

STERKIANA

NUMBER 12

COLUMBUS, OHIO

DECEMBER, 1963

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FRONTISPIECE. DR. VICTOR STERKI. Pen and ink portrait by William Bruden, Museum of Zoology, University of Michigan. Drawn from a photograph reproduced in Annals of the Carnegie Museum, vol. XXII, No. 1, March 6, 1934.

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STERKIANA is named after Dr. Victor Sterki (1846-1933) of New Philadelphia, Ohio, famed for his work on the Sphaeriidae, Pupillidae, and Valloniidae. It is fitting that this serial should bear his name both because of his association with the Midwest and his lifelong interest in non-marine Mollusca.

The purpose of STERKIANA is to serve malacologists and paleontologists interested in the living and fossil non-marine Mollusca of North and South America by disseminating information in that special field. Since its resources are modest, STERKIANA is not printed by conventional means. Costs are kept at a minimum by utilizing various talents and services available to the Editor. Subscription and reprint prices are based on cost of paper and mailing charges.

STERKIANA accepts articles dealing with non-marine Mollusca of the Americas in English, French, or Spanish, the three official languages of North America. Contributors are requested to avoid descriptions of new species or higher taxa in this serial as the limited distribution of STERKIANA would probably prevent recognition of such taxa as validly published. Papers on distribution, ecology, and revised checklists for particular areas or formations are especially welcome but those on any aspect of non-marine Mollusca will be considered.

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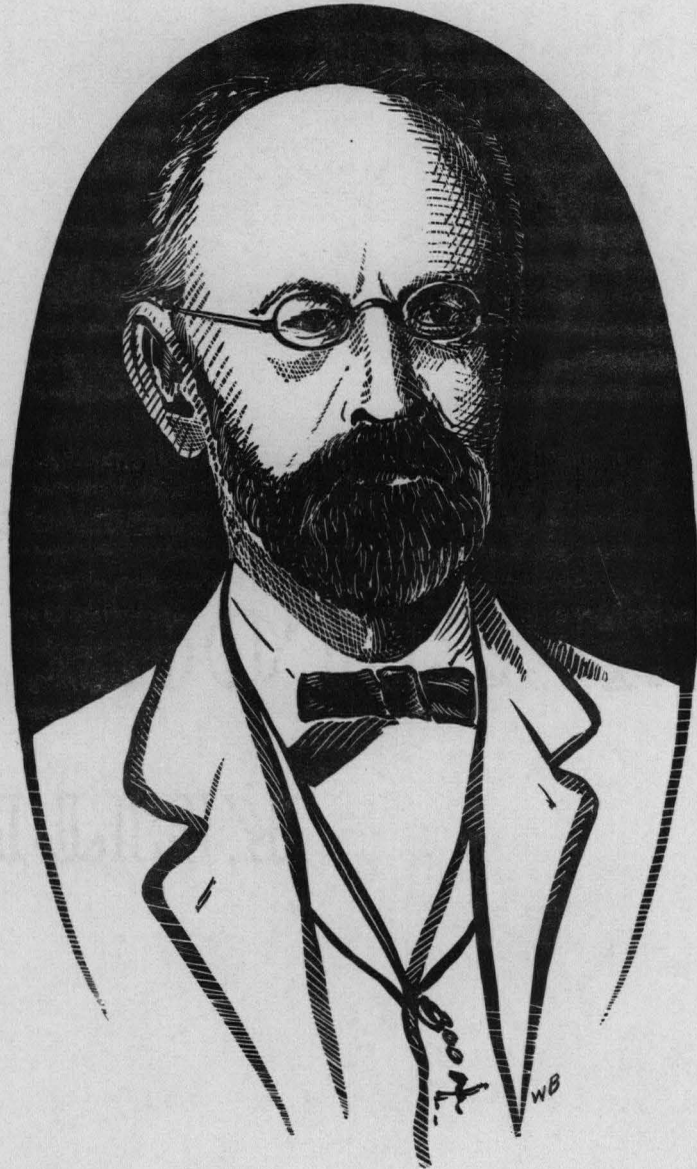
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STERKIANA est une collection de travaux sur les Mollusques extra-marins des deux Amériques, distribuée par un groupe de malacologues du centre des Etats-Unis. STERKIANA publie des travaux en anglais, en français et en espagnol acceptés par le conseil de rédaction. Prière d'adresser toute correspondance au Rédacteur.

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OBSERVACIONES ANATOMICAS SOBRE OMALONYX PATERA DOER., CON
UNA NOTA BIOGRAFICA ACERCA DE ADOLFO DOERING (1848-1926)

J. J. PARODIZ

Carnegie Museum, Pittsburgh, Pa.

Durante una excursión realizada por el autor en 1961 a la región del Chaco y Bajo Paraná, con el auspicio de la National Science Foundation de Washington D. C., para coleccionar, especialmente, moluscos fluviales sudamericanos, se obtuvieron numerosos ejemplares de *Omalonyx* en las áreas inundadas del Arroyo Negro, afluente del Rio Paraná, cerca de Resistencia, Provincia del Chaco, Argentina. Estas llamadas "babosas de agua dulce" han sido poco estudiadas y no son muy frecuentes en colecciones, y tanto como los Succineidae sudamericanos en general, merecen una completa revisión. La presente nota ha de servir para aclarar algunos detalles anatómicos y taxonómicos.

Omalonyx patera Doering ha sido, y es, fácilmente confundida con *O. unguis* Férussac, especie con la cual están relacionadas otras del norte de Brasil, Venezuela y las Antillas Menores. Las referencias son las siguientes:

- O. patera* Doer., Doering 1, p. 58, pl. 1, fig. 10-14. 1873.
- Doering 2^a, p. 67. 1874.
- Doering 2^c, p. 300. 1876.
- Doering 3, p. 1. 1875.
- Pfeiffer, Nomenclator Heliceorum Viventium, p. 409, Cassel. 1881.
- O. unguis* Fér., Parodiz, Nautilus 70, p. 130. 1957.

La forma de las conchillas descritas por d'Orbigny como *unguis* concuerda mejor con *patera*, pero las figuras tomadas del animal vivo son algo diferentes, desde que ninguna de los ejemplares por mí observados en la misma condición son de tonos verdes tan oscuros, sino más bien hialinos con un pálido tinte verdoso; también en el pie, la figura muestra un burlete marginal engrosado que no aparece en *patera*; indudablemente d'Orbigny poseyó ambas especies y los ejemplares figurados pueden ser de diferentes localidades. Una opinión similar fue adelantada por Gibbon [quien no mencionó *patera*], al anotar que: "it seems evident that the species found by D'Orbigny in Bolivia [sic; Bolivia], and collected by me in Bahía is not *O. unguis* Ferussac," (Journal of Conchology 2: 101, 1879). Además, comparando la diagnosis de d'Orbigny con la de *patera* en Doering, la similitud es tan grande que parece no dejar lugar a dudas de que el autor francés se basó, al menos para los ejemplares de Corrientes, en especímenes de *patera*.

