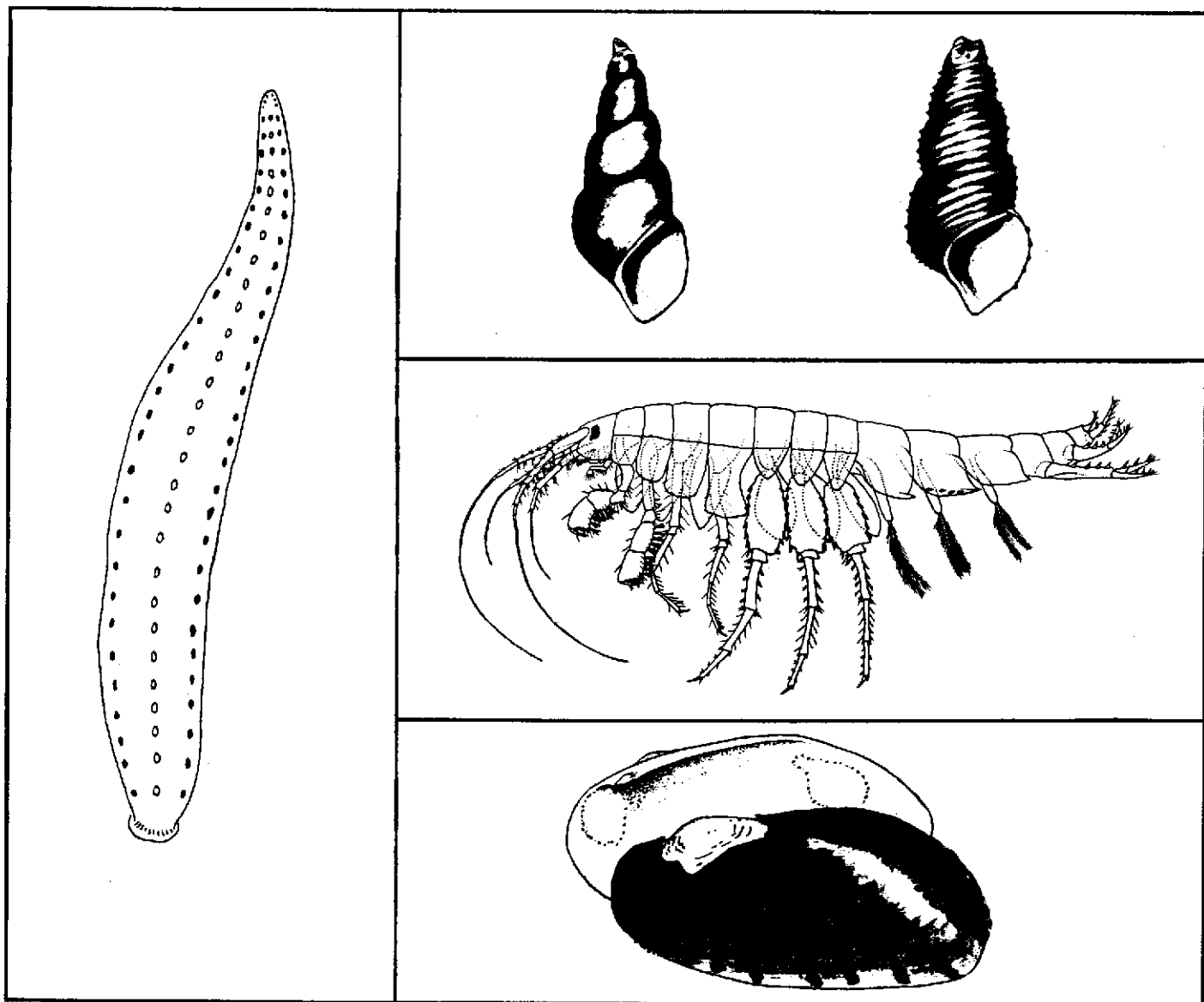


# SELECTED FRESHWATER INVERTEBRATES PROPOSED FOR SPECIAL CONCERN STATUS IN MASSACHUSETTS



massachusetts department of environmental quality engineering  
DIVISION OF WATER POLLUTION CONTROL  
thomas c. mcMahon, director

SELECTED FRESHWATER INVERTEBRATES PROPOSED FOR  
SPECIAL CONCERN STATUS IN MASSACHUSETTS  
(MOLLUSCA, ANNELIDA, ARTHROPODA)

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## INTRODUCTION

During the last two decades, an increasing awareness of the declining biota of North American rivers and streams has developed among both scientists and non-scientists alike. In New England, contraction of aquatic animal and plant populations followed the construction of the first dams on the larger rivers and the commencement of industrial pollution. Artificially induced extinctions began occurring by the early 1900s. By the beginning of the twentieth century, a large salmon and sturgeon fishery was gone (Netboy, 1968). Elsewhere in North America, we have seen the extinction of several species of freshwater bivalve and univalve mollusks (Jorgensen and Sharp, 1971) as well as some fish species (Hubbs and Lagler, 1962). Many more fish species have undergone drastic range contraction and disjunctions (Deacon et al, 1979).

Another problem, compounding the pollution-damming dilemma, involves the uncontrolled introduction and mismanagement of exotic animals (i.e., carp) that have progressively excluded native species from former habitats. The latter crisis might well become the crucial problem in native wild plant and animal protection in the future. It seems reasonably certain that pollution and its subsequent effects will become more alleviated as technology finds easier and more efficient means to treat or avoid pollution. Large dams are becoming far too expensive to construct and public concern regarding their long-term deleterious side effects is growing. However, as has been often documented, once a foreign organism has taken hold, it is virtually impossible to remove it. Succession of aquatic native animal populations by introduced competitively superior ones can proceed at astonishing rates.

In 1973, the federal government placed into law the Endangered Species Act which initiated the process of protecting vanishing wildlife and plants in the United States. Since then several states have commenced endangered species programs along the same lines. Concerning invertebrates, such states as North Carolina, Missouri, Ohio and Alabama have attempted to identify endangered aquatic invertebrate species and are planning measures to protect them or their habitat. With growing interest on both federal and state levels to protect endangered animal species, particularly invertebrates, it is appropriate, at this point, to provide an account that identifies and discusses those indigenous aquatic species that presently exist or have existed in certain areas of Massachusetts but whose continued existence is uncertain. The present account provides information on certain aquatic macro-invertebrates inhabiting Massachusetts which, due to contraction of former ranges or because of their biological uniqueness, are worthy of special concern.

## TERMINOLOGY AND PRIOR LISTS

The selection of categories or ranks into which particular species fit has been based on a review of previous reports dealing with endangered animals and plants. Unfortunately, little uniformity exists and several terms are available to identify various levels of concern. Furthermore, different terms often share similar definitions and clear separation of categories used in different reports is difficult.

The parent study on North American aquatic invertebrate species in ecological danger was published in 1970 and summarized a year later (Jorgensen and Sharp, 1971). This publication employed the general category "Rare and Endangered." The selection of a single broad category was, in the opinion of the contributors, the result of too little information being available on individual species to establish several specific categories.

On a regional level, a list of Massachusetts Rare and Endangered Species (Isgur, 1973) was distributed by the United States Soil Conservation Service. Categories adopted included "Endangered," "Rare" and "Undetermined." However, invertebrates were not included in the list. In 1979 the Massachusetts Division of Fisheries and Wildlife (Anon., 1979), which has jurisdiction over endangered organisms in Massachusetts, published a list "Massachusetts Species for Special Consideration" in which an "Endangered" category was utilized along with the novel groupings "State Rare" and "State Local" but because of jurisdictional constraints, invertebrates were not included.

