans*	Brook Stickleback						LT [68]			NS [19] LT [128]
Gobiidae	*Neogobius melanostomus*	Round Goby									LT [143]
Hiodontidae	*Hiodon alosoides*	Goldeye				NI [7]					
Ictaluridae	*Ameiurus natalis*	Yellow Bullhead									NI [154]
Lepisosteidae	*Lepisosteus osseus*	Longnose Gar	NI [152]								LT [128]
Moronidae	*Morone chrysops*	White Bass									NI [154]
Percidae	*Etheostoma caeruleum*	Rainbow Darter									NILT [128]
	Etheostoma exile	Iowa Darter									NS [19] NILT [128]
	Etheostoma nigrum	Johnny Darter									NI [43] NS [19] NILT [128]
	Perca flavescens	Yellow Perch	LT [138]								NILT [128] NI [82,83,91]
	Sander canadensis	Sauger	NI [152]								
	Sander vitreus	Walleye				LT [16]					
Sciaenidae	*Aplodinotus grunniens*	Freshwater Drum		NT [17] NI [28,70, 78,154]		LT [16]			NS [78] LT [18,114] NI [28,70,154,152]	NT [17] LT [114] NI [23,28,70,122,154]	NI [154]

Table 2 (continued)

Fish Species			Mussel Species								
Family	**Scientific Name**	**Common Name**	***Quadrula quadrula***	***Strophitus undulatus***	***Toxolasma parvum***	***Toxolasma texasiensis***	***Truncilla donaciformis***	***Truncilla truncata***	***Uniomerus tetralasmus***	***Utterbackia imbecillis***	***Utterbackia suborbiculata***
Ambystomatidae	*Ambystoma tigrinum*	Tiger Salamander								LT [147]	
Centrarchidae	*Ambloplites rupestris*	Rock Bass		LT [116,117]						LT [128]	
	Lepomis cyanellus	Green Sunfish		LI [35] LT [20,45]	NS [40] LT [49]					LT [130,128]	LT [79,81]
	Lepomis gibbosus	Pumpkinseed		LT [20]						LT [128]	
	Lepomis gulosus	Warmouth			NI [154] NS [40]	NI [121]				NI [121]	LT [11,12]
	Lepomis humilis	Orangespotted Sunfish			NS [40]						
	Lepomis macrochirus	Bluegill		LT [20,45,47,57]	NS [40]	NI [121]				NI [121] LT [88,128]	
	Lepomis megalotis	Longear Sunfish		LT [143]						LT [102]	LT [79,81]
	Micropterus dolomieu	Smallmouth Bass		LT [20]							
	Micropterus salmoides	Largemouth Bass		LT [5,20,45,47, 57,116,117]						LT [88,128,147]	LT [11,12]
	Pomoxis annularis	White Crappie		LT [139,148]	NS [40]						LT [11]
	Pomoxis nigromaculatus	Black Crappie		LT [20]						LT [55]	
Cottidae	*Cottus cognatus*	Slimy Sculpin		LT [117,153]							
Cyprinidae	*Campostoma anomalum*	Central Stoneroller		LT [20]							
	Carassius auratus	Goldfish								LT [147]	
	Cyprinella spiloptera	Spotfin Shiner		LT [20,47,57]						LT [55]	
	Luxilus cornutus	Common Shiner		LT [20,116,117]							
	Nocomis micropogon	River Chub		LT [116,117]							
	Notemigonus crysoleucas	Golden Shiner		LT [153]					NI [121]	LT [88]	LT [11,12]
	Notropis stramineus	Sand Shiner		LT [139,148]							
	Pimephales notatus	Bluntnose Minnow		LT [20,139,148]							
	Pimephales promelas	Fathead Minnow		LT [20,57,47]							
	Rhinichthys atratulus	Blacknose Dace		LT [20,117]							
	Rhinichthys cataractae	Longnose Dace		LT [20,116, 117,139,148,153]							
	Semotilus atromaculatus	Creek Chub		LT [5,20]						NI [19]	
	Umbra limi	Central Mudminnow		LT [20]							
Fundulidae	*Fundulus diaphanus*	Banded Killifish								LT [128]	
Gadidae	*Lota lota*	Burbot		LT [20]							
Gasterosteidae	*Culaea inconstans*	Brook Stickleback		LT [20]							
Ictaluridae	*Ameiurus melas*	Black Bullhead		LT [20,45,47,57]							
	Ameiurus natalis	Yellow Bullhead		LT [20,47,57,117]							
	Ameiurus nebulosus	Brown Bullhead		LT [142]							
	Ictalurus punctatus	Channel Catfish	LT [112]	LT [20]						LT [88]	LT [79,81]
	Pylodictis olivaris	Flathead Catfish	NI [78]	LT [80,81]							
Percidae	*Etheostoma caeruleum*	Rainbow Darter		LT [20,143]							
	Etheostoma exile	Iowa Darter		LT [20]							
	Etheostoma flabellare	Fantail Darter		LT [20,139,148]							
	Etheostoma nigrum	Johnny Darter		LT [20]	LT [143]						
	Etheostoma zonale	Banded Darter		LT [139,148]							
	Perca flavescens	Yellow Perch		LT [20,45,116,117]						LT [128]	
	Percina caprodes	Logperch		LT [20,142]							
	Percina maculata	Blackside Darter		LT [20]							
	Percina phoxocephala	Slenderhead Darter		LT [20]							
	Sander canadensis	Sauger					NI [122,154]	NI [122]			
	Sander vitreus	Walleye		LT [47,57]							
Poeciliidae	*Gambusia affinis*	Mosquitofish								NI [121]	
Ranidae	*Lithobates catesbeiana*	American Bullfrog								LT [147]	
	Lithobates pipiens	Northern Leopard Frog								LT [147]	
Salamandridae	*Notophtalmus v. viridescens*	Red-spotted Newt		LT [117]							
Salmonidae	*Oncorhynchus mykiss*	Rainbow Trout		LT [117]							
	Salvelinus fontinalis	Brook Trout		LT [117]							
Sciaenidae	*Aplodinotus grunniens*	Freshwater Drum					NS [78] LT [114] NI [70,122,72,154]	NS [78] NI [154] LT [114] NT [17]			

