

17 Freshwater Mollusca

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Mollusks, snails (class Gastropoda) and clams (class Bivalvia), are well represented in freshwater habitats throughout the northeastern United States. The molluscan fauna of this region contains about 135 species distributed among 13 families. The fauna can be divided into five groups: the prosobranch and pulmonate snails and the corbiculid, sphaeriid, and unionacean clams.

Gastropoda

The prosobranchs are gill-breathing snails derived from marine ancestors. Because prosobranchs depend on oxygen dissolved in the water for respiration, they are intolerant of sites where dissolved oxygen is scarce, such as sites of organic pollution. They also are absent from temporary waters. Some prosobranchs are long-lived, with life spans of three to five years. Although most prosobranch species have separate sexes and lay eggs, there are some conspicuous exceptions to this pattern. Members of the family Valvatidae are hermaphrodites, and members of the family Viviparidae (the "mystery snails") are ovoviviparous, including one common species, *Campeloma decisum*, that is parthenogenetic.

Pulmonate snails are descended from terrestrial snails, so they have lungs and breathe air. Although this feature frees them from a dependence on oxygen dissolved in the water (some pulmonates inhabit grossly polluted sites), most pulmonates must come to the water's surface to breathe. A few pulmonates have developed some kind of secondary "gills," which enable them to remain submerged indefinitely. The limpets (family Ancyliidae) have an external *pseudobranch* that functions as a gill, and in some of the Lymnaeidae, the highly vascularized mantle cavity can be filled with water and used as a gill. Many pulmonates are short-lived and are able to complete their life cycles in a year or less. All of the freshwater pulmonates in the northeastern

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Key to Species of Freshwater Bivalvia

- 1a. Shell always < 50 mm long and almost always < 20 mm long; hinge teeth consist of a set of cardinal teeth near the beaks, flanked on *both* sides by lateral teeth (Fig. 75); interior of shell usually dull bluish grey Superfamily SPHAERACEA 2
- 1b. Shell often > 50 mm long; hinge teeth consist of a set of pseudocardinal teeth near the beaks, flanked on *one* side by lateral teeth (Fig. 76), either or both of these sets of teeth may be vestigial or lacking; interior of shell usually a lustrous white, purple, orange, or pink Superfamily UNIONACEA 5

- 2a (1a). SPHAERACEA: Lateral teeth serrated (Fig. 77); exterior of shell with coarse growth lines (Fig. 78); shell often > 20 mm long; an introduced species that has just recently reached the northeastern United States **Corbiculidae**, *Corbicula fluminea*
- 2b. Lateral teeth smooth; growth lines usually not especially coarse; shell never > 20 mm long; very common and widespread **Sphaeriidae** 3

- 3a (2b). **Sphaeriidae**: Beaks posterior to center of shell, usually obviously so (Fig. 79); shell small (< 12 mm long) *Pisidium*
- 3b. Beaks near center of shell or slightly anterior; shell up to 20 mm long 4

- 4a (3b). Beaks "capped" (separated from the remainder of the shell by a distinct suture) (Fig. 80); shell often yellowish and translucent *Musculium*
- 4b. Beaks not capped (Fig. 81); shell usually brown or gray *Sphaerium*

- 5a (1b). UNIONACEA: Shell with obvious pustules (Figs. 83, 84) or ridges (Fig. 82); species of central and western New York **Unionidae** (in part) 6
- 5b. Shell smooth or a little rough, but without distinct pustules or ridges; widespread 9

- 6a (5a). **Unionidae** (in part): Nacre purple *Cyclonaias tuberculata*
- 6b. Nacre white 7

- 7a (6b). Shell with ridges (Fig. 82) *Amblema plicata*
- 7b. Shell with pustules (Figs. 83, 84) *Quadrula* 8

- 8a (7b). Shell with prominent median sulcus, giving the shell a squarish shape (Fig. 83) *Q. quadrula*
- 8b. Shell evenly rounded, usually with a broad green color ray on beaks (Fig. 84) *Q. pustulosa*

- 9a (5b). Obvious hinge teeth absent **Unionidae** (in part) 10
- 9b. Obvious hinge teeth present 15

- 10a (9a). **Unionidae** (in part): Beaks not projecting above the hinge line (Fig. 85); a species of western and central New York *Anodonta imbecilis*