The present discussion incorporates the category "Special Concern." This category is sufficiently broad so as to encompass any species whose existence in Massachusetts appears threatened to some extent, either due to restricted range and/or human activity.

#### Species Proposed for Special Concern Status

The following list is provisional and can be amended as new information becomes available. Other species can and should be added if further investigation justifies their imperilment.

#### MOLLUSCA

##### Pelecypoda

Alasmidonta heterodon (Lea 1830)

Alasmidonta varicosa (Lamarck 1819)

"Leptodea" ochracea (Say 1817)

##### Gastropoda

Goniobasis virginica (Gmelin 1790)

#### ANNELIDA

##### Hirudinea

Macrobdella sestertia (Whitman 1886)

#### ARTHROPODA

##### Amphipoda

Crangonyx pseudogracilis (Bousfield 1958) Population B

## SPECIES ACCOUNTS

### Mollusca

#### Pelecypoda

##### Alasmidonta heterodon Inverted floater (Figure 1)

Alasmidonta heterodon possesses no widely accepted vernacular name. The name used herein is a combination of two other proposed names. This mussel is the only North American species of the family Unionidae known to contain two lateral hinge teeth in the right valve of the shell (Fig. 1a). A small form, A. heterodon rarely reaches a shell length of 50 mm. The species exhibits strong sexual dimorphism with females showing posterior inflation of the shell to accommodate the marsupial demibranchs (gills).

Alasmidonta heterodon has a discontinuous range in several large rivers along the Atlantic Slope region (Johnson, 1970).

Museum records (MCZ)<sup>1</sup> suggest that this species was formerly widespread throughout the state (map 1). Several historical collections presently housed at the MCZ also indicate it was once common in the Connecticut River; however, recent extensive surveying in the river has turned up only a single shell of a deceased individual. Investigation indicates that the species is declining in many minor tributary streams as well, but further study is necessary. Recent UMA<sup>2</sup> collections have documented the species occurrence in the Fort River, Amherst, and the Mill River in Northampton, both in Hampshire County (map 1).

Alasmidonta heterodon is a long-term breeder (Johnson, 1970). Eggs are deposited into the gills of the female parent during the late summer. The eggs develop into glochidea and are brooded until the following spring at which time they are released. As with all unionid clams, the glochidia of the species parasitize a host fish until development to a juvenile mussel is complete. However, the host fish of this species is unknown. Alasmidonta heterodon is a species typically found in large rivers but can occur in small streams as well. It never is found in stagnant water.

Clarke (In Jorgensen and Sharp, 1971) considered A. heterodon as "Rare and Endangered" throughout its range and, therefore, in need of conservation. Fuller (1977) reiterated Clarke's proposal and reviewed the status of the species on a national level. Fuller (Loc. cit.) suggested that the species should receive federal protection.

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<sup>1</sup>Museum of Comparative Zoology, Harvard University

<sup>2</sup>Museum of Zoology, University of Massachusetts

As with most other mussel species, A. heterodon is adversely affected by point and non-point source pollution and habitat destruction. The latter is usually the direct result of channeling, damming, stream flow regulation and road and bridge construction. Typical cases of documented damage to A. heterodon populations in Massachusetts are provided below. Two populations occur in two small stream systems in Hampshire County (see above). However, both were substantially disturbed when, in one stream, a small oil spill eliminated most of the benthic community and in the other stream, the construction of a small bridge resulted in accelerated sedimentation and erosion which buried and killed many of the bivalves. Fuller (loc. cit.) discusses similar cases.

The future persistence of A. heterodon in Massachusetts is doubtful unless corrective measures are undertaken to reduce pollution and curb habitat destruction.

Alasmidonta varicosa Brook floater (Figure 2)

This mussel species is easily separated from all other Massachusetts mussel species by the "corrugated" posterior ridge on the shell (Figure 2). It also is a small species rarely reaching 70 mm. Shells lack lateral hinge teeth.

Alasmidonta varicosa has been considered a common species throughout its range which includes much of the Atlantic Slope (Johnson, 1970). Historical records at the MCZ suggest that the species has had a wide distribution in Massachusetts (map 2), but that individual populations were small and very localized. Recent extensive surveying in the Connecticut River system, in particular, has turned up only a few specimens in scattered streams (UMA records). It is strongly suspected that the species is declining rapidly.

This species, as with A. heterodon, is a long-term breeder (Johnson, 1970). The host fish and other particular aspects of this species life history in Massachusetts are unknown.

Unlike A. heterodon, A. varicosa predominately lives in small streams which makes remaining populations highly susceptible to annihilation by only slight degrees of pollution or habitat destruction.

Alasmidonta varicosa is not now formally protected by state or federal law. Fuller (1977) has stated that the species is possibly declining in North Carolina.

The principal causes of this species decline in Massachusetts are probably similar to those affecting A. heterodon. Subsequently, protective measures are similar to those suggested for A. heterodon.

"Leptodea" ochracea Tidewater mucket (Figure 3)

The taxonomic status of "Leptodea" ochracea is presently in a state of flux due to peculiarities in secondary sexual characters of the female (see Fuller(1977) for discussion). The tidewater mucket is a medium sized mussel ranging locally up to 80 mm in length. The species is strongly sexually dimorphic and contains lateral teeth in the "typical" compliment. Specimens are difficult to diagnose from Lampsilis cariosa, a superficially similar species also occurring in Massachusetts. A

useful guide for determining this and similar mussel species is Burch (1973).

"Leptodea" ochracea is distributed along the Atlantic coast of North America from Georgia to Nova Scotia (Johnson, 1970). In Massachusetts, the species is restricted to a small number of Great Ponds (greater than ten acres) in Plymouth and Barnstable counties (Johnson, 1947) (map 3). Several collections of this species from the above mentioned counties exist at the MCZ.

The only information on the life cycle of "L." ochracea has been summarized by Johnson (1970) who states that the species lays eggs in mid-summer and broods larvae through the winter to the following spring at which time they are released. The host fish for this species is unknown.

Based on literature accounts (Johnson, 1947) plus personal observations, "L." ochracea prefers sandy-bottomed waterways with little or no current. Occasional specimens are found on muddy bottoms. Populations are always found near the ocean whether or not the pond they occur in drains to the sea.

This species is not protected by state or federal law. The inclusion of this mussel in the "Special Concern" category is based on its restricted ecological and geographical distribution in Massachusetts. It is found only, as presently understood, in a handful of Great Ponds in Plymouth and Barnstable counties (Johnson, 1947). In that the mussel appears to require clear, clean, and sandy-bottomed ponds, land fill operations and accelerated eutrophication could endanger these populations.

#### Gastropoda

##### Goniobasis virginica Virginia river snail (Figure 4)

The Virginia river snail is the only species of the gastropod family Pleuroceridae occurring in southern New England. It is a large snail with a shell that often reaches 30 mm in height.

Specimens are easily diagnosed by the conical multi-whorled shape of the shell (Figure 4) and the presence of an operculum that covers the aperture.

The Connecticut River is the northeastern-most range limit of the species and the only river in New England known to have supported populations. To the west and south of New England, G. virginica is known to have populated the Hudson, Delaware, Susquehanna and other major rivers of the middle Atlantic Slope region.

Presently the Virginia river snail occupies only a three-mile portion of the Connecticut River in Connecticut two miles south of the Connecticut-Massachusetts border. It is believed that the snail possibly existed in Longmeadow, Massachusetts, as recently as about 1950 (E. Reed, Pers. Comm.) but has not been reported there since then.

Historically limited in distribution, G. virginica was found in the Connecticut River only as far north as Springfield. Extant museum records at the MCZ (ca. 1900) are from Agawam and Springfield (map 4).