Table 3: Fish host information as of October 2014 for mussel SGNC species (based on 2015 revision).

Fish Species			Mussel Species									
Family	Scientific Name	Common Name	Alasmidonta marginata	Alasmidonta viridis	Amphinaias nodulata	Cyclonaias tuberculata	Cyprogenia stegaria	Ellipsaria lineolata	Elliptio crassidens	Elliptio dilatata	Epioblasma rangiana	Epioblasma triquetra
Catostomidae	*Carpiodes carpio*	River Carpsucker	LT [14]									
	Carpoides cyprinus	Quillback	LT [14]									
	Catostomus commersonii	White Sucker	NI [78] LT [14,90]									
	Erimyzon oblongus	Creek Chubsucker	LT [14]									
	Hypentelium nigricans	Northern Hog Sucker	NI [78] LT [14]									
	Ictiobus bubalus	Smallmouth Buffalo	LT [14]									
	Moxostoma anisurum	Silver Redhorse	LT [14]									
	Moxostoma erythrurum	Golden Redhorse	LT [14]									
	Moxostoma macrolepidotum	Shorthead Redhorse	NI [78] LT [14]									
Centrarchidae	*Ambloplites rupestris*	Rock Bass	NI [78]							LT [31,93]		
	Lepomis cyanellus	Green Sunfish						NI [22,122,154]				
	Lepomis gulosus	Warmouth	NI [78]									
	Lepomis macrochirus	Bluegill			LI [73]							
	Micropterus salmoides	Largemouth Bass			LI [73]					LT [31]		
	Pomoxis annularis	White Crappie			NI [22,122,154]					NI [73,154]		
	Pomoxis nigromaculatus	Black Crappie			LI [73]					NI [73]		
Clupeidae	*Alosa chrysochloris*	Skipjack Herring							NI [73,75]			
	Dorosoma cepedianum	Gizzard Shad								NI [154]		
Cottidae	*Cottus bairdi*	Mottled Sculpin	LT [14]	NS [19]			LT [86]				LT [95,96,129,142]	LT [129,143]
	Cottus carolinae	Banded Sculpin	LT [14]	NI [162]			NS [111] LT [86]			LT [93]		LT [44,159]
	Cottus cognatus	Slimy Sculpin	LT [14]									
	Cottus sp.	Holston Sculpin								LT [31]		
Cyprinidae	*Luxilus chrysocephalus*	Striped Shiner	LT [14]									
	Luxilus cornutus	Common Shiner	LT [14]									
	Nocomis biguttatus	Hornyhead Chub	LT [14]									
	Notemigonus crysoleucas	Golden Shiner	LT [14]									
	Rhinichthys cataractae	Longnose Dace	LT [14]									
	Semotilus atromaculatus	Creek Chub	LT [14]									
Fundulidae	*Fundulus catenatus*	Northern Studfish	LT [14]									
	Fundulus diaphanus	Banded Killifish	LT [14]									
	Fundulus olivaceus	Blackspotted Topminnow	LT [14]									LT [9]
Gasterosteidae	*Culaea inconstans*	Brook Stickleback	LT [14]									
Gobiidae	*Neogobius melanostomus*	Round Goby										LT [129]
Ictaluridae	*Ameiurus melas*	Black Bullhead			LT [115]	LT [50]						
	Ameiurus natalis	Yellow Bullhead				LT [58,62]						
	Ameiurus nebulosus	Brown Bullhead			LT [115]							
	Ictalurus furcatus	Blue Catfish			LT [115]							
	Ictalurus punctatus	Channel Catfish			LT [115] NI [154,22]	LT [50]						
	Noturus exilis	Slender Madtom			LT [115]							
	Pylodictis olivaris	Flathead Catfish			NI [22] LT [115]	LT [50]				NI [73]		
Percidae	*Etheostoma blennioides*	Greenside Darter					LT [86,111]					
	Etheostoma caeruleum	Rainbow Darter								LT [93]	LT [96]	
	Etheostoma camurum	Bluebreast Darter									LT [136]	
	Etheostoma exile	Iowa Darter									LT [95,96]	
	Etheostoma nigrum	Johnny Darter		NS [19]							LT [95,96]	
	Etheostoma zonale	Banded Darter					LT [86]				LT [142]	
	Percina caprodes	Logperch					LT [86]				LT [96]	LT [9,44,45,52,85,113,129,159]
	Percina maculata	Blackside Darter									LT [95]	LT [45]
	Sander canadensis	Sauger								NI [73]		
Salmonidae	*Salmo trutta*	Brown Trout									LT [136]	
Sciaenidae	*Aplodinotus grunniens*	Freshwater Drum						NI [154] NT [17] LT [21,110] NILT [22,72,78]				