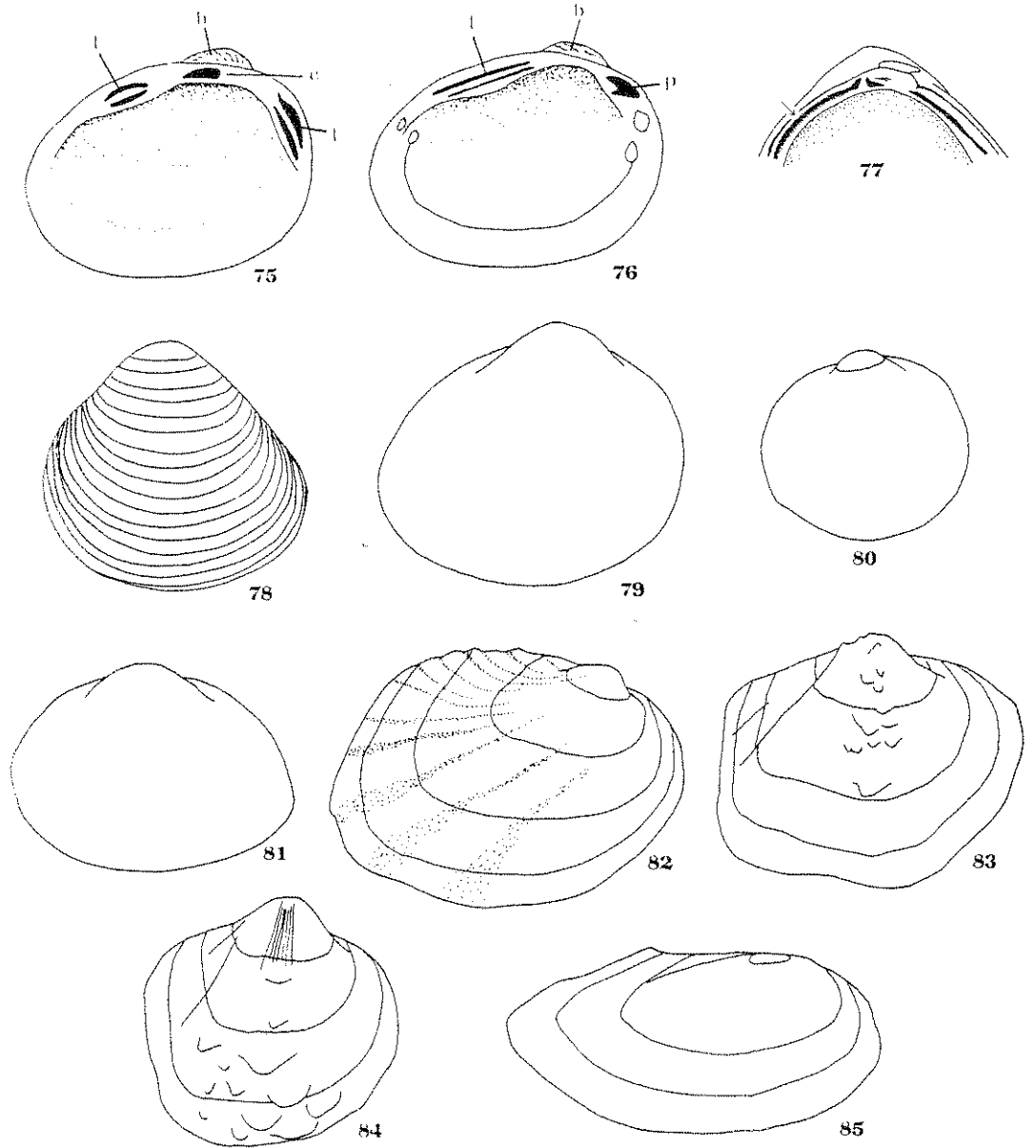
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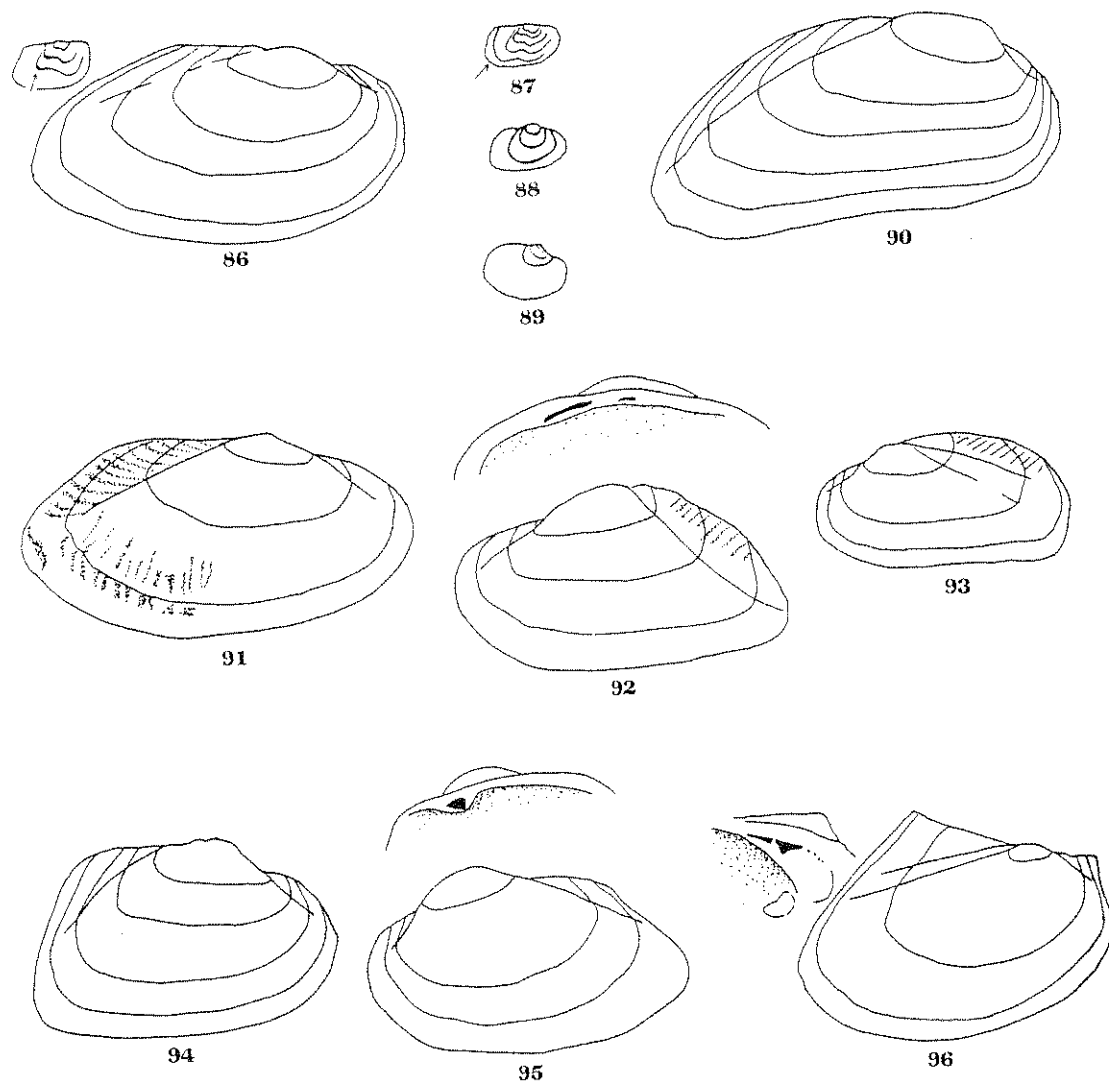