El cuerpo de *O. patera* es semitransparente cuando vivo y hasta en ejemplares bien conservados que no hayan sufrido mucha contracción. La suela extendida es muy delgada y sin ribete y la parte superior del pie, que termina en aguda punta, sin surcos. El borde del manto rodea el margen de la conchilla formando un burlete de

aproximadamente 1 mm. de ancho, aunque se va ensanchando hacia el frente, donde es más grueso. (Fig. 2) El pneumostoma es central. Quitando la conchilla y a través del manto o separándolo aparece el riñón lunado alrededor de la masa hepatopancreática que está atravesada por el pericardio, y la venosidad pulmonar, los cuales no difieren mayormente de *Succinea*. El manto, (Fig. 3) así como la parte distal del pie y la región cefálica (Fig. 5) están pigmentadas con manchitas alargadas marrón oscuras hasta negras; la parte del manto que está cubierta por la conchilla no es pigmentada, y en la parte posterior está espiralado, con una sola vuelta, correspondiente a la porción que se inserta en la conchilla bajo el ápice (Fig. 2).

El aparato sexual (Fig. 4) presenta el ovotestis muy racimoso y compacto, con un par, aunque no bien distinguibles, de lóbulos, y el ducto hermafroditico largo y enulado; la glándula albuminífera es oval y la espermateca esférica (no oval como ha sido indicada para *unguis*), con el ducto espermático conectado cerca de la uretra (igual que en *Oxyloma*) y en esto parece diferenciarse de *Succinea* (en *S. burmeisteri* está colocado más abajo, y más aún en *S. andecola* en la que ya ocupa una posición post-vaginal). La rádula (Fig. 9) es de tipo succinoideo corriente, los dientes central y laterales con cúspides agudas; el raquídeo es más ancho y las laterales más altos que en *unguis* (Fig. 8).

La conchilla (Fig. 1) es generalmente más pequeña y estrecha que en *unguis*, tenue, estrecha en la base y relativamente menos convexa, siendo también más transparente, de color

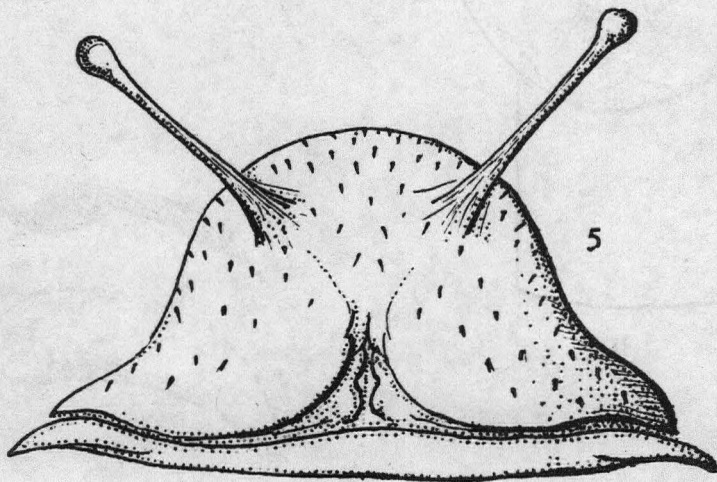
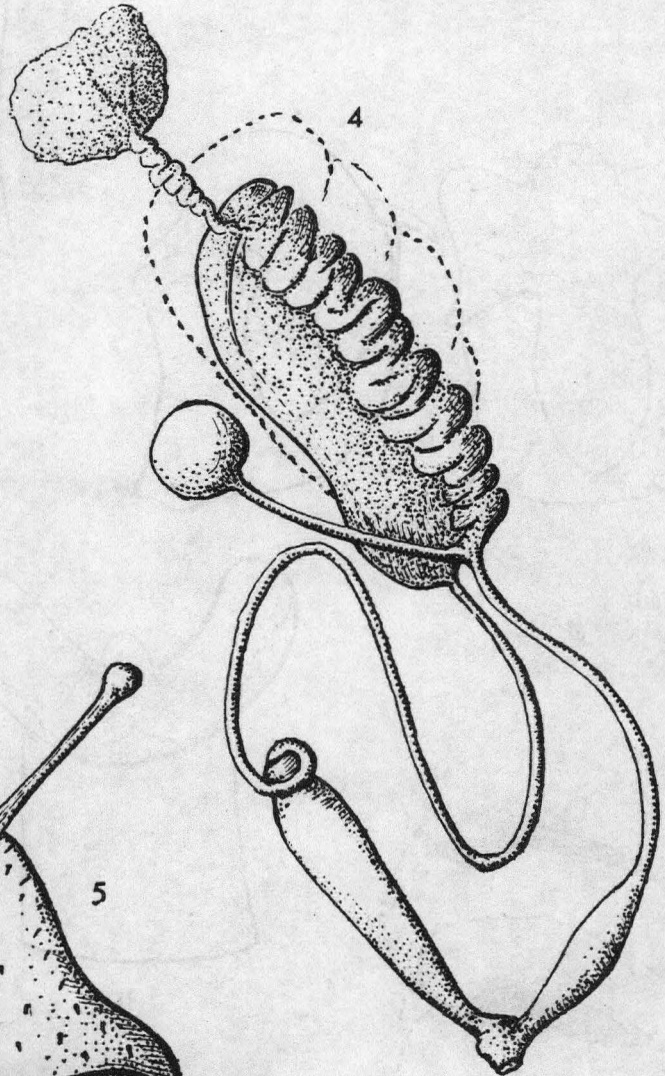
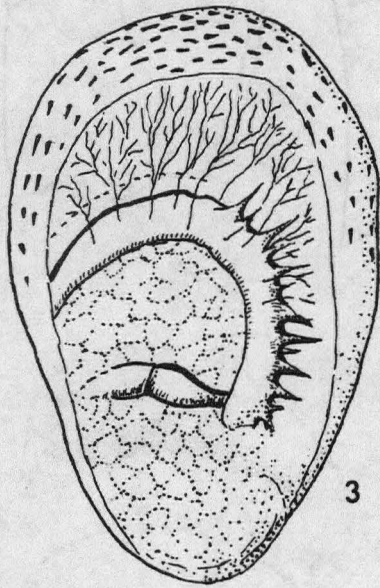
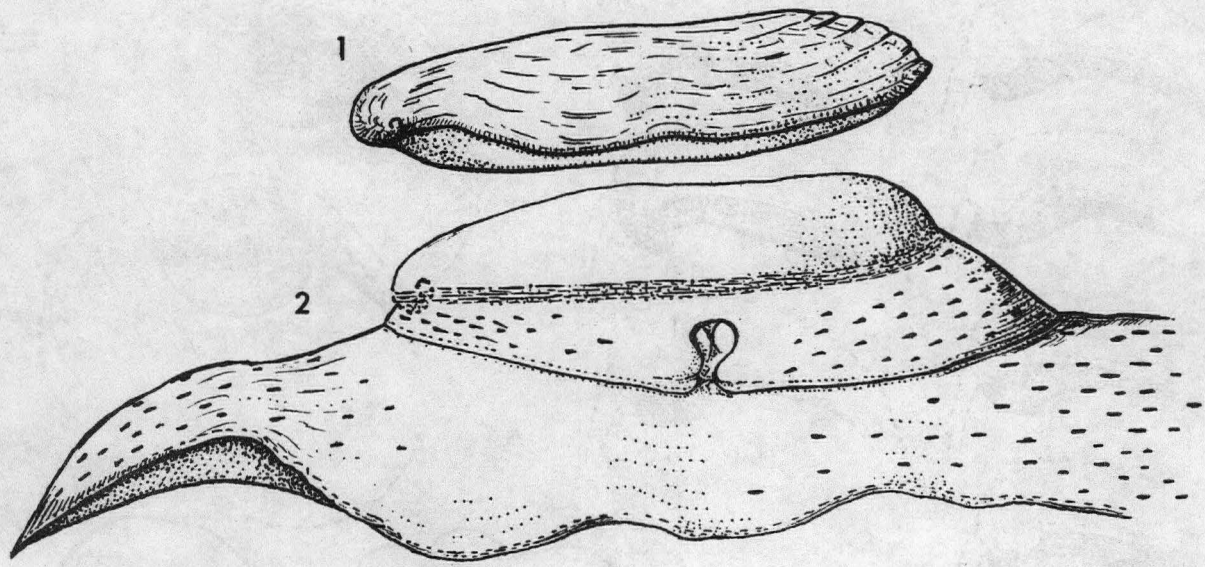
marrón-anaranjado, más claro en el margen y porcelanácea en ejemplares gerónticos. Los pliegues o dientes columelares (Fig. 6 y 11) es el carácter más variable de ambas especies dentro de una misma población. En los ejemplares del Arroyo Negro, que sirvieron para la anatomía, algunas veces presentan una lamela plana, o un doble pliegue, hasta convertirse en un perfecto gancho; en otros, el área es completamente lisa. Colocando el ejemplar de modo que puedan verse las cicatrices de inserción en la concavidad apical, estas son también muy variables y fuertes (Fig. 7).