Table 3 (continued)

Fish Species			Mussel Species										
Family	**Scientific Name**	**Common Name**	***Fusconaia ebena***	***Lampsilis abrupta***	***Lampsilis fasciola***	***Lampsilis higginsii***	***Lampsilis hydiana***	***Lampsilis ovata***	***Lasmigona compressa***	***Lasmigona costata***	***Leptodea leptodon***	***Ligumia recta***	***Margaritifera monodonta***
N/A	N/A	N/A						hosts unknown					
Amiidae	*Amia calva*	Bowfin								LT [54,60,125]			
Anguillidae	*Anguilla rostrata*	American Eel								LT [125]		NI [22]	
Aphredoderidae	*Aphredoderus sayanus*	Pirate Perch								LT [54]			
Catostomidae	*Carpiodes cyprinus*	Quillback								LT [54]			
	Catostomus commersonii	White Sucker								LT [125]			
	Erimyzon oblongus	Creek Chubsucker								LT [54]			
	Hypentelium nigricans	Northern Hog Sucker								LT [54,125,139,148]			
	Ictiobus cyprinellus	Bigmouth Buffalo								LT [54,125]			
	Moxostoma anisurum	Silver Redhorse								LT [54]			
	Moxostoma carinatum	River Redhorse								NI [152]			
	Moxostoma macrolepidotum	Shorthead Redhorse								LT [54,125]			NI [4]
Centrarchidae	*Ambloplites rupestris*	Rock Bass								LT [54,93]		LI [92] LT [118]	
	Lepomis cyanellus	Green Sunfish				LT [131]	LT [79,81]		LT [94]	LT [93,125]		LT [118,161]	
	Lepomis gibbosus	Pumpkinseed								LT [139,125]		LT [149]	
	Lepomis humilis	Orangespotted Sunfish							LT [94]	LT [54,125]		LT [161]	
	Lepomis macrochirus	Bluegill				LT [131]			LT [94]	LT [60,125,143]		NS [19] LI [92] NI [22,122,154] LT [59,89,149]	
	Lepomis megalotis	Longear Sunfish			LT [140]					LT [93]		LT [149]	
	Lepomis microlophus	Redear Sunfish								LT [125]			
	Micropterus dolomieu	Smallmouth Bass		LT [10]	NS [99] LT [96,98,129,164]	LT [131]			LT [94]	LT [54,93,125]			
	Micropterus punctulatus	Spotted Bass		LT [10]									
	Micropterus salmoides	Largemouth Bass	NI [73]	LT [10]	LT [96,98]	LI [124] LT [131]				LT [54,60,125,139]		LT [60,89,92,118,149,161]	
	Pomoxis annularis	White Crappie	NI [73]									NS [19] NI [22,154] LT [89,92,161]	
	Pomoxis nigromaculatus	Black Crappie	NI [73]						LT [56,94]	LT [54,125]		LT [89]	
Clupeidae	*Alosa chrysochloris*	Skipjack Herring	NI [73,122,154] LT [21,22,75]										
	Dorosoma cepedianum	Gizzard Shad							LT [94]	NI [152]			
Cottidae	*Cottus bairdi*	Mottled Sculpin			LT [96,129]								
	Cottus carolinae	Banded Sculpin								LT [93]			