The life history of this species in the Connecticut River has been discussed by Smith (1980). Recruitment of young commences in the early summer and most likely continues through the summer. Females lay small clutches of eggs on surfaces of rocks and debris. Longevity is unknown, but probably does not exceed two years.

Goniobasis virginica is a species of larger rivers. It has never been found in lentic environments. Specimens are typically found on exposed lithic surfaces that are not subject to sedimentation. Based on work by Smith (1980), G. virginica, in the Connecticut River, is not able to exist in silted or otherwise soft-bottomed parts of the river. Populations are always found to occur in regions of the river subjected to sustained current. This species is not presently protected anywhere throughout its range.

Smith (1980) attributed the decline of the species, in part, to complications of inorganic point source pollution from private industry along the river. Since the species formerly occurred as far north as Springfield, Massachusetts, it is possible that the snail could regain some territory in Massachusetts provided that pollution is abated and proper habitats remain available.

## Annelida

### Hirudinea

#### Macrobdella sestertia New England medicinal leech (Figure 5)

Macrobdella sestertia was first discovered in Massachusetts in the 1870s but was not formerly recognized until 1886 by C.O. Whitman. The species is a large, brightly-colored annelid belonging to a small group of leeches that are voracious blood-suckers of vertebrates. The animal is usually bright green with sequential yellow spots above, and orange-red beneath. Leeches belonging to the genus Macrobdella are difficult to diagnose, as distinguishing characteristics are restricted to reproductive morphology. Useful guides for these animals are Sawyer (1972) and Pennak (1979). Smith (1977a) has reviewed and discussed the taxonomic history and morphology of this species.

Macrobdella sestertia is, as presently known, endemic to coastal freshwaters of Massachusetts (map 5). Extant museum records are from Chebacco Lake, Hamilton, Essex County (UMA AN. 221). A single specimen in the MCZ (No. 1729) is from "Chebaco Row" apparently near Chebacco Lake. Populations might occur in Rhode Island, but none have yet been found. Elsewhere, M. sestertia is replaced by M. decora, a common, widespread species. The known distribution of these species, either from museum or literature records, has been recently discussed (Smith, 1977a).

The life history of this species is essentially unknown except for brief notes on sizes in Smith (1977a). Based on personal observations, peak activity periods of this leech are during the spring and early summer.

Macrobdella sestertia is probably very similar to M. decora in its reproductive habits and biology. Moore (1923) provided an adequate account of the life history of M. decora in New York.

Macrobdella sestertia apparently occupies low-lying coastal freshwater waterways. Streams and ponds characterized by dark water (dystrophic) and abundant vegetation would be considered typical situations in which M. sestertia would be found.

Macrobdella sestertia is at present unprotected by either state or federal regulations. Although leeches provide little, if any, aesthetic or economic value, M. sestertia generates great scientific interest in that it is truly a species unique to the Massachusetts fauna. The species can be exceedingly useful scientifically in attempting to recount the biotic history of the region. As the species occurs in coastal areas that have been subjected to long-term urbanization, some concern is necessary regarding the condition of the aquatic habitats supporting populations of M. sestertia. Since this leech is an inhabitant of vegetated ponds and streams, land filling and seepage of sewage might pose substantial threats to its continued existence.

#### Arthropoda

##### Amphipoda

##### Crangonyx pseudogracilis Population B scud (Figure 6)

Although closely related to other populations of C. pseudogracilis in central and western Massachusetts, and elsewhere, this form differs in certain morphological characters and is probably a genetically distinct form. Holsinger (1972) has remarked that the C. pseudogracilis species complex is actually composed of several discrete species. Major diagnostic characters separating population B from other populations elsewhere in Massachusetts includes size differences of adult males and the arrangement of comb spines on the outer rami of the second uropods of the male. In population B, examined males reached about 5 mm commonly, while males of population A collected in the Connecticut River system rarely exceeded 4.5 mm. Most importantly, the comb spines on the second uropod of population B males occupy over half the length of the ramus, whereas in males of population A, the comb spines are limited to the distal third of the ramus. It should be noted that amphipod species are very difficult to diagnose and consultation with experts would be necessary to determine the identity of C. pseudogracilis and its various populations.

Presently, C. pseudogracilis population B is known to occur only in a few small tributaries of the Mystic and Merrimack River systems in Middlesex and Worcester counties (map 6). Museum records of C. pseudogracilis population B include small, unnamed streams in Harvard, Worcester County (UMA AR. 969); Reading (UMA AR. 960), Stoneham (UMA AR. 961), Medford (UMA AR. 962), and Acton (UMA AR. 968), all Middlesex County.

Little is known regarding the life history of this population; however, based on museum collections made throughout the summer months, it is assumed to be much like that of C. pseudogracilis population A which has been discussed by Smith (1977b). Generally, females mature in the spring and commence brooding of eggs from April through to September. Juveniles appear in May or June. Crangonyx pseudogracilis population B is a form frequenting small seepage or runoff streams in low-lying areas. Usually, abundant vegetation and organic debris is present.

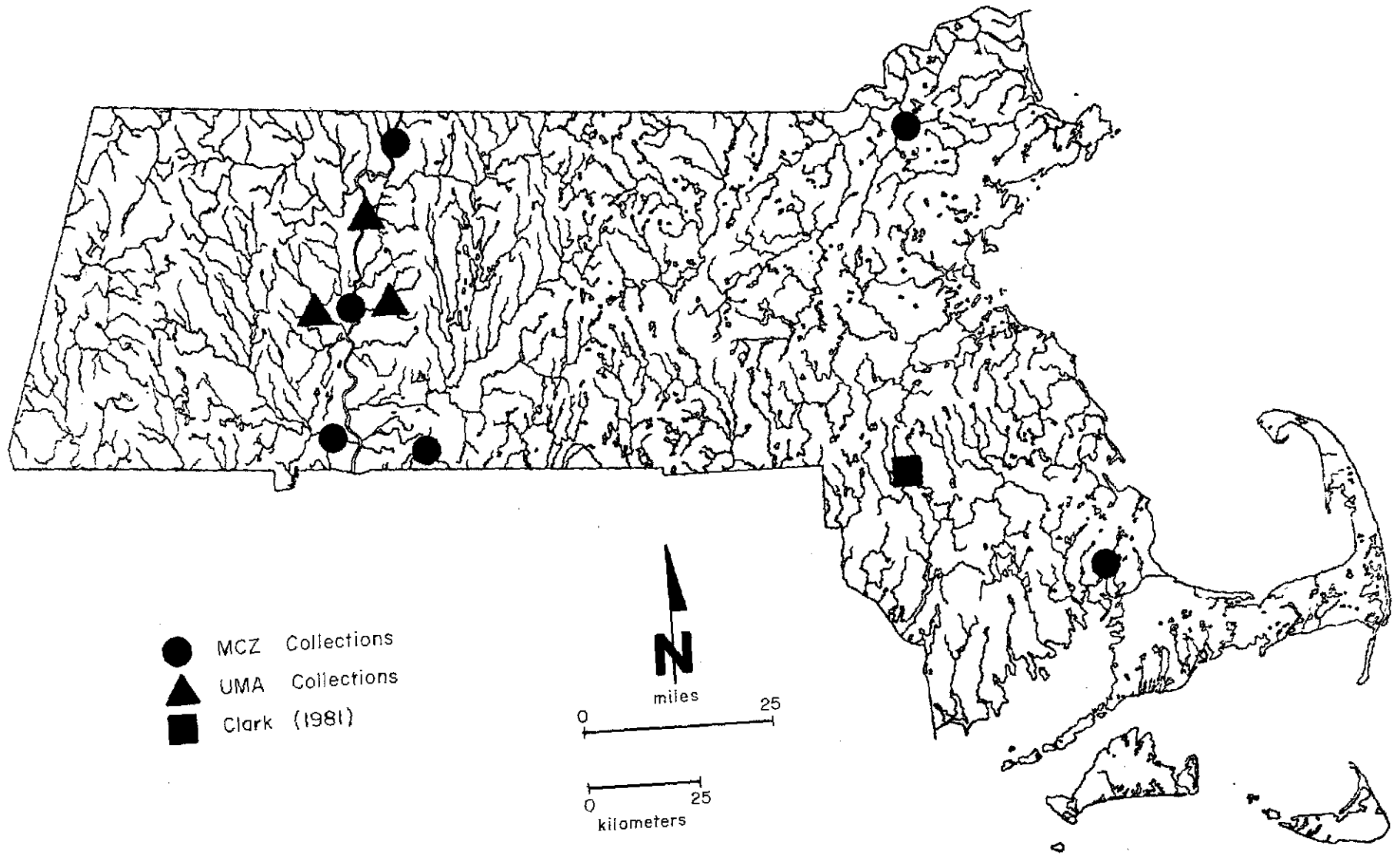
No protection, either on a state or federal level, is presently observed. As with the leech, M. sestertia, C. pseudogracilis Population B is, as presently known, endemic to Massachusetts. Because the form exists as small populations in areas easily affected by sewage or habitat destruction, it is desirable to carefully implement sediment controls at land fill projects and other potentially polluting actions in regions where the populations exist.