11. *Promenetus aulus deflectus*
Myraulus parvus
 aridae), w. 67.
Myraulus subglobosa
), lv. 70. Lateral
 Physidae), lv. p.
), lv. 73. Perial
 Physidae), lv. lv.
 ch 1982; 63-65
 drawn from Te



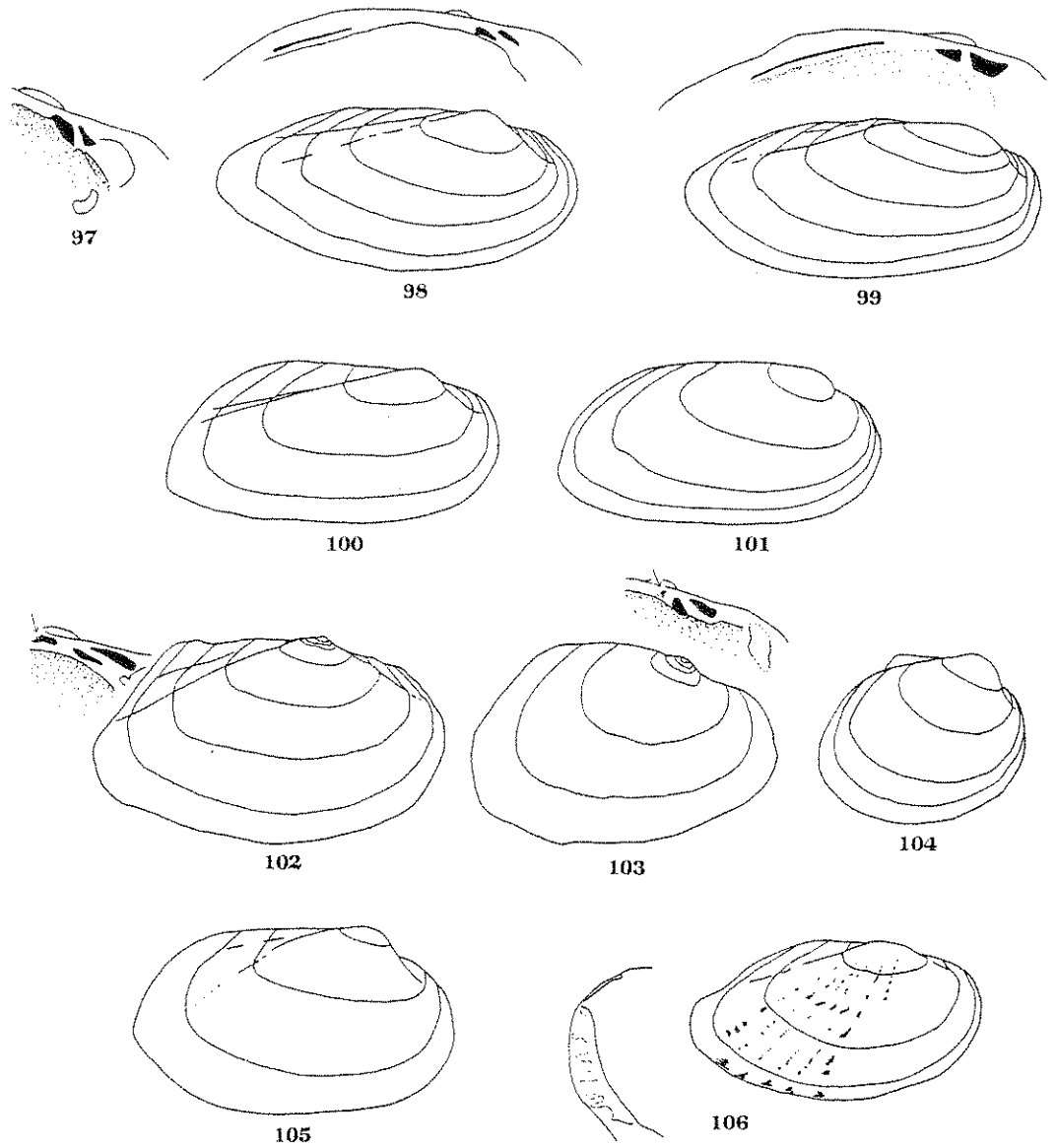
75. Interior of a sphaeriid shell: b, beak; c, cardinal teeth; l, lateral teeth. 76. Interior of a unionid shell: b, beak; l, lateral teeth; p, pseudocardinal teeth. 77. *Corbicula fluminea* (Corbiculidae), with detail of hinge teeth, lv. 78. *Corbicula fluminea* (Corbiculidae), lv. 79. *Pisidium* (Sphaeriidae), lv. 80. *Musculium* (Sphaeriidae), lv. 81. *Sphaerium* (Sphaeriidae), lv. 82. *Amblema plicata* (Unionidae), lv. 83. *Quadrula quadrula* (Unionidae), lv. 84. *Quadrula pustulosa* (Unionidae), lv. 85. *Anodonta imbecilis* (Unionidae), lv. lv, lateral view, (77-81 modified from Burch 1975a; 82-85 modified from Burch 1975b.)