	Cottus cognatus	Slimy Sculpin							LT [56]				
Cyprinidae	*Campostoma anomalum*	Central Stoneroller								LT [54,143]		LT [149]	
	Carassius auratus	Goldfish							LI [126]	LT [143]			
	Chrosomus erythrogaster	Southern Redbelly Dace								LT [125]			
	Cyprinella lutrensis	Red Shiner								LT [54]			
	Cyprinella spiloptera	Spotfin Shiner							LT [56,94]	LT [54,125]			
	Cyprinella venusta	Blacktail Shiner								LT [54]			
	Cyprinella whipplei	Steelcolor Shiner								LT [125]			
	Cyprinus carpio	Common Carp								LI [92] LT [54,91,125]		LI [92]	
	Hybognathus hankinsoni	Brassy Minnow							LT [94]	LT [54,125]			
	Hybopsis amblops	Bigeye Chub											NI [4]
	Luxilus chrysocephalus	Striped Shiner								LT [54]			
	Luxilus cornutus	Common Shiner								LT [125]			
	Lythrurus umbratilis	Redfin Shiner										LT [149]	
	Macrhybopsis storeriana	Silver Chub								LT [54]			
	Nocomis biguttatus	Hornyhead Chub								LT [54,125]			
	Notemigonus crysoleucas	Golden Shiner								LT [54,125]			
	Notropis atherinoides	Emerald Shiner							LT [94]				
	Notropis hudsonius	Spottail Shiner								LT [54,125]			
	Notropis volucellus	Mimic Shiner							LT [94]	LT [54,125]			
	Pimephales notatus	Bluntnose Minnow								LT [54,125]			
	Pimephales promelas	Fathead Minnow								LT [54]			
	Pimephales vigilax	Bullhead Minnow								LT [54]			
	Rhinichthys cataractae	Longnose Dace							LT [94]	LT [125,139,148]			
	Semotilus atromaculatus	Creek Chub							LT [94]	LT [125,143]			
	Umbra limi	Central Mudminnow								LT [54]			
Esocidae	*Esox lucius*	Northern Pike				LT [131]				LT [54,60]			
Fundulidae	*Fundulus catenatus*	Northern Studfish								LT [93]			
	Fundulus diaphanus	Banded Killifish								LT [54]		LT [161]	
	Fundulus olivaceus	Blackspotted Topminnow								LT [125]			
Gadidae	*Lota lota*	Burbot								LT [54]			
Gasterosteidae	*Culaea inconstans*	Brook Stickleback							LT [94]				
Hiodontidae	*Hiodon alosoides*	Goldeye	LT [15]										
Ictaluridae	*Ameiurus melas*	Black Bullhead							LT [94]	LT [54,125]			
	Ameiurus natalis	Yellow Bullhead							LT [94]	LT [54,125]			
	Ameiurus nebulosus	Brown Bullhead								LT [54,93]			
	Ictalurus furcatus	Blue Catfish					LT [81]			LT [54]			
	Ictalurus punctatus	Channel Catfish					LT [81]			LT [125]			
	Noturus flavus	Stonecat								LT [54]			
	Pylodictis olivaris	Flathead Catfish							LT [94]	LT [54]			