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SPECIES DISTRIBUTION MAPS AND FIGURES



Map 1.  
Known distribution of *Alasmidonta heterodon*.

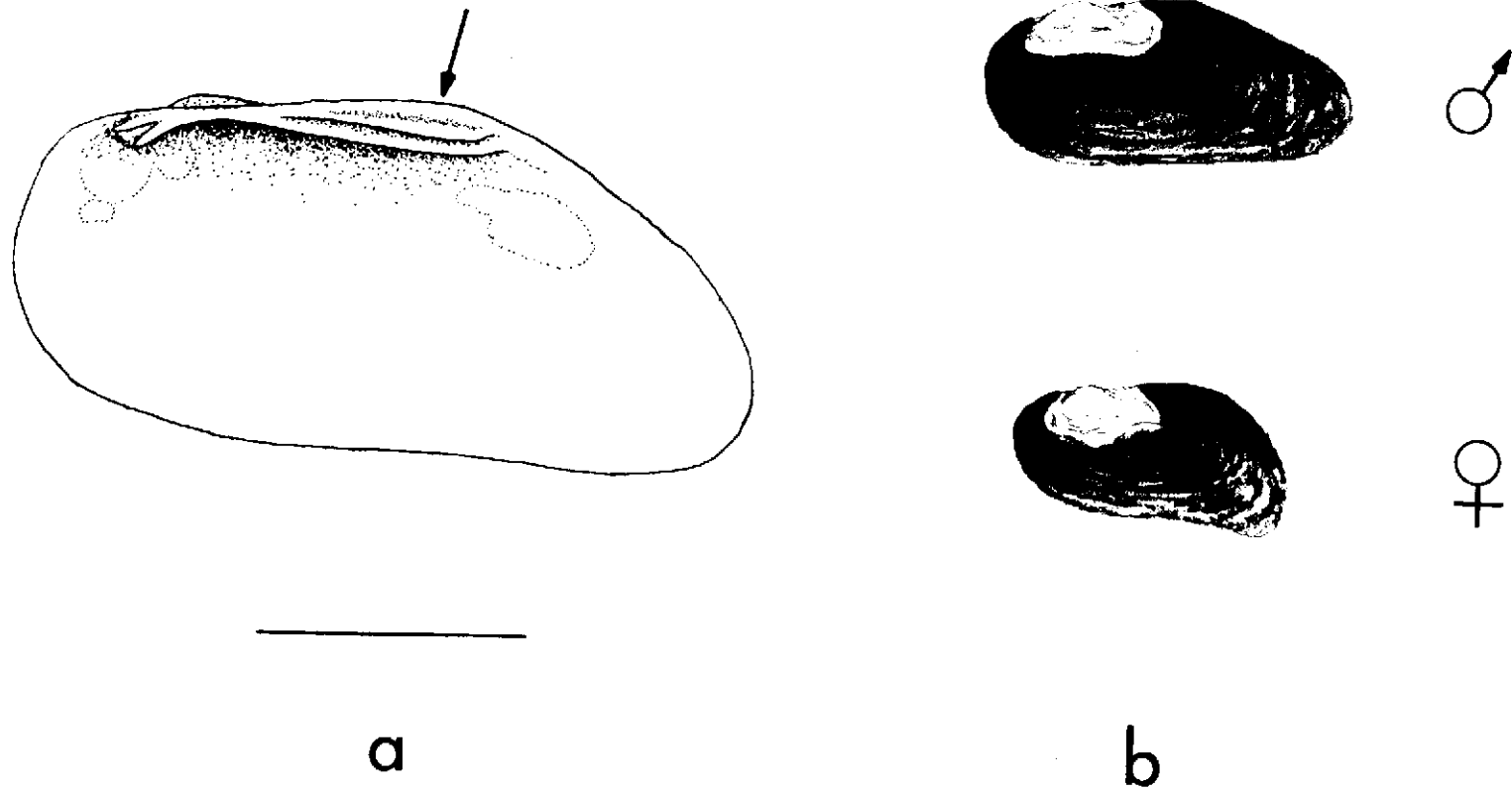
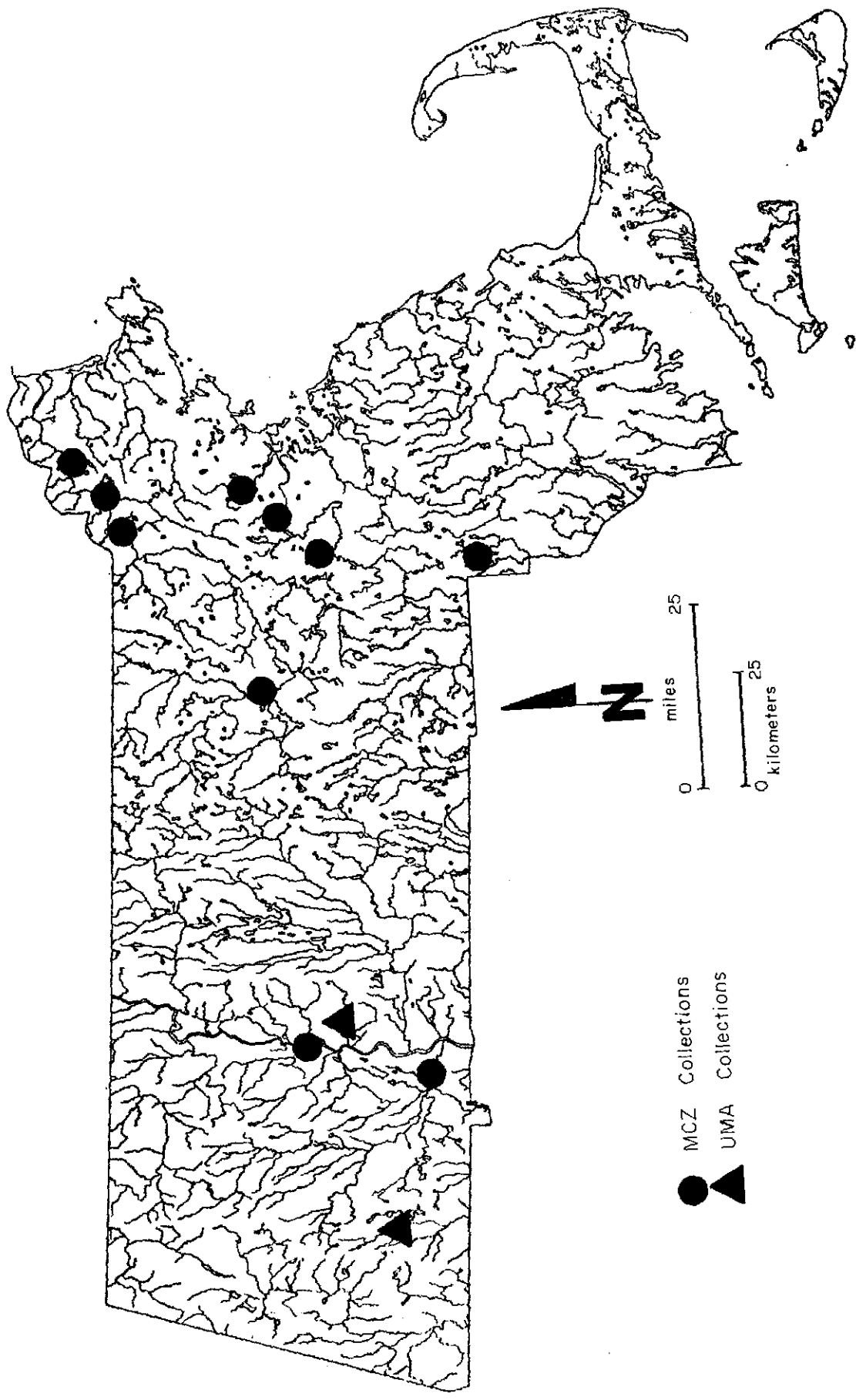