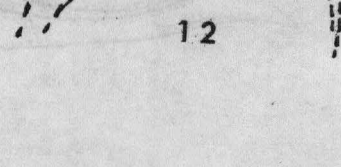
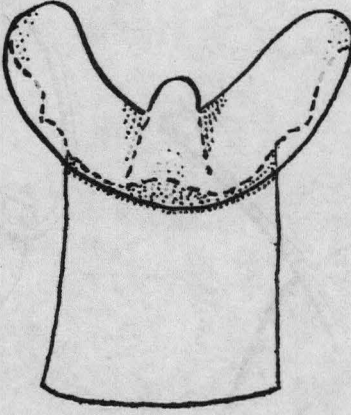
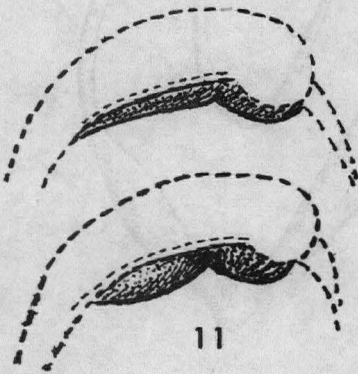
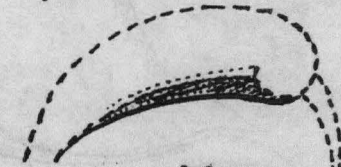
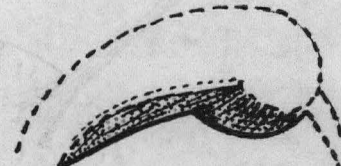
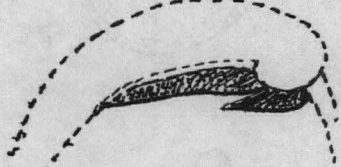
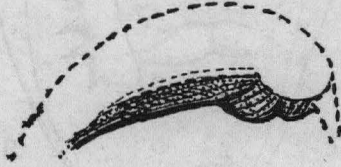
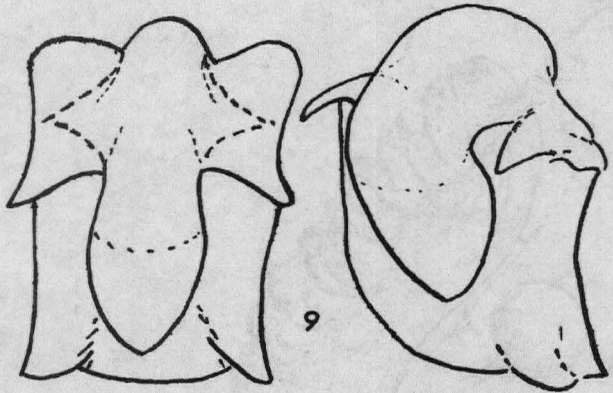
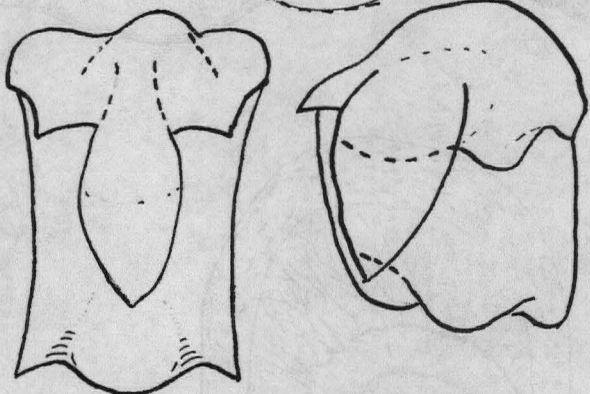
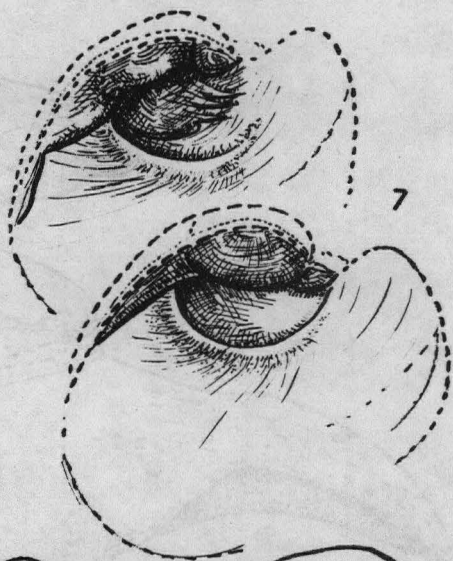
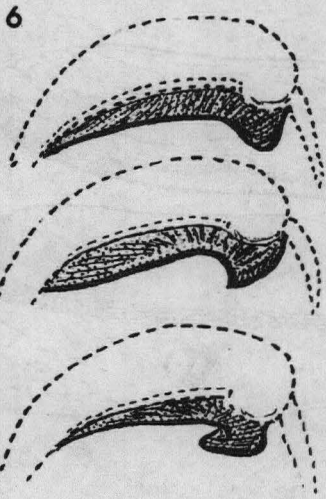
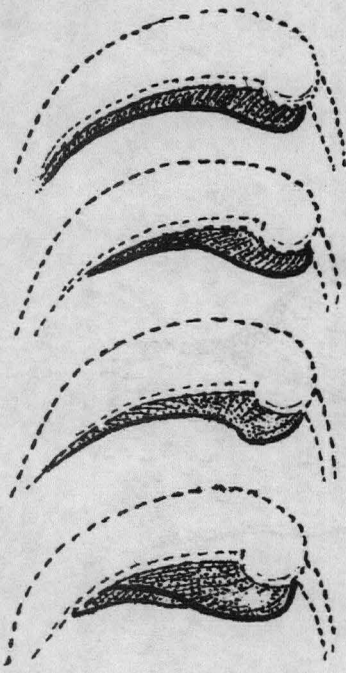
Las especies de *Omalonyx* nunca se encuentran fuera del agua en lugares húmedos como *Succinea*, sino siempre sumergidas, entre las plantas acuáticas o reptando en el barro del fondo. La distribución de *patera* es más meridional que la de *unguis*, hacia la región baja de la cuenca platense, pero en la región del Chaco y hacia el norte, las áreas de ambas especies se superponen. La localidad típica de *patera* es Rosario, Santa Fe, sobre el Rio Paraná, pero en la lista del "Periódico Zoológico" (1875) Doering indica solamente, Corrientes. Algunos ejemplares colectados en el noroeste de Argentina, en las provincias de Salta y Jujuy, son de tamaño más pequeño y de color blanco, pero como de estos no se conoce el animal serán necesarias nuevas búsquedas en esa área y en la adyacente de Bolivia, para establecer su relación específica o subespecífica. Al presente, por los caracteres observados, la diferencia específica entre *patera* y *unguis* parece justificarse; es muy posible, sin embargo, que una investigación más completa, basada en poblaciones numerosas de diferentes localidades, demuestre una relación mucho más estrecha.