(these mussel species continue below)

Table 3 (continued)

Family	Scientific Name	Common Name	*Fusconaia ebena*	*Lampsilis abrupta*	*Lampsilis fasciola*	*Lampsilis higginsii*	*Lampsilis hydiana*	*Lampsilis ovata*	*Lasmigona compressa*	*Lasmigona costata*	*Leptodea leptodon*	*Ligumia recta*	*Margaritifera monodonta*
Lepisosteidae	*Lepisosteus osseus*	Longnose Gar								LT [54]			
	Lepisosteus platostomus	Shortnose Gar							LT [94]				
Moronidae	*Morone americana*	White Perch										LT [118]	
Percidae	*Etheostoma caeruleum*	Rainbow Darter								LT [93,125]			
	Etheostoma flabellare	Fantail Darter								LT [54,93]			
	Etheostoma nigrum	Johnny Darter								LT [54]			
	Etheostoma zonale	Banded Darter								LT [139,148]			
	Perca flavescens	Yellow Perch				LT [131]			LT [56]	LT [54,60,125]		LI [92] LT [118]	
	Percina caprodes	Logperch								LT [54]			
	Percina maculata	Blackside Darter								LT [54]			
	Percina phoxocephala	Slenderhead Darter								LT [54]			
	Percina shumardi	River Darter								LT [54]			
	Sander canadensis	Sauger				NI [22,122,154]				LT [54]		NI [103] LT [89]	
	Sander vitreus	Walleye		LT [10]		LI [124] LT [131] NT [17]				LT [54,60,125]		LT [60]	
Percopsidae	*Percopsis omiscomaycus*	Trout Perch								LT [54]			
Poeciliidae	*Gambusia affinis*	Western Mosquitofish								LT [125]			
Sciaenidae	*Aplodinotus grunniens*	Freshwater Drum				NI [154]				LT [54]	LT [9]		

Table 3 (continued)