- 10b. Beaks projecting above hinge line (Fig. 86); widespread 11
- 11a (10b). Beak sculpture double-looped (seagull-shaped) (Figs. 86, 87)
 *Anodonta* (in part) 12
- 11b. Beak sculpture concentric (Figs. 88, 89) 14
- 12a (11a). Nacre salmon or copper-colored; shell thick; in or near tidewaters
 *A. implicata*
- 12b. Nacre bluish or white; widespread 13
- 13a (12b). Beak sculpture nodulous (Fig. 86); periostracum usually brown or yellowish;
 common in the Allegheny, Lake Erie, Lake Champlain, Lake Ontario, and
 parts of the Hudson basins, rare or absent elsewhere in the northeastern
 United States *A. grandis*
- 13b. Beak sculpture not nodulous (Fig. 87); periostracum usually greenish; absent
 from the Allegheny and Lake Erie basins, but common and widespread else-
 where in the northeastern United States *A. cataracta*
A. grandis and *A. cataracta* are difficult to distinguish and have been
 shown by Kat (1983a) to hybridize in our area.
- 14a (11b). Beak sculpture coarse (Fig. 88); nacre usually orange in the beak cavity;
 pseudocardinal teeth usually represented by a faint thickening of the nacre
 near the beaks *Strophitus undulatus*
- 14b. Beak sculpture fine (Fig. 89); nacre usually bluish white; pseudocardinal
 teeth absent *Anodontoides ferussacianus*
- 15a (9b). Lateral teeth well developed, functional and interlocking
 **Unionidae** (in part) 22
- 15b. Lateral teeth absent or reduced, not functional and not interlocking 16
- 16a (15b). Shell elongate (H/L ca. 0.50) and often arched (Fig. 90); periostracum without
 color rays; lateral teeth entirely or almost entirely absent 17
- 16b. Shell shape variable (H/L = 0.48–0.70); periostracum usually with numerous
 fine color rays; vestigial lateral teeth present **Unionidae** (in part) 18
- 17a (16a). Shell large (adults > 75 mm long); periostracum blackish; scattered in cool,
 softwater streams from Oneida Lake northeast (Fig. 90)
 **Margaritiferidae**, *Margaritifera margaritifera*
- 17b. Shell small (adults < 60 mm long); periostracum grey to brown; a very rare
 species formerly found in the northeastern United States near Buffalo, N.Y.
 **Unionidae** (in part), *Simpsoniconcha ambigua*
- 18a (16b). **Unionidae** (in part): Transverse ridges on the posterior slope prominent (Fig.
 91); shell compressed (W/H < 0.6) *Lasmigona costata*
- 18b. Transverse ridges on the posterior slope absent or fine; shell inflated (W/H
 usually > 0.6) *Alasmidonta* (in part) 19