FIGURAS 1 - 5. *Omalonyx patera* Doering

1. Conchilla
2. Parte media y posterior del cuerpo mostrando neumatóforo y manto bajo la conchilla no pigmentado

3. Organos de la cavidad paleal vistos por transparencia bajo el manto
4. Aparato sexual
5. Región cefálica con tentáculos extendidos





Desde tal punto de vista, un estudio comparativo de todas las especies sudamericanas es necesario.

LOCALIDADES

CM, Carnegie Museum
 MCZ, Museum of Comparative Zoology
 MZUM, Museum of Zoology, University of Michigan
 MACN, Museo Argentino de Ciencias Naturales

PARAGUAY:

Asunción (CM)
 Laguna Yparoray, San Bernardino (CM)

ARGENTINA:

Arroyo Negro, Chaco (CM)
 Islas del Rio Paraná frente a Sta. Fe (CM)
 Abra Vieja, Paraná Delta, Buenos Aires (CM y MACN)
 Rosario, Sta. Fe (CM)
 Rosario (MZUM)
 Rio Santiago, La Plata, Buenos Aires (CM y MACN)
 Noroeste:
 Vinalito
 Sierra Sta. Bárbara
 Termas del Palmar
 all Jujuy (CM)
 Orán, Salta (CM)

También se han observado ejemplares de unguis de las siguientes localidades:

PARAGUAY:

Villarica (MCZ)

BOLIVIA:

Santa Cruz de la Sierra (MZUM)

BRASIL:

Manguimbo, Rio Janeiro (MCZ)

Camaquan, Rio Grande do Sul (MCZ)

ARGENTINA:

Resistencia, Chaco (MCZ)
 Arroyo Guaycurú, Chaco (CM)

.

Resultará de interés, en esta oportunidad, agregar algunas notas biográficas sobre el autor de la especie, ADOLFO DOERING, quien contribuyó muy eficazmente al conocimiento de los moluscos fluviales y terrestres de los países del Plata. Hacia la mitad del siglo pasado, ese conocimiento se reducía a las descripciones específicas de especialistas y exploradores europeos entre los que se destaca d'Orbigny, junto con Strobil, Spix, Hidalgo, Philippi, Pfeiffer y Martens. Doering fue uno de los primeros malacólogos residentes en Sud América, abriendo nuevos horizontes para los estudios locales, ocupándose también de otras ramas de la Historia Natural.

Adolfo Doering nació en la provincia de Hannover, Alemania, el 22 de Enero de 1848. Habiendo obtenido el doctorado en la universidad de Goettingen, fué recomendado por German Burmeister¹, entonces Director del Museo de Buenos Aires, para integrar un plantel de especialistas en la Universidad de Córdoba. En esa época, durante la presidencia de Sarmiento, numerosos hombres de ciencia fueron contratados

1. El Museo de Buenos Aires, fundado en 1823, no tuvo significación científica hasta 1854 cuando la "Asociación de Amigos de la Historia Natural" le dio nuevo impulso y llamó de Alemania al Dr. Burmeister, para ocupar la Dirección.

FIGURAS 6 - 10. *Omalonyx patera* Doering

- | | | |
|---|----------------------|---------------|
| 6. (Arroyo Negro) | Variación en los | 9. Rádula |
| 11. (San Bernardino) | pliegues columelares | 10. Mandíbula |
| 7. Vista de las cicatrices de inserción interna | | |

FIGURAS 8 y 12. *Omalonyx unguis* (Férussac)

- | | |
|-----------|--------------------------|
| 8. Rádula | 12. Pliegues columelares |
|-----------|--------------------------|

por el gobierno argentino, para establecer las bases de la exploración e investigación científica del país, que llegaron de Europa y Estados Unidos, y la mayoría de ellos, como Burmeister y Doering se radicaron definitivamente. Doering llegó a la Argentina en 1872 (algunos años antes que otro compatriota y estudiante de la misma universidad, von Ihering, fuera al Brasil); en 1873 reemplazó a Burmeister a la cabeza de Academia Nacional de Ciencias, y después de prolijos estudios hidrológicos fué titular de la cátedra de Química en la Universidad de Córdoba, tarea que alternaba con otras investigaciones zoológicas y geológicas. Desde 1892 hasta 1916 fué profesor de zoología en la Academia, y presidente de la misma de 1914 a 1923.

Doering exploró casi todas las regiones de Argentina, coleccionando y estudiando moluscos, y sus colegas naturalistas en la Academia, como Weyenbergh, Lallemand, Stelzner, Hieronimus, Brackebusch y otros, contribuyeron al incremento de las colecciones, nombres todos que se encuentran reflejados en las especies que Doering describió. Las más raras y interesantes especies de pulmonados fueron descubiertas por Doering durante su participación en la comisión científica que acompañó a la "Expedición al Desierto" (Oficialmente conocida como Expedición al Río Negro), encabezada por el General Roca en 1879 para poner coto a los ataques indios que constituían una constante amenaza a la frontera civilizada.