Fish Species			Mussel Species									
Family	**Scientific Name**	**Common Name**	***Megalonaias nervosa***	***Obovaria subrotunda***	***Plectomerus dombeyanus***	***Plethobasus cooperianus***	***Plethobasus cyphyus***	***Pleurobema clava***	***Pleurobema cordatum***	***Potamilus capax***	***Potamilus purpuratus***	***Ptychobranchus fasciolaris***
N/A	N/A	N/A			hosts unknown	hosts unknown						
Acipenceridae	*Scaphirhynchus platorynchus*	Shovelnose Sturgeon	LT [140]									
Amiidae	*Amia calva*	Bowfin	NI [73]									
Anguillidae	*Anguilla rostrata*	American Eel	NI [22,123,154]									
Catostomidae	*Carpiodes velifer*	Highfin Carpsucker	LI [73]									
	Hypentelium nigricans	Northern Hog Sucker						LT [41]				
Centrarchidae	*Lepomis cyanellus*	Green Sunfish	LILT [73] LT [22,140,157]									
	Lepomis gulosus	Warmouth	NI [152]									
	Lepomis macrochirus	Bluegill	LILT [73] NILT [22] LT [146]						NI [22,122]			
	Lepomis megalotis	Longear Sunfish	LT [146]									
	Micropterus punctulatus	Spotted Bass	NI [152]									
	Micropterus salmoides	Largemouth Bass	LI [73] LT [140,146]									
	Pomoxis annularis	White Crappie	NILT [22] LILT [73] NI [152]									
	Pomoxis nigromaculatus	Black Crappie	LILT [73] LT [22]									
Clupeidae	*Alosa chrysochloris*	Skipjack Herring	NI [22,154]									
	Dorosoma cepedianum	Gizzard Shad	NI [22,73,152]									
Cottidae	*Cottus carolinae*	Banded Sculpin		LT [33]								
Cyprinidae	*Campostoma anomalum*	Central Stoneroller	LT [146]				LT [42,143]	LT [41,101,144]				
	Chrosomus erythrogaster	Southern Redbelly Dace					LT [42]					
	Cyprinella lutrensis	Red Shiner					LT [42]					
	Cyprinella spiloptera	Spotfin Shiner					LT [42,156]					
	Cyprinella venusta	Blacktail Shiner					LT [42]					
	Cyprinella whipplei	Steelcolor Shiner					LT [42,156]					
	Hybognathus hankinsoni	Brassy Minnow					LT [42]					
	Luxilus chrysocephalus	Striped Shiner					LT [42,156]	LT [101,144]				
	Luxilus cornutus	Common Shiner					LT [42,156]	LT [41,97]				
	Lythrurus ardens	Rosefin Shiner							LT [160]			
	Macrhybopsis storeriana	Silver Chub					LT [156]					
	Nocomis biguttatus	Hornyhead Chub					LT [156]					
	Nocomis micropogon	River Chub						LT [97]				
	Notemigonus crysoleucas	Golden Shiner	LT [140]				LT [156]					
	Notropis blennius	River Shiner					LT [42]					
	Notropis hudsonius	Spottail Shiner					LT [156]					
	Notropis nubilus	Ozark Minnow					LT [42]					
	Notropis volucellus	Mimic Shiner					LT [42]					
	Phenacobius mirabilis	Suckermouth Minnow					LT [42]					
	Pimephales notatus	Bluntnose Minnow					LT [42,156]	LT [41]				
	Pimephales promelas	Fathead Minnow					LT [42,156]	LT [41]				
	Pimephales vigilax	Bullhead Minnow					LT [42]					
	Rhinichthys atratulus	Blacknose Dace					LT [42]	LT [41]				
	Rhinichthys cataractae	Longnose Dace					LT [42]					
	Semotilus atromaculatus	Creek Chub					LT [156]	LT [41]	LT [41,141,143]			
Fundulidae	*Fundulus catenatus*	Northern Studfish	LT [140]									
	Fundulus diaphanus	Banded Killifish					LT [156]					
	Fundulus olivaceus	Blackspotted Topminnow					LT [42]					
Gasterosteidae	*Culaea inconstans*	Brook Stickleback							LT [141,143]			LT [143]
Hiodontidae	*Hiodon alosoides*	Goldeye	LT [15]									
Ictaluridae	*Ameiurus melas*	Black Bullhead	LILT [73] LT [22,140,157]									
	Ameiurus natalis	Yellow Bullhead	LT [140]									
	Ameiurus nebulosus	Brown Bullhead	LT [22]									
	Ictalurus punctatus	Channel Catfish	LILT [73] LT [22,157]									
	Noturus gyrinus	Tadpole Madtom	NI [22]									
	Pylodictis olivaris	Flathead Catfish	NI [73,152] NILT [22]									
Lepisosteidae	*Lepisosteus osseus*	Longnose Gar	NI [152] LT [146]									
Moronidae	*Morone chrysops*	White Bass	NILT [73] NI [22,152,154]									
Percidae	*Etheostoma blennioides*	Greenside Darter		LT [33]								
	Etheostoma caeruleum	Rainbow Darter										LT [140]
	Etheostoma exile	Iowa Darter		LT [96]								
	Etheostoma flabellare	Fantail Darter		LT [33,96]								LT [140]
	Perca flavescens	Yellow Perch	LT [146]									
	Percina caprodes	Logperch	LT [146]					LT [101,144]				
	Percina maculata	Blackside Darter		LT [96]				LT [101,144]				
	Percina phoxocephala	Slenderhead Darter	LT [146]									
	Sander canadensis	Sauger	LI [73]				NI [122,154]					
Poeciliidae	*Gambusia affinis*	Western Mosquitofish					LT [42]					
Sciaenidae	*Aplodinotus grunniens*	Freshwater Drum	NILT [22] LILT [73] NI [122,123,152,154]							NI [28] LT [6,8]	NI [122,154] NS [78]	

Table 3 (continued)