FIGURE 1. *Alasmidonta heterodon* (shell).

a, interior of right valve showing tooth structure, note two lateral teeth (arrow).

b, external views showing sexual differences exhibited by shell. Scale lines indicate 15 mm.



MAP 2. Known distribution of *Alasmidonta varicosa*.

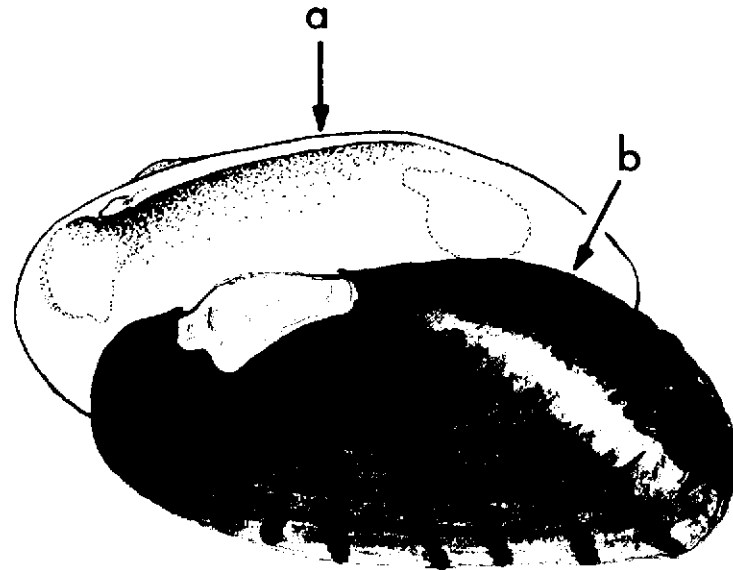
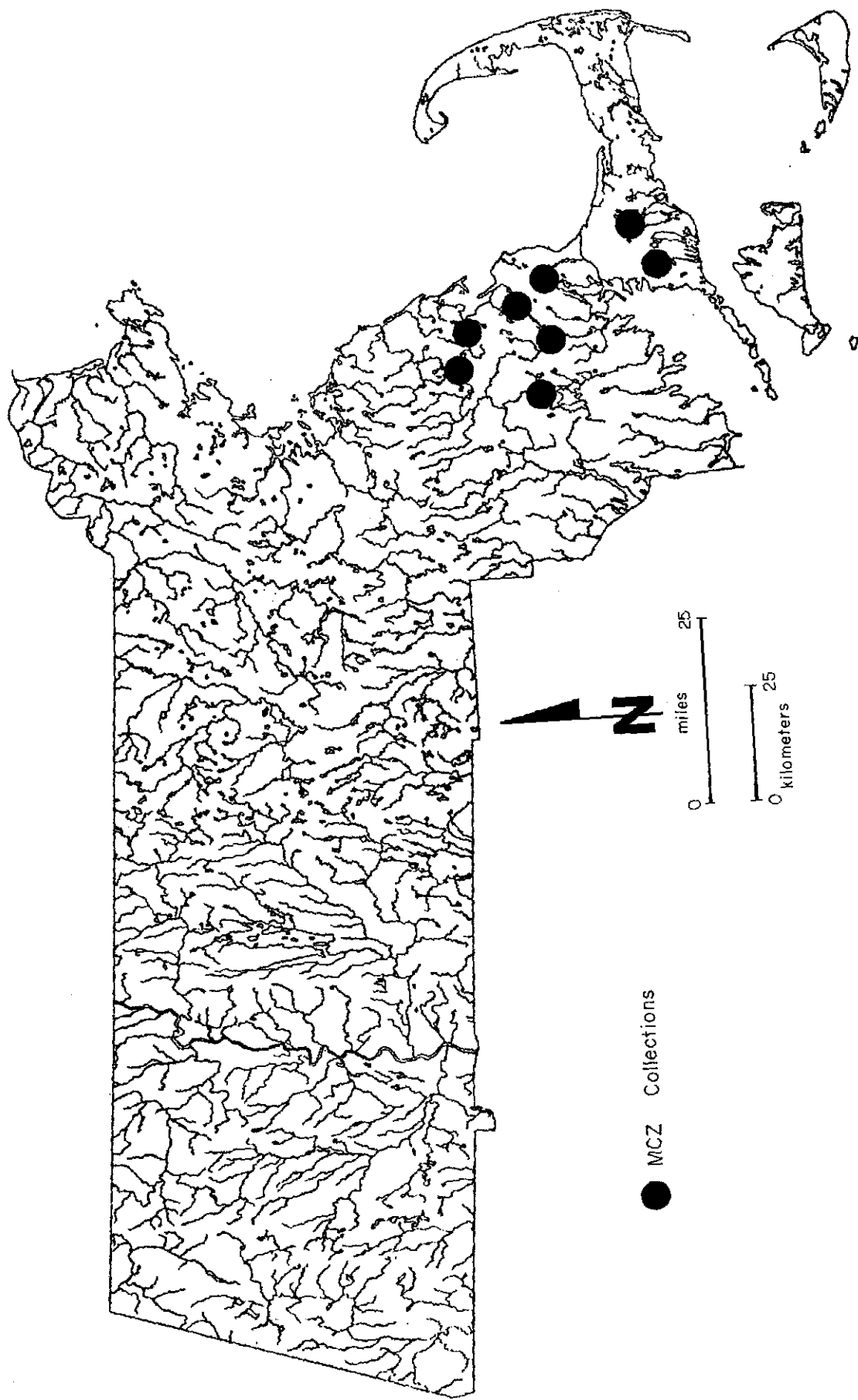


FIGURE 2. *Alasmidonta varicosa* (shell).

Note lack of lateral teeth (arrow a) and presence of "corrugated" posterior ridge on shell (arrow b). Scale indicates 20 mm.