Doering falleció en Capilla del Monte, Córdoba, pueblo que contribuyó a fundar, el 19 de Enero de 1926, después de 54 años de residencia en el país. Publicó en castellano, francés, alemán y latín. Sus más importantes trabajos malacológicos aparecieron en el Boletín de la Academia Nacional de Ciencias desde 1874 a 1879, y en el Periódico Zoológico, órgano de la extinta Sociedad Zoológica Argentina fundada por Weyenbergh y que en 1874 ya contaba con 50 socios, número considerable para aquella época. Lamentablemente muchas de sus descripciones en esas revistas aparecieron sin ilustración, pero como Doering enviara duplicados de sus colec-

ciones a sus colegas europeos, varias fueron re-descriptas con figuras por Kobelt y Döhrn en el *Nachrichtsblatt d. Deutschen Malakozoologische Gesellschaft y Malakozool. Blätter*.

La bibliografía malacológica de Doering es la siguiente:

1. 1873. Bemerkungen über die Mollusken-Fauna der Argentinischen Republik und über einige neue Argentinische Succineen. *Malakozool. Blätter*, 22: 49, pl. I-II.
2. 1874/79. Apuntes sobre la fauna de moluscos de Argentina.
 - 2^{a-b} partes 1 y 2, *Boletín Acad. Nac. C.* I: 48 y 424 (1874-75).
 - 2^c parte 3, *Ibid.*, II: 300 (1876).
 - 2^d parte 4, *Ibid.*, III: 63 (1879).
 - 2^e parte 5, *Ibid.*, VII: 457 (1885).
3. 1875. *Molluscorum Terrestrium et Fluvialium Fauna Argentinae*. *Periódico Zoológico I* (2).
4. 1875. Suplemento a la lista de moluscos terrestres, etc. *Boletín Acad. Nac. C.*, I: 457.
5. 1875. Estudios sistemáticos y anatómicos sobre los moluscos pulmoníferos de los países del Plata. *Periódico Zoológico*, I:(3).
6. 1878. Verzeichniss der in Laplatagebiet lebenden Binnenmollusken. *Jahrb. d. Malakozool. Gesell.*, V: 130.
7. 1881. Moluscos [en] Informe Oficial de la Comisión Científica de la Expedición al Río Negro, I (Zool.), Buenos Aires.
8. 1884. Estudios Hidrognósticos, etc. [Descripción de Chilina]. *Boletín Acad. Nac. C.* VI.
9. 1884. Moluscos [en] Holmberg, Viajes al Tandil y La Tinta. *Actas Acad. Nac. C.*, V(3).
10. 1907. La Formación Pampeana de Córdoba [Descripción de moluscos pleistocénicos]. *Revista Museo de La Plata*, XIV.
11. 1916. Recuerdos de la Expedición al Río Negro. *Boletín Acad. Nac. C.*, XXI: 301; (con numerosas notas ecológicas sobre moluscos).

LISTA DE LAS ESPECIES DESCRIPTAS POR DOERING

| NOMBRE ORIGINAL | PRESENTE NOMENCLATURA |
|---|--|
| STROPHOCHEILIDAE | |
| Bulimus (Borus) lorentzianus 1875 | Strophocheilus (Megalobulimus) oblongus lorentzianus |
| Bulimus (Borus) d'orbignyi 1876 | S. (Austroborus) lutescens d'orbignyi |
| Bulimus (Borus) cordillerae 1876 | S. (Austroborus) |
| BULIMULIDAE (BULIMULINAE) | |
| Bulimulus (Scutalus) conispirus 1879 | Neopetraeus stelzneri conispirus |
| B. (Scutalus) peristomatus 1879 | N. stelzneri peristomatus |
| B. (Scutalus) oxylabris 1879 | Protoglyptus (Rimatula) oxylabris |
| B. (Scutalus) centralis 1879 | " " " |
| B. (Peronaeus) famatinus 1879 | Peronaeus |
| B. (Peronaeus) clachaquinus 1879 | " |
| B. monticola 1879 | " |
| B. tortoranus 1879 | " (Lissoacme) |
| Eudioptus mendozanus azulensis 1881 | " " azulensis |
| E. mendozanus bonarensis | " " " |
| E. aguirrei 1884 | " " aguirrei |
| BULIMULIDAE (ODONTOSTOMINAE) | |
| Odontostomus philippii 1875 | Cyclodontina (Spixia) |
| O. maculosus 1875 | " " |
| O. tumulorum 1875 | " " |
| O. champaquianus 1875 | " " tumulorum champaquianus |
| O. profundidens 1875 | " " |
| O. pucuranus 1875 | " " |
| O. olainensis 1875 | " " pucuranus olainensis |
| O. martensi 1875 | " " |
| O. riojanus 1877 | " " |
| O. reticulatus 1877 | " " |
| O. aconjigastanus 1877 | " " |
| Bulimus (Odontostomus) chancaninus 1876 | " " |
| Odontostomus popanus 1877 | " " |
| O. berghi 1877 | " " |
| O. salinicola 1877 | " " |
| Bulimus kobeltianus 1888 | " " |
| Eudioptus avellanadae 1881 | " (Ventania) |
| *Plagiodontes rocae 1881 | " (Plagiodontes) |
| Odontostomus multiplicatus 1875 | " " |
| O. brackebuschii 1877 | " " |
| Plagiodontes Weyenberghi 1875 | " " |
| Clessina stelzneri 1875 | " *(Scalarinella) cordovana |

HELMINTHOGLYPTIDAE (EPIPHRAGMOPHORINAE)

| | |
|---|---|
| Helix (Eurycampta) hidalgonis 1875 | Epiphragmophora trenquelleonis hidalgonis |
| H. monographa 1875 [not monographa Burmeister] | E. trenquelleonis rhathymos |
| *Epiphragmophora hieronymi 1875 | E. hieronymi |
| Aglaja yocotulana 1875 | E. hieronymi |
| A. estella tucumanensis 1874 | E. tucumanensis |

SUCCINEIDAE

| | |
|---|----------------|
| Succinea meridionalis cornea 1881 | = |
| S. burmeisteri 1873 | meridionalis ? |
| S. rosarinensis 1873 | meridionalis ? |
| Omalonyx patera 1873 | = |

PUPILLIDAE

| | |
|--------------------------------|-----------------|
| Pupa microdonta 1879 | Gastrocopta |
| P. clessini 1879 | " |
| P. dicrodonta 1879 | " (Immersidens) |

LIMACIDAE

| | |
|--|----------------------|
| Agriolimax meridionalis 1875 | Deroceras agrestis ? |
|--|----------------------|

CYCLOPHORIDAE

| | |
|---------------------------------|---|
| *Adelopoma tucma 1885 | = |
|---------------------------------|---|

BITHYNIIDAE

| | |
|-------------------------------------|-------------|
| *Lyrodes guaranítica 1885 | = |
| Hydrobia ameghini 1885 | Littoridina |
| H. occidentalis 1885 | " |
| H. montana 1885 | " |

CHILINIDAE

| | |
|-----------------------------------|---|
| Chilina lallemanti 1884 | = |
| C. echagui 1884 | = |