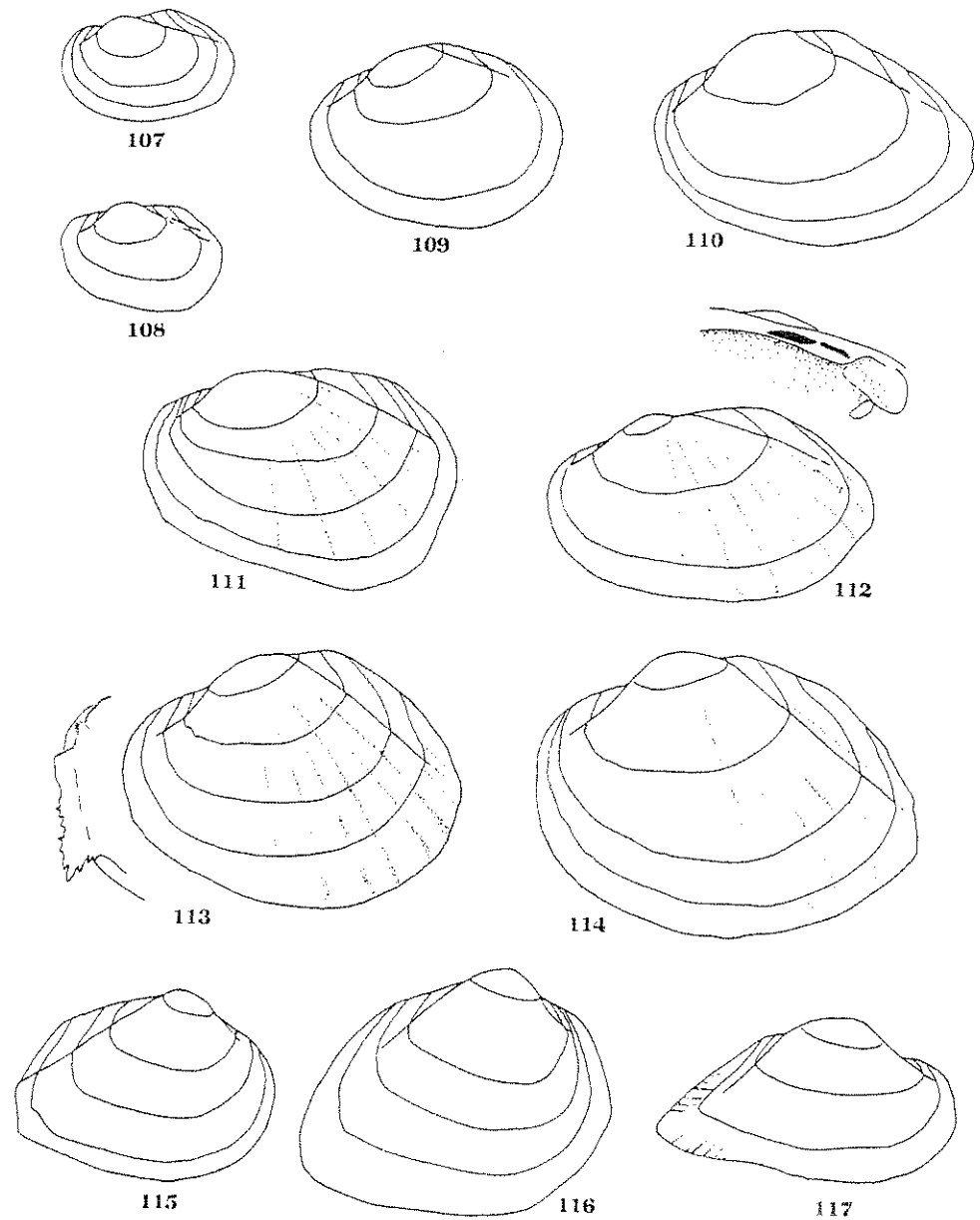
86. *Anodonta grandis* (Unionidae) and beak sculpture, lv. 87. Beak sculpture of *Anodonta cataracta* (Unionidae), lv. 88. Beak sculpture of *Strophitus undulatus* (Unionidae), lv. 89. Beak sculpture of *Anodontoides ferussacianus* (Unionidae), lv. 90. *Margaritifera margaritifera* (Margaritiferidae), lv. 91. *Lasmigona costata* (Unionidae), lv. 92. *Alasmidonta marginata* (Unionidae), and hinge, lv. 93. *Alasmidonta varicosa* (Unionidae), lv. 94. *Alasmidonta viridis* (Unionidae), lv. 95. *Alasmidonta undulata* (Unionidae) and hinge, lv. 96. *Leptodea fragilis* (Unionidae) and hinge, lv. lv, lateral view. (86 [lower], 90, 91, 94, 96 modified from Burch 1975b; 86 [upper], 87–89 modified from Clarke and Berg 1959; 92 [lower], 93 modified from Ortmann 1919; 92 [upper], 95 modified from Clarke 1981b.)

- 19a (18b). Fine transverse ridges present on the posterior slope (Figs. 92, 93); pseudocardinal teeth reduced and elongate, with smooth surfaces (Fig. 92) 20
- 19b. Transverse ridges on posterior slope absent (Figs. 94, 95); pseudocardinal teeth strong and triangular, with rough surfaces (Fig. 95) 21
- 20a (19a). Posterior ridge angular and prominent; shell truncate and small to large (Fig. 92); found in scattered sites east to Albany, N.Y. *A. marginata*
- 20b. Posterior ridge rounded; shell rounded and usually < 70 mm long (Fig. 93); found in streams of the Atlantic drainage *A. varicosa*
- 21a (19b). Shell < 50 mm long; subrhomboid (Fig. 94); uncommon and found in the northeastern United States only in western and central New York ... *A. viridis*
- 21b. Shell small to large; triangular to ovate (Fig. 95); widespread and common in the northeastern United States except in western New York *A. undulata*
- 22a (15a). **Unionidae** (in part): Right valve with two lateral teeth; rare *Alasmidonta heterodon*
- 22b. Right valve with one lateral tooth; common 23
- 23a (22b). Shell compressed, with prominent dorsal wing (Fig. 96) ("heel-splitters"); species of larger lakes and rivers, northeast to Lake Champlain 24
- 23b. Shell without dorsal wing 25
- 24a (23a). Pseudocardinal teeth reduced, thin, and bladelike (Fig. 96); nacre white to pink or purple *Leptodea* 52
- 24b. Pseudocardinal teeth strong and triangular (Fig. 97); nacre purple or pink ... *Proptera alata*
- 25a (23b). $H/L \leq 0.48$ *Ligumia* 26
- 25b. $H/L > 0.48$ 27
- 26a (25a). Posterior ridge prominent; posterior end of shell subangular; pseudocardinal teeth elongate (Fig. 98); shell usually < 110 mm long *L. nasuta*
- 26b. Posterior ridge not prominent; posterior end of shell rounded; pseudocardinal teeth triangular (Fig. 99); shell often > 110 mm long *L. recta*
- 27a (25b). Nacre purple *Elliptio* (in part) 28
- 27b. Nacre white or colored, but not purple 29
- 28a (27a, 39b). Shell subrhomboid with well-defined posterior ridge and slope (Fig. 100); very common and widespread in the northeastern United States, but absent from western New York *E. complanata*
- 28b. Shell subelliptical with posterior ridge rounded and following the hinge line so that the posterior slope is small and poorly defined (Fig. 101); common in western New York, but rare elsewhere in the northeastern United States *E. dilatata*