MAP 3. Known distribution of "*Leptodea*" *ochracea*.

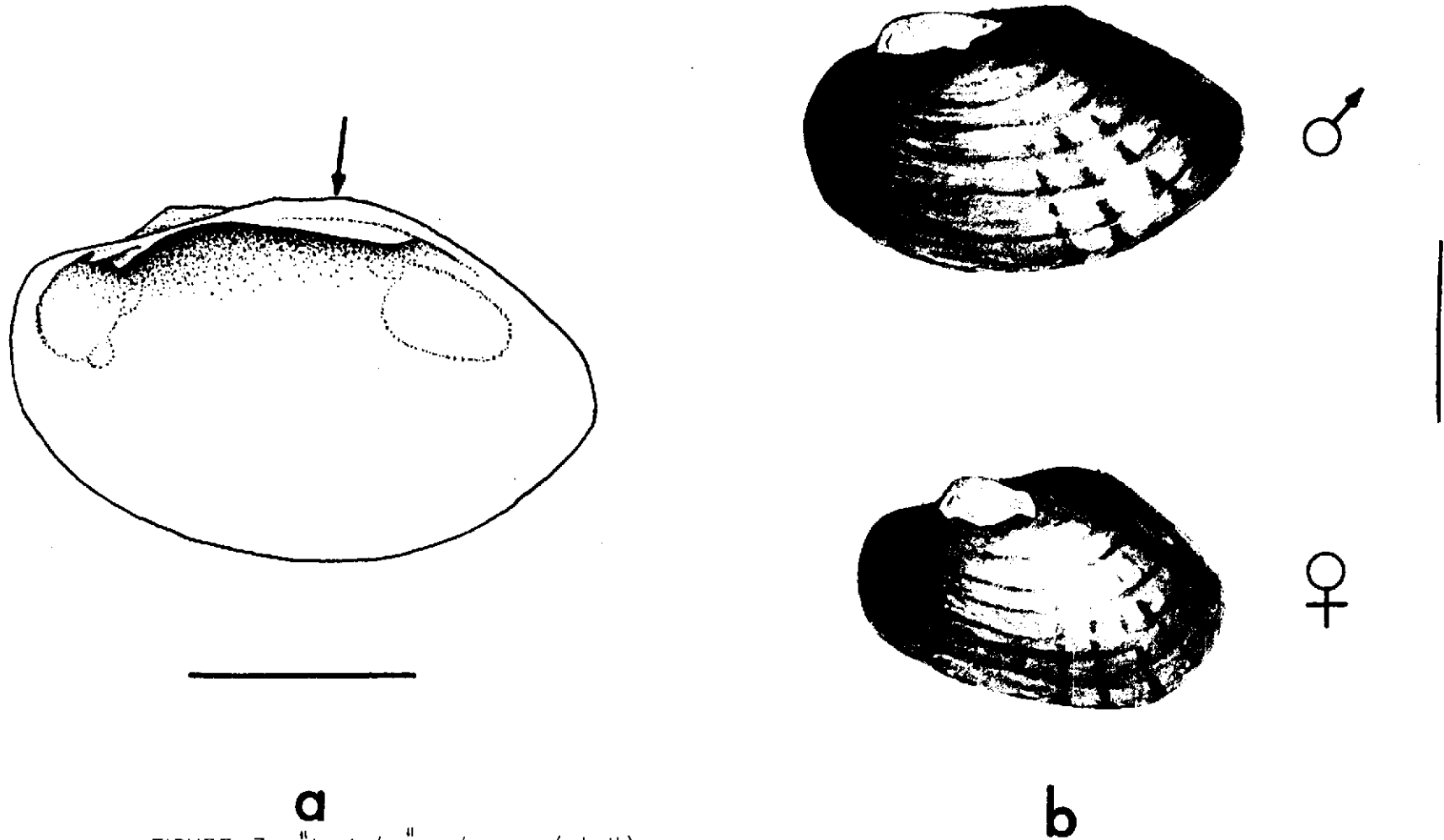
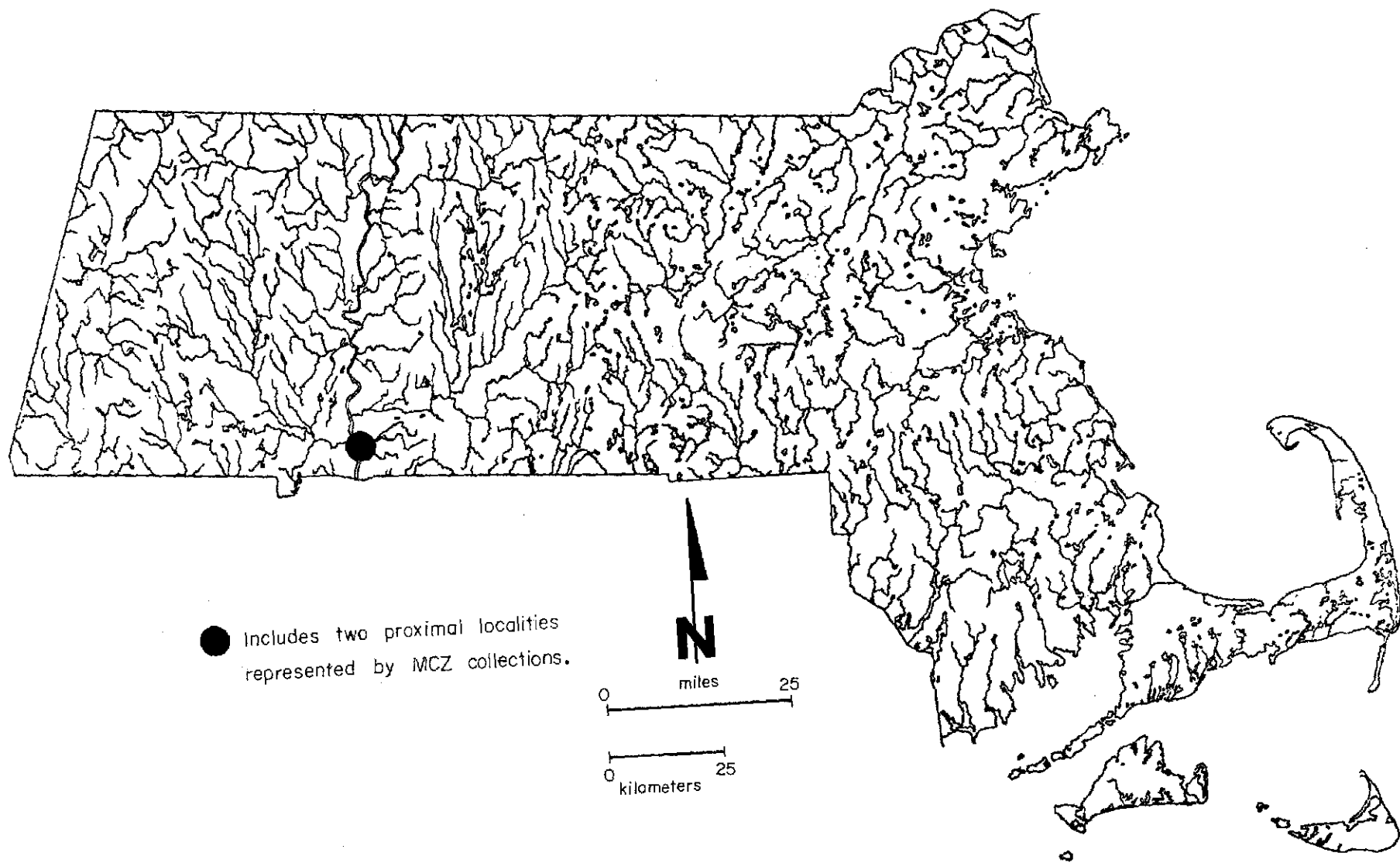


FIGURE 3. "*Leptodea*" *orchracea* (shell).