ABSTRACT

The "fresh-water slugs" of the genus *Omalonyx* have been scarcely studied and infrequently found in collections. The present anatomical observations were made on specimens collected in 1961 during the author's trip, sponsored by the National Science Foundation to the Chaco region, in flooded areas of Arroyo Negro, an affluent of the Parana River near Resistencia, province of Chaco, Argentina, and identified as *O. patera* Doering. The description given by d'Orbigny (1837) of *O. unguis* Fér., does not agree with that species (an opinion advanced by Gibbon in 1879), but with *patera*; the figures,

however, show a thick marginal strip on the foot and stronger colors not present in our observed specimen; possibly d'Orbigny had both species and the figure is from a sample of another locality. The spermatheca is spherical and the seminal duct is connected close to the urethra as in *Oxyloma*, differing by this from *Succinea*. The margin of the mantle surrounds the shell with a narrow strip, while in *Neohyalimax* it covers it completely. Radula with central tooth wider and laterals higher than in *O. unguis*. The columellar folds of the shell are very variable: from the shape of a strong hook

to a very flat lamella or without lamella at all. The shell is smaller than in *unguis*, less convex and more translucent. The distribution of *patera* corresponds to the southern district of the Parana-La Plata basin, but in the North overlaps in part that of *unguis*. The present observations seem to justify the specific differences between *patera* and *unguis*; however, a more complete investigation based on larger populations from different localities may show closer, perhaps subspecific, affinities; a revision on such basis of all the species of the genus is necessary. Other materials observed (shells on-

ly), include several localities in Paraguay and Argentina, along the Parana to La Plata River. Northwestern specimens (from Salta and Jujuy) are smaller and thinner than those of Chaco, but their animals are unknown. Also localities of *unguis* from Paraguay, Bolivia, Brasil and Argentina are added.

The article is followed by a biographical sketch on the author of the species, ADOLFO DOERING, a pioneer on South American malacology, his bibliography and a list of his described species with both original and up-to-date nomenclature.

CURRENT LITERATURE ON NON-MARINE OSTRACODES

All of us who work with freshwater Mollusca, whether living or fossil, encounter considerable numbers of freshwater ostracodes in the collections that we study. It has not always been easy to get these identified since specialists in this field have been few; for example, the "Directory of Zoological Taxonomists of the World," compiled by the Blackwelders (1961) showed only 13 specialists interested in freshwater ostracodes. It seems a pity not to use our opportunities in this field by laying aside fossil or living ostracodes for identification by specialists. Similarly, workers in freshwater Mollusca should be aware of the significance, particularly in ecology and paleoecology, of this prolific group of arthropods. For this reason, a few recent papers on ostracodes are noted below and the co-operation of readers of *STERKIANA* is invited. It is unlikely that all the authors listed will be willing to identify large collections of ostracodes but it is most likely that material forwarded to them for reference collections will be appreciated. In all studies on Pleistocene non-marine Mollusca which have been done by me or under my direction, ostracodes have been carefully saved. In some cases, they have been worked up by the specialists to whom they have been sent and the conclusions based on this group

have been most interesting to compare with those independently reached by the mollusk specialist. The list of references is by no means exhaustive but each paper has a list of literature cited which may be helpful.

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SWAIN, Frederick M. (1963) Pleistocene Ostracoda from the Gubik formation, Arctic Coastal Plain, Alaska. -- *Jour. Paleont.*, 37: 798-834, pls. 95-99, 13 text figs.

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Aurèle La Rocque

RECENT PUBLICATIONS

The following publications have been added, among others, to the Editor's library. They are noticed here either because they have been published in journals not usually received by malacologists, or because of outstanding interest to the study of non-marine Mollusca of the Americas, or again because their title does not indicate that they contain mollusk records.

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BRANSON, Branley A. (1960) Gastropoda of the Rob and Bessie Welder Wildlife Foundation Refuge, San Patricio County, Texas. -- Southwestern Naturalist, 5: 143-159.

----- (1962) The Slugs (Gastropoda: Pulmonata) of Oklahoma and Kansas with new records. -- Trans. Kans. Acad. Sci., 65: 110-119.

BRANSON, B. A., TAYLOR, John, and TAYLOR, Constance (1962) A Pleistocene local fauna from Caddo and Canadian counties, Oklahoma. -- Okla. Geol. Notes, 22: 280-295, 3 figs.

BROWNE, Ruth G. and McDONALD, Donald E. (1960) Wisconsin Molluscan Faunas from Jefferson County, Kentucky. -- Bull. Am. Paleont., 41: 165-183, pls. 18-22, 3 text figs.

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FRANKEL, Larry (1960) Geographic distribution of *Planorbula vulcanata* Leonard in Nebraska. -- Jour. Paleont., 34: 591-592, 1 text fig.

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KUPSCH, Walter O. (1960) Radiocarbon-dated organic sediment near Herbert, Saskatchewan. -- Am. Jour. Sci., 258: 282-292, 3 figs.

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McCRAW, Bruce M. (1961) Life history and growth of the snail *Lymnaea humilis* Say. -- Trans. Am. Microsc. Soc., 80: 16-27, 9 figs.

MILLER, Barry B. (1961) A late Pleistocene molluscan faunule from Meade County, Kansas. -- Mich. Acad. Sci., Arts, and Letters, 46: 103-125, 1 fig.

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van der Schalie, Henry and PARMALEE, Paul W. (1960) Animal remains from the Etowah site, Mound C, Bartow County, Georgia. -- Fla. Anthropologist, 13: 37-54, 1 fig.

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SOME INTERESTING MOLLUSCAN RECORDS
OF GEORGE J. STREATOR, 1881-1909

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I. INTRODUCTION

George Jason Streator was born in Shalersville Township of Portage County, Ohio, on 23 July 1846. He settled near Garrettsville where he became a nurseryman and an amateur naturalist of considerable ability. He assembled a large collection of local shells, and he made some exchanges with other collectors. He published but a single note (Streator, 1889). In 1881 he began to keep a diary which continued until his death in 1925 (volumes for 1888-1893 and 1903-1904 inclusive are now missing). Through the kindness of his son, Sidney V. Streator, I have made a study of these diaries with special reference to George Streator's studies of natural history in general and of the Mollusca in particular. His primary avocation was the collection and study of land and fresh-water shells, which he pursued avidly until he left Ohio in 1904 to reside in California. In 1909 he returned to Ohio for the specific purpose of shipping his collection of shells to Stanford University, to which he had donated his collection. This paper reports on noteworthy molluscan records Streator made in his diaries.