97. Hinge of *Proptera alata* (Unionidae), lv. 98. *Ligumia nasuta* (Unionidae) and hinge, lv. 99. *Ligumia recta* (Unionidae) and hinge, lv. 100. *Elliptio complanata* (Unionidae), lv. 101. *Elliptio dilatata* (Unionidae), lv. 102. *Lasmigona compressa* (Unionidae) and hinge, lv. 103. *Lasmigona subviridis* (Unionidae) and hinge, lv. 104. *Obovaria olivaria* (Unionidae), lv. 105. *Carunculina parva* (Unionidae), lv. 106. *Villosa iris* (Unionidae) and mantle edge, lv. lv, lateral view. (97-106 modified from Burch 1975b.)

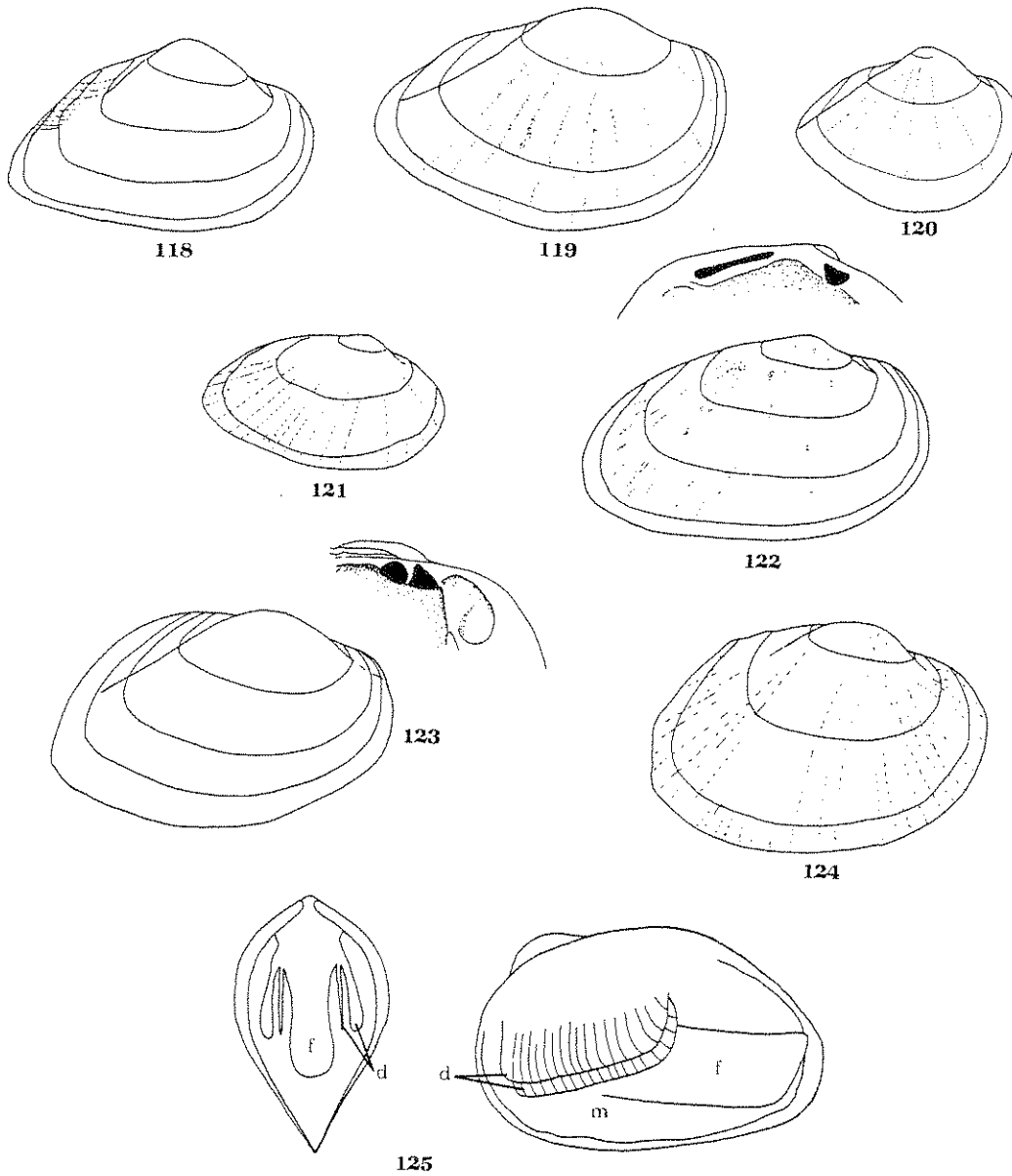
- 29a (27b). With interdental tooth, so that the left valve appears to have 3 pseudocardinal teeth (Figs. 102, 103); shell more or less compressed and subrhomboid; periostracum dark green with numerous color rays, or brown *Lasmigona* (in part) 30
- 29b. No interdental tooth, so that the left valve appears to have 2 pseudocardinal teeth 31
- 30a (29a). Adult shell usually > 70 mm long; interdental tooth prominent (Fig. 102); widespread east to Lake Champlain and the Hudson River basin *L. compressa*
- 30b. Adult shell < 65 mm long; interdental tooth small (Fig. 103); from sites in the Atlantic drainage and along the Erie Canal west to Syracuse, N.Y. *L. subviridus*
- 31a (29b). Shell ovate to elliptical with beaks very near the anterior end (distance from beaks to anterior end less than 1/5 of the shell length) (Fig. 104); shell with color rays; only parts of outer demibranchs swollen in gravid females (see Fig. 125); hinge teeth massive; a rare species of the St. Lawrence and Niagara rivers *Obovaria olivaria*
- 31b. Not with the above combination of characters; common and widespread 32
- 32a (31b). Adult shell small (< 35 mm long); periostracum green to black without color rays (Fig. 105); a species of western New York *Carunculina parva*
- 32b. Not with the above combination of characters; widespread 33
- 33a (32b). Collected from western New York (Allegheny River, Lake Erie, and Niagara River basins) 40
- 33b. Collected from other drainage systems 34
- 34a (33b). Outer 2 demibranchs swollen in gravid females (see Fig. 125); periostracum usually smooth and glossy, yellow or green, often with color rays 35
- 34b. All 4 demibranchs swollen in gravid females (see Fig. 125); periostracum not smooth and glossy, usually brown, color rays usually absent, but if present they are fine 39
- 35a (34a). Adult shell small (< 75 mm long) and delicate; shell subelliptical; yellow-green with broad color rays; nacre white, often with an iridescent sheen; posterior mantle margins with fingerlike projections (Fig. 106); St. Lawrence basin *Villosa iris*
- 35b. Adult shell often > 75 mm long and not delicate; shell subovate (Figs. 107-114); nacre white, bluish, or pink; posterior mantle margins without fingerlike projections; widespread *Lampsilis* (in part) 36
- 36a (35b). Shell small (usually < 80 mm long) and thin, hardly thicker anteriorly than posteriorly; periostracum dull yellow without rays or with fine rays all over the shell (Figs. 107, 108); in or near tidewaters *L. ochracea*