- a, Interior of right valve showing tooth structure, note single lateral tooth (arrow). Scale indicates 20 mm;  
 b, External views showing sexual differences exhibited by shell. Scale indicates 20 mm.



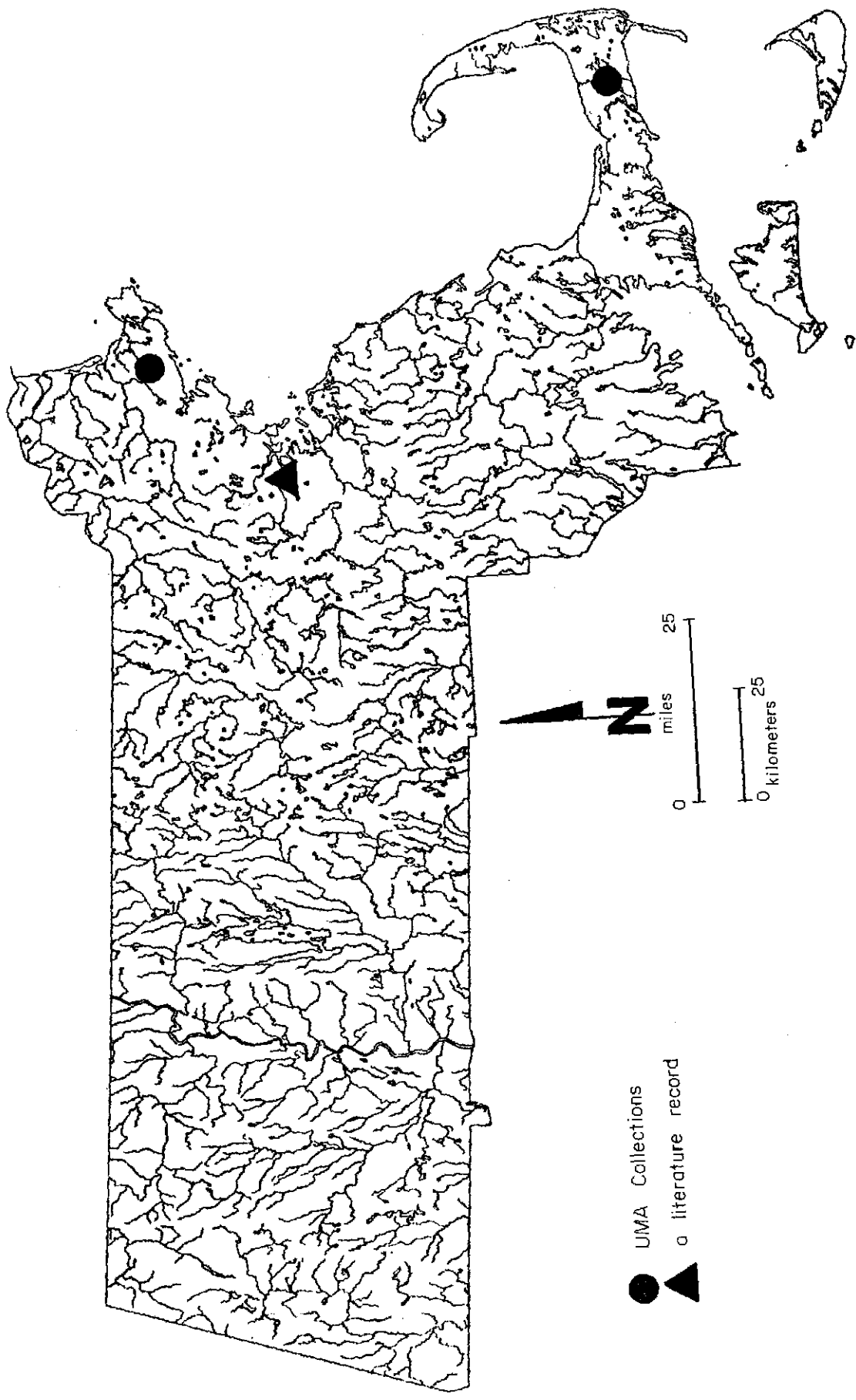
MAP 4. Known distribution of *Goniobasis virginica*.



FIGURE 4. *Goniobasis virginica*.

Left specimen is common smooth form,

right specimen is the infrequently found sculptured form. Scale indicates 10 mm.

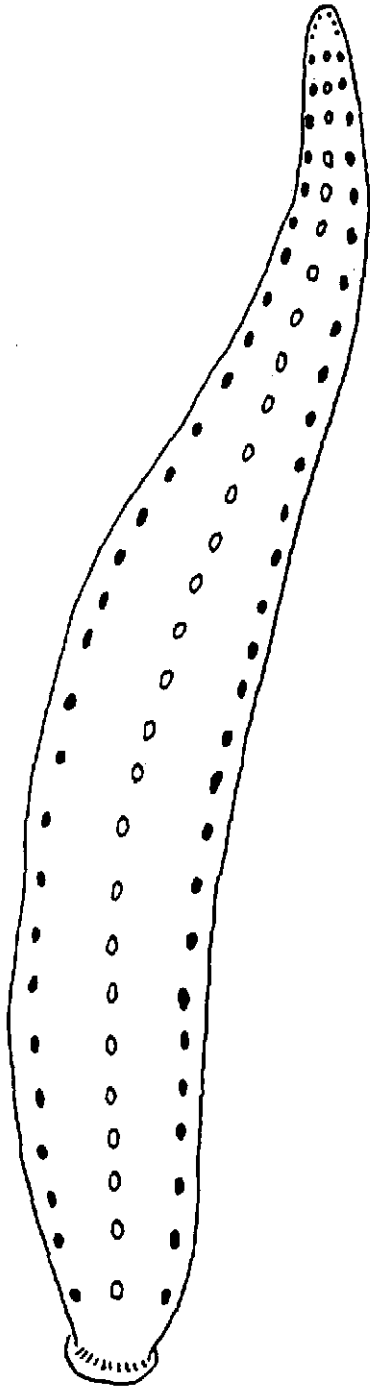


MAP 5. Known distribution of *Macrobdella sesteria*.

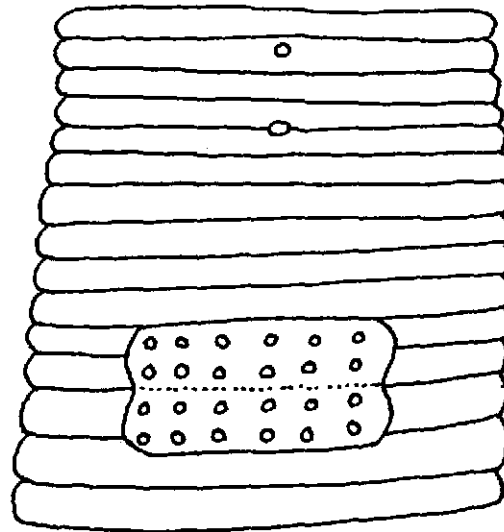
FIGURE 5. *Macrobdella sestertia*

a, ventral view of reproductive region showing 24 copulatory pores posterior to (below) male and female openings. Scale indicates 10 mm.