II. UNUSUAL SPECIMENS COLLECTED
IN OHIO

On 5 June 1885, he recorded in his diary the collection of an albino specimen of *Helix al-*

bolabris made by his friend, S. M. Luther. Mr. Luther was a druggist at Garrettsville, whose hobby was also the collection of shells. These two men frequently made collecting trips together, exchanged specimens, and aided each other in their mutual interest. An account of their collecting trip down the Mahoning River and into the Ohio River in 1885 has already been published (Dexter, 1961a). On 19 July 1885, Streator recorded the collection of a deformed specimen of *Anodonta imbecilis* from Brady Lake in Portage County. He also collected on 25 October 1885 two specimens of *Helix profunda* near Garrettsville, each of which contained three opercula. On 28 May 1886, he recorded the collection of an albino *Mesodon profunda*, which was just in the process of forming its lip. On 18 June that year, he mentioned the receipt of a package of shells from Prof. E. W. Claypole of Buchtel College in Akron containing, among other things, two immature specimens of *Melantho decisa* (*Campeloma decisum*), which were left-handed in form.

While collecting in the West Branch of the Mahoning River two miles below the dam at Leavittsburgh on 15 August 1886, Streator "found a small *Unio luteolus* attached to a small pebble by a thread or byssus. The first I ever saw of this." The next day he recorded in his diary that, "Mr. Luther brought me a fine, white, light colored *Unio cylindricus* from the Ohio River." On a collecting trip to the South

Branch of the Mahoning River near Newton Falls made 10 August 1887, Streator collected a specimen of *Margaritana hildrethiana*. He noted that this "is the first specimen of the kind found in this part of the country." The next day he wrote in his diary, "I cleaned up a few of the shells collected yesterday. I am certain that one of the specimens is *Margaritana hildrethiana*, and I believe it is the first specimen taken and recorded from this part of Ohio." On 16 September that year, he collected 8 more of this species from the same place.

III. UNIO LUTEOLUS VS. U. RADIATUS

Streator was among the first to recognize the synonymy of *U. luteolus* and *U. radiatus*. On 10 April 1885, he wrote, "Stopping at Mr. Luther's on my way home, he gave me *Unio radiatus*, from Seneca River, New York -- *U. radiatus* closely resembles *U. luteolus*. I think it but a variety of it" (underlining his). His friend, George W. Dean of Kent, another nurseryman and amateur conchologist, published notes in the NAUTILUS (1891 and 1892) "On the distinguishing characters of *Unio radiatus* and *U. luteolus*." Dean was convinced that the two were distinct species. His notes were in reply to Beauchamp (1891) who had raised the question, "Can anyone point out an invariable feature distinguishing *Unio radiatus* and *luteolus*? The distinctions do very well for some, but others seem a good deal mixed." Simpson (1891) entered the controversy and wrote that, "Mr. George W. Dean claims to be able at sight, to refer to its proper species any specimen of either *Unio luteolus* or *radiatus*. I confess that this is more than I can do, and I have handled many thousands of both, collected from the entire territory inhabited by these familiar forms." Gradually, this synonymy became generally recognized, and today the name persists as *Lampsilis radiata*. It is to Streator's credit that he recognized the synonymy of *U. luteolus* at such an early date. Competent amateurs with critical obser-

various and keen analysis can often reach scientifically sound conclusions.

IV. ON DEAN'S PRESUMED NEW SPECIES OF UNIONIDAE

Streator's friend and frequent field companion, George W. Dean of Kent, believed that he had found an undescribed species of a river mussel in the Mahoning River. Streator was not convinced that this was anything new. In his diary he wrote the following comments pertaining to this problem -- 16 Sept. 1887: "I collected specimens (Mahoning River near Newton Falls) that prove that Dean's much desired new species to be *Unio kirtlandiana*." The following day he wrote in his diary, "I had a sharp talk with George W. Dean in regard to the species he desires to be a new one. I found *Unio kirtlandiana* above the pond where he found his supposed new species and also below it. My specimens have all the appearance of his minus the eroded beaks and absence of color of his specimen due to, I think, being grown in a pond. I told him that they were in my opinion simply pond-grown *kirtlandiana*. The old man was unreasonable and foolish in a great deal of what he said, but I held my temper and made the old boy come to his senses."

V. ON PISIDIUM STREATORI

Dr. Victor Sterki (1901) described and named a new species, *Pisidium streator*, which Streator had collected in a swamp near Garrettsville. Streator never seemed to be fully convinced that the species named in his honor was really a valid species. This doubt is expressed in several entries in his diary. On 10 January 1901, he wrote: "Went to the swamp on Combs' farm and collected some *Sphaerium* and a few *Pisidium* of the latter that I suppose to be the species Dr. Sterki named after me and recently published in the NAUTILUS as new; 13 January 1901, Took a walk to the swamp where *Pisidium streator* is found. Collected but a few after much search. The species is far from abundant; 20 January 1901, Looked over the

Pisidia from North America. I am unable to tell the specimens from the Combs' swamp from *Pisidium abditum* unless the beaks are less elevated. If the swamp specimens prove to be a true species and new, then our so-called *P. compressum* is very close or is that species; 3 February 1901, Took my swamp species of *Pisidium* to Mr. Luther and compared with his. We both think it different from shells he has labeled as *P. abditum*." In the recent revision of the Sphaeriidae of North America by H. B. Herrington (1962), *P. streatori* has been reduced as a synonym of *P. casertanum* (Poli), 1791, and *P. abditum* has also been reduced as a synonym of this same species. Streator's doubts proved to be valid.

VI. SHELL COLLECTING EXCURSION TO THE TENNESSEE RIVER (1886)

Between 20-28 Sept. 1886, Streator made a special trip to Alabama to collect shells. Some interesting excerpts from his diary on that trip are given here.

"20 Sept. Rev. Artemis Dean accepted my offer to pay my expenses on a trip south collecting and to have one-half the find. I went to the bank borrowed \$20 for ten days. Before the 4 P. M. train was ready to start I was bound for the southland -- 8:50 and we were crossing the Ohio on the high bridge that spans this stream, thence through the rugged as well as fair land of Kentucky.

21 Sept.: 6 A.M. found us at Chattanooga, Tennessee, where I took a train in a few minutes for Bridgeport, Alabama -- a small town 28 miles below. Here I found good quarters at the residence of a Mrs. Jones. 22 Sept.: After breakfast I crossed the R.R. bridge 1,600 feet in length and examined the water for shells on the right bank of the island -- shells found here mostly univalves plus *Canaliculatum nodosum*, etc. Unios (muskrat shells) of *U. dromos*, *gravidiferous*, *ligamentinus* and others. Difficult walking -- the water too high for work at the end of the island -- the east end of R.R. bridge I found a single live *Io spinosa*, but

plenty of other live univalve shells -- collected some fair univalves on the west end of the long bridge. 23 Sept.: Bridgeport, Alabama -- Widow's Creek excursion. Examined the woods for Helices -- found *Zonitoides suppressus* and three other species -- some six *Helix albolabris*, only under logs were they of any account. I inquired of a resident as to prospects for my kind of plunder -- he thought the "Bottom" was the best place -- found it to be a sluggish, disturbed stream. Pleurocera were abundant; found several species of Unios with beautifully colored nacre. I collected a large number of *Goniobasis* at a large spring. The Unios were rat shells. I found *Margaritana rugosa* -- three specimens only are good enough to retain.