107. *Lampsilis ochracea* (male) (Unionidae), lv. 108. *Lampsilis ochracea* (female) (Unionidae), lv. 109. *Lampsilis cariosa* (female) (Unionidae), lv. 110. *Lampsilis cariosa* (male) (Unionidae), lv. 111. *Lampsilis radiata* (female) (Unionidae), lv. 112. *Lampsilis radiata* (male) (Unionidae) and hinge, lv. 113. *Lampsilis ovata* (female) (Unionidae) and mantle, lv. 114. *Lampsilis ovata* (male) (Unionidae), lv. 115. *Fusconaia flava* (Unionidae), lv. 116. *Pleurobema cordatum* (Unionidae), lv. 117. *Dvsnomia triquetra* (female) (Unionidae), lv. lv, lateral view. (107-111, 112 [lower], 113 [right], 114 modified from Ortmann 1919; 112 [upper], 113 [left], 115-117 modified from Burch 1975b.)

- 36b. Shell often > 80 mm long, much thicker anteriorly than posteriorly; may have obvious broad color rays; widely distributed 37
- 37a (36b). Shell without color rays (Figs. 109, 110), or with color rays only on the posterior slope *L. cariosa*
- 37b. Shell with color rays all over the shell (although they may be obscure in old specimens) 38
- 38a (37b). H/L < 0.60 in males and in most females; posterior ridge low and rounded; beaks not prominent (Figs. 111, 112); common and widespread *L. radiata* group
L. siliquoides is a species or subspecies closely allied to and difficult to distinguish from *L. radiata*. See Clarke and Berg 1959 and Kat 1986 for notes on the distribution, identification, and taxonomic status of these two taxa.
- 38b. H/L > 0.60 in both sexes; posterior ridge usually well developed; beaks often prominent (Figs. 113, 114); western New York, the Lake Champlain and St. Lawrence River basins, and rarely in the Lake Ontario and Hudson River basins *L. ovata*
- 39a (34b). Shell subtriangular (H/L > 0.70) (Fig. 115) and thick, with massive hinge teeth; western New York *Fusconaia flava*
- 39b. H/L < 0.70, shell subrhomboid to subelliptical (Figs. 100, 101) and not especially thick; widespread and common *Elliptio* (in part) 28
- 40a (33a). Periostracum usually dull, brown, and without color rays (rarely, dark green with many fine color rays); entire outer demibranchs swollen in gravid females (see Fig. 125); inner demibranchs may be swollen as well 41
- 40b. Periostracum often shiny, usually yellow or light green, usually with obvious green color rays; only parts of outer demibranchs swollen in gravid females (see Fig. 125) 43
- 41a (40a). Shell elongate (H/L < 0.60) *Elliptio dilatata*
- 41b. Shell short and high (H/L > 0.60) 42
- 42a (41b). All 4 demibranchs swollen in gravid females (see Fig. 125); shell subtriangular to subquadrate, usually flattened or with a slight median sulcus and posterior slope often sharply set off; beaks relatively central (distance from beaks to anterior margin of shell usually 1/5-2/5 of shell length) (Fig. 115) *Fusconaia flava*
- 42b. Outer 2 demibranchs swollen in gravid females (see Fig. 125); shell subtriangular to subovate, usually rounded and posterior slope not sharply set off; beaks relatively anterior (distance from beaks to anterior margin of shell usually 1/20-1/4 of shell length) (Fig. 116) *Pleurobema cordatum*
 It is difficult for a novice to distinguish the shell of *F. flava* from that of *P. cordatum*; gravid females should be examined for a positive identification.