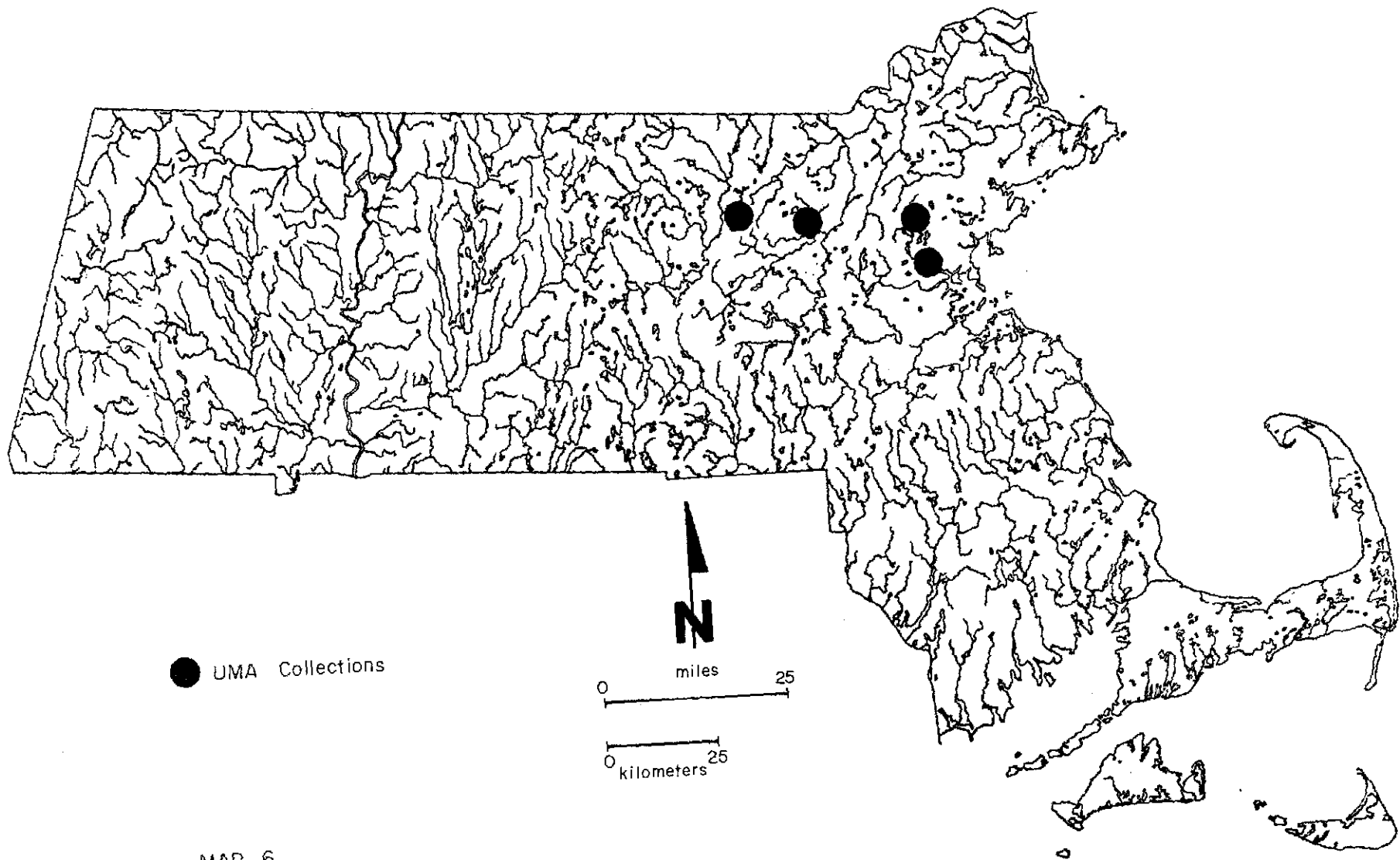
b, dorsal view of whole animal showing pattern of pigment spots. Scale indicates 20 mm.



b



a



MAP 6.  
Known distribution of *Crangonyx pseudogracilis* pop. B.  
Reading (UMA AR. 960) and Stoneham (UMA AR. 961) combined.

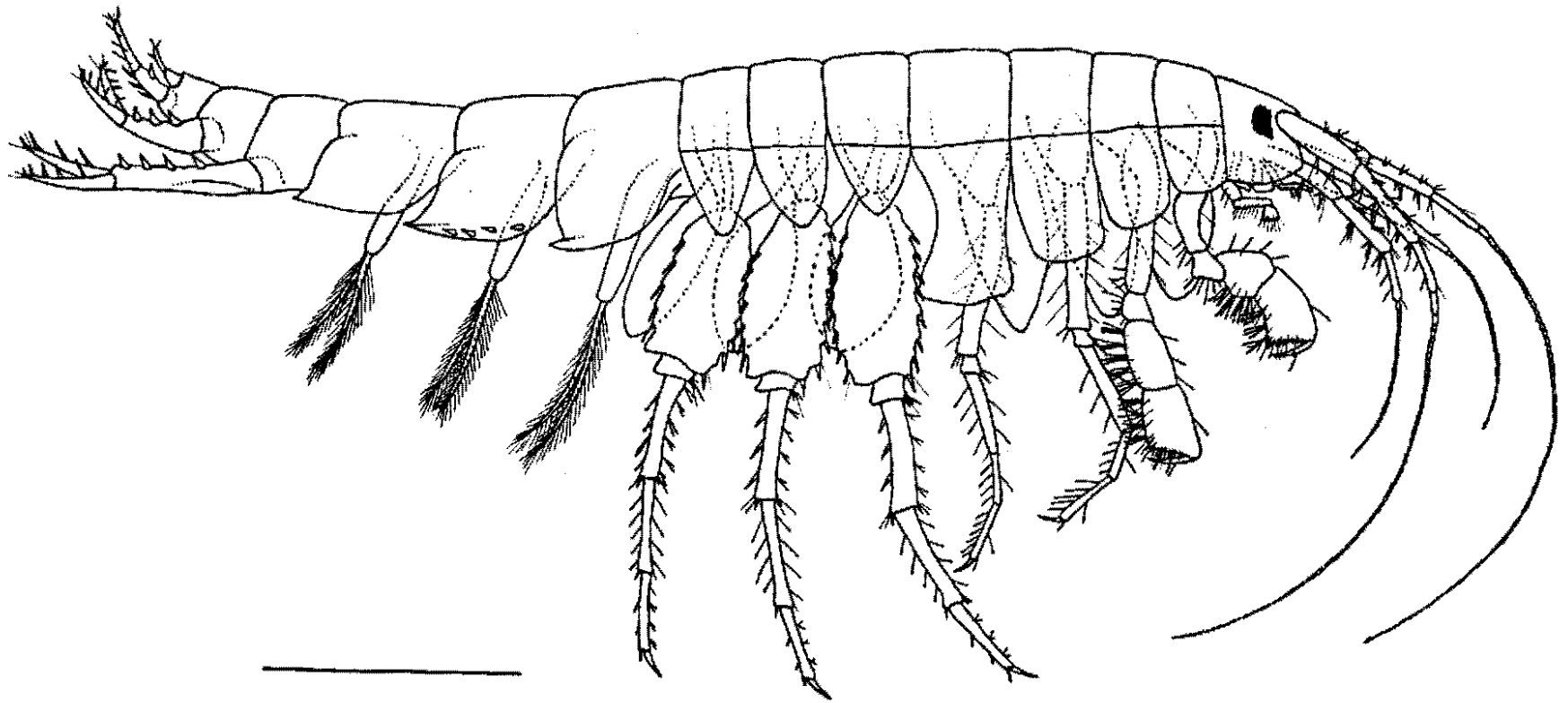


FIGURE 6. *Crangonyx pseudogracllis* pop. B. An adult female. Scale indicates 2 mm.