Family	Scientific Name	Common Name	*Quadrula nobilis*	*Simpsonaias ambigua*	*Theliderma cylindrica*	*Theliderma metanevra*	*Toxolasma lividum*	*Tritogonia verrucosa*	*Venustaconcha ellipsiformis*	*Villosa fabalis**	*Villosa iris*	*Villosa lienosa*
Catostomidae	*Moxostoma erythrurum*	Golden Redhorse			LT [38]							
Centrarchidae	*Ambloplites rupestris*	Rock Bass									LI [164] NS [99,163] LT [98,129]	
	Lepomis cyanellus	Green Sunfish				NI [73,122,154]	LT [84,44]				LT [145]	LT [29]
	Lepomis humilis	Orangespotted Sunfish										LT [29]
	Lepomis macrochirus	Bluegill				NI [22,73,122,154]						LT [88]
	Lepomis megalotis	Longear Sunfish					LT [44,84]					LT [29]
	Lepomis microlophus	Redear Sunfish										LT [29]
	Micropterus dolomieu	Smallmouth Bass									LI [164] NS [99,163] LT [143,145]	
	Micropterus punctulatus	Spotted Bass									LT [100]	
	Micropterus salmoides	Largemouth Bass									LT [100,145]	LT [88]
Cottidae	*Cottus bairdi*	Mottled Sculpin							LT [1,63]		LT [129,143]	
	Cottus cognatus	Slimy Sculpin							LT [1,51]			
Cyprinidae	*Campostoma anomalum*	Central Stoneroller				LT [39]						
	Campostoma oligolepis	Largescale Stoneroller				LT [39]						
	Cyprinella lutrensis	Red Shiner				LT [39]						
	Cyprinella spiloptera	Spotfin Shiner			LT [38,142*,158*]	LT [26,39,57]						
	Cyprinella venusta	Blacktail Shiner			LT [38]	LT [39]						
	Cyprinella whipplei	Steelcolor Shiner				LT [39]						
	Hybognathus hankinsoni	Brassy Minnow				LT [39]						
	Hybognathus nuchalis	Mississippi Silvery Minnow				LT [39]						
	Hybopsis amblops	Bigeye Chub			LT [158*]							
	Luxilus chrysocephalus	Striped Shiner			LT [38,140]	LT [39]					LT [145]	
	Luxilus cornutus	Common Shiner				LT [39]						
	Macrhybopsis storeriana	Silver Chub				LT [39]						
	Nocomis biguttatus	Hornyhead Chub				LT [39]						
	Notropis atherinoides	Emerald Shiner			LT [38]							
	Pimephales notatus	Bluntnose Minnow				LT [26,39]						
	Pimephales promelas	Fathead Minnow				LT [39]						
	Pimephales vigilax	Bullhead Minnow			LT [38]							
	Rhinichthys atratulus	Blacknose Dace				LT [26]						
	Rhinichthys cataractae	Longnose Dace				LT [39]						
	Semotilus atromaculatus	Creek Chub				LT [26,39]		LI [67]				
Fundulidae	*Fundulus notatus*	Blackstripe Topminnow			LT [38]							
Gasterosteidae	*Culaea inconstans*	Brook Stickleback							LT [1,63,64]			
Gobiidae	*Neogobius melanostomus*	Round Goby									LT [129]	
Ictaluridae	*Ameiurus melas*	Black Bullhead						LI [67]				
	Ameiurus natalis	Yellow Bullhead						LI [67] LT [64,105]				
	Ameiurus nebulosus	Brown Bullhead						LT [65,67]				
	Ictalurus punctatus	Channel Catfish	LT [81]					LT [81]				LT [88]
	Pylodictis olivaris	Flathead Catfish	LT [80,81]					LT [53,67,80,81]				
Percidae	*Etheostoma asprigene*	Mud Darter							LT [1]			
	Etheostoma blennioides	Greenside Darter							NI [109]		LT [145]	
	Etheostoma caeruleum	Rainbow Darter			LT [140,142]				LT [108,109] NILT [1]		LT [145]	
	Etheostoma camurum	Bluebreast Darter									LT [145]	
	Etheostoma exile	Iowa Darter							LT [1,63]			
	Etheostoma flabellare	Fantail Darter							LT [63] NILT [1]			
	Etheostoma nigrum	Johnny Darter							LT [51] NILT [1]			
	Etheostoma spectabile	Orangethroat Darter							NI [109] LT [13]			
	Etheostoma zonale	Banded Darter							LT [1,142]			
	Perca flavescens	Yellow Perch									LT [145]	
	Percina caprodes	Logperch							LT [63]			
	Percina maculata	Blackside Darter							NI [1] LT [45,63]			
	Sander canadensis	Sauger				NI [22,73,103]						
Poeciliidae	*Gambusia affinis*	Western Mosquitofish									LT [100]	
Proteidae	*Necturus maculosus*	Mudpuppy		NILT [74] NS [78] NILT [77] LT [3,9]								

**Villosa fabalis* has no host with distributions in Illinois. Confirmed hosts are *Etheostoma maculatum* (Spotted Darter) and *E. tippecanoe* (Tippecanoe Darter), LT[41].

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