- 43a (40b). Shell small (usually < 60 mm long); usually subtriangular with a prominent and sometimes angular posterior ridge (Figs. 117–120); rare species of Lake Erie and large streams 44
- 43b. Shell small to large; subovate, subelliptical, or subrhomboid (Figs. 111–114); posterior ridge rarely prominent and never angular; widespread 46
- 44a (43a). Posterior slope finely corrugated (Figs. 117, 118); posterior ridge of female ending in raised radiating lines (Fig. 117) *Dysnomia triquetra*
- 44b. Posterior slope smooth, not corrugated *Truncilla* 45
- 45a (44b). Shell subtriangular, sharp, straight, posterior ridge extends to the shell margin; posterior slope small and steep (Fig. 120) *T. truncata*
- 45b. Shell subtriangular to subovate; posterior ridge fades out before it reaches the margin of the shell and often is bowed downward; posterior slope well developed (Fig. 119) *T. donaciformis*
- 46a (43b). Adult shell small (< 40 mm long) and thick; lateral teeth short and stout; periostracum usually green or brown with numerous fine color rays (Fig. 121); posterior mantle margins with long fingerlike projections (as in Fig. 106); rare *Villosa fabalis*
- 46b. Not with the above combination of characters 47
- 47a (46b). Shell subrhomboid to subelliptical, compressed ($W/L = 0.18-0.33$); lateral teeth short, stout, and swollen posteriorly (Fig. 122); entire ventral part of demibranch swollen in gravid females *Ptychobranchus fasciolare*
- 47b. Shell subovate to subelliptical (Figs. 111–114), compressed to inflated ($W/L = 0.20-0.50$); lateral teeth not as above; posterior part of outer demibranch swollen in gravid females 48
- 48a (47b). Shell small (< 75 mm), compressed ($W/L < 0.35$); subelliptical and relatively elongate ($H/L < 0.60$) and thin; hinge teeth fine and delicate; posterior mantle margins with fingerlike projections (Fig. 106) *Villosa iris*
- 48b. Shell small to large, compressed to inflated ($W/L = 0.25-0.50$); subovate ($H/L = 0.52-0.80$) and thin to thick; hinge teeth fine to stout; posterior mantle margins without fingerlike projections 49
- 49a (48b). Pseudocardinal teeth large and triangular, with ragged surfaces; shell thick; posterior mantle margins without ribbonlike projections; shell relatively compressed ($W/L = 0.25-0.40$) and elongate ($H/L = 0.54-0.70$) (Fig. 123); in rivers and large creeks *Actinonaias carinata*
- 49b. Pseudocardinal teeth not triangular, but flexed upward and with relatively smooth surfaces (Fig. 112); posterior mantle margins with ribbonlike flaps that may resemble a small fish (Fig. 113); shell various shapes ($W/L = 0.25-0.50$; $H/L = 0.52-0.80$), thin to thick; common and widespread in streams and lakes *Lampsilis* (in part) 50



118. *Dysnomia triquetra* (male) (Unionidae), lv. 119. *Truncilla donaciformis* (Unionidae), lv. 120. *Truncilla truncata* (Unionidae), lv. 121. *Villosa fabalis* (Unionidae), lv. 122. *Ptychobranchus fasciolaris* (Unionidae) and hinge, lv. 123. *Actinonaias carinata* (Unionidae) and hinge, lv. 124. *Lampsilis fasciola* (Unionidae), lv. 125. Diagrammatic sketch of the internal anatomy of unionid in cross section (left) and lateral view (right). The outer demibranchs on the left are swollen and filled with developing glochidia: d, demibranchs; f, foot; m, mantle. lv, lateral view. (118, 119, 121-124 modified from Burch 1975b.)

- 50a (49b). Shell elongate and relatively compressed ($H/L \leq 0.625$ in almost all males and some females; $W/L = 0.25-0.40$); posterior ridge low and rounded; beaks not prominent (Figs. 111, 112) *L. radiata*
 See comments under 38a.
- 50b. Shell relatively short and inflated ($H/L \geq 0.625$ in all males and females; $W/L = 0.30-0.50$); posterior ridge may be well developed; beaks often prominent 51
- 51a (50b). Shell small (< 80 mm), with numerous fine green color rays; beaks not especially prominent (Fig. 124) *L. fasciola*
- 51b. Shell small to large, with color rays usually present, but not especially numerous or fine; beaks and posterior ridge often prominent (Figs. 113, 114) ...
 *L. ovata*
- 52a (24a). Nacre white (sometimes pink in the beak cavity); periostracum smooth but dull *L. fragilis*
- 52b. Nacre pink or purple; periostracum smooth and glossy *L. laevisima*

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