24 Sept.: Bought a tobacco pail for 25 cents in which I packed the Unios I collected yesterday. I spread the univalve shells on a board to dry -- packed the Helices in paper. At 9 A.M. I started on my trip to the mountain across the river -- I climbed the mountain leisurely examining the moist spots of earth, under stones, logs, etc. I found some Helices, but they were dead shells, but *Z. cuspidata* were very good. The *Helicina*, *Stenotrema*, and *Pupilla* groups were fairly represented -- went to the river where I examined for shells. I found one *Io spinosa*, some small species of univalves -- found 10 small *U. cylindricus*.

25 Sept. reached the creek in which I think Dr. De Camp found the *Melantho* named after him. I passed a stagnant pool of water -- searched its margin for Physas but there was none -- -- pigs rout along the margins of the streams evidently for shells -- -- I think the pig will eventually destroy many of the delicate species. After a prolonged search I found several small *Melanthos* but whether they were *M. decampi* subsequent comparison must determine. Species of Pleurocera similar to those found in Widow's Creek abounded -- there were several shell mounds that I passed over. They were of considerable extent. The shells were of the same species that are now found in the river, the epidermis was largely gone, and many were broken and decomposed -- -- I was informed by a

fisherman that there was a plenty of clams on the bar at the head of an island -- I started for the upper end of the island -- I found the water shallow for a considerable distance each side of the end of the point. The number of muscles (sic) (see Dexter, 1961b, for discussion of spelling of this name for bivalve mollusks) was considerable and in six to eight varieties, but badly eroded. I collected some 90 specimens and a couple hundred of a beautiful *Pleurocera*? I left my rake in the hurry to get away -- I crossed a very prominent (Indian) mound.

28 Sept. I arrived in Garrettsville shortly after 7 A.M. pretty tired from the journey. The long hours of waiting in Chattanooga, Ashville, Cincinnati, Dayton, and Leavittsburgh were very tiresome. The attack of dysentery I had Saturday night is not yet subdued (Streator drank water freely from ground water that he encountered on his field trip). Cost of trip was \$27.60.

List of Shells Sent to Rev. A. Dean According to Agreement
(one-half of collection)

| Bivalves | |
|---|----|
| <i>Unio crassidens</i> | 14 |
| <i>U. ligamentinus</i> | 6 |
| <i>U. rectus</i> | 5 |
| <i>U. dromos</i> | 17 |
| <i>U. securis</i> | 10 |
| <i>U. verucosus</i> | 5 |
| <i>U. irroratus</i> | 2 |
| <i>U. pustulatus</i> | 6 |
| <i>U. pyramidalus</i> | 16 |
| <i>U. subrotundus</i> | 1 |
| <i>U. retusus</i> | 12 |
| <i>U. cormelus</i> | 2 |
| <i>U. cylindricus</i> | 8 |
| <i>U. tuberculatus</i> | 2 |
| <i>U. monodontus</i> | 1 |
| <i>U. clavus</i> | 1 |
| <i>Margaritana rugosa</i> | 1 |
| also, 19 specimens of 7 spp. not determined. | |

| Univalves | |
|----------------------------|-----|
| <i>Angitrema verrucosa</i> | 100 |

| | |
|----------------------------|-----|
| <i>Melantho ponderosa</i> | 20 |
| <i>Pleurocera nobile</i> | 45 |
| <i>Arculari planospira</i> | 75 |
| <i>A. praerosa</i> | 50 |
| <i>Zonites interna</i> | 35 |
| <i>Z. infesta</i> | 12 |
| <i>Z. sculptilis</i> | 12 |
| <i>Io spinosa</i> | 1 |
| <i>Mesodon albolabris</i> | 2 |
| Widow's Creek Univalves | 35 |
| Undetermined specimens | 200 |

VII. SOME INTERESTING CORRESPONDENCE
AND NOTES FROM STREATOR'S DIARY

Following are brief excerpts from Streator's diary concerning his correspondence with other conchologists and notes of general interest. The following excerpts were written in 1886.

"25 Jan. I worked all day in putting up collections of shells from Mr. A. Winkley of Dubois, Illinois, H. A. Pilsbry, Davenport, Iowa, and N. J. H. Michaels of Morro Bay. -- 25 Feb. The Smithsonian would be pleased to send me a copy of Binney's work for the local shells and I offered to send them. -- 10 Mar. Packed in a box the returned *Unios* from Dr. William H. De Camp and another species with an *Anodonta* -- the so-called *shefferiana* -- wrote a letter and sent them to Isaac Lea of Philadelphia. -- 22 Mar. A letter and package of shells sent to W. G. Binney. -- 27 Mar. Received a letter from W. G. Binney. He stated that the *Succinea* was *avara* instead of *verrilla*, the *Vertigo* was *simplex*, the *Zonites exigua* was *Patula alternata*. -- 19 April. Received a letter and the 4 species of shells I sent to Dr. Isaac Lea of Philadelphia (one was *Unio abacus*). -- 24 Apr. I received from Dr. Isaac Lea a copy by mail of the "Bibliography of Isaac Lea" -- a most interesting and valuable present. -- 27 Aug. Sent 10 specimens of *Mesodon mullanii* to Prof. A. G. Weatherby of Wilder, Mitchell County, North Carolina. -- 29 Sept. Received a letter from H. A. Pilsbry and pack of printed matter relative to shells. -- 4 Oct. Received the box of shells from H. A. Pilsbry, Davenport, Iowa. -- 14 species all new

to me and desirable. I sent him a box of shells early last winter and his return is thus late by being absent from home he states. -- 27 Oct. The mail brought letters from Hon. William McAdams, Philip Marsh, A. A. Hinkley with a box of shells. Also a letter and box of shells from N. W. Palmar, Jr., in the interest of Miss Mary Day. The shells were all smashed and broken and smelled bad. I sent a letter to J.C. Beatly. -- 17 Nov. The P.M. was used in listing and packing a box of shells to send the Smithsonian Institution at Washington for favor of Binney's "Manual of Land Shells" received last spring. -- 18 Nov. Expressed a box of Unios to the Smithsonian Institution -- 26 species found in the Mahoning River at Leavittsburgh, except *U. iris* which I replaced by *U. nasutus*. The following excerpts were written in 1887.

"23 Mar. Took a walk down the stream below the house of Prof. Pike. Saw where a live-ly muskrat had collected and eaten at least 50 specimens of *Anodonta decurva* Lea. I collected a few fair examples of these species -- *A. subcylindrica*, *U. complanatus*, and a few *U. pressus*. -- I made out a list of the land and fresh water shells in my cabinet. There are nearly 700 species or quite that number if we included varieties. The list summary is as quoted below.

| | | | |
|----------------|-----|--------------------|----|
| Unio | 120 | Asthaticus | 1 |
| Anodonta | 25 | Ampullaria | 1 |
| Margaritana | 10 | Stenopus | 1 |
| Glandina | 1 | Truncatella | 1 |
| Helix (Native) | 107 | Cylindrella | 1 |
| Helicina | 3 | Valvata | 5 |
| Bulimulus | 10 | Carychium | 1 |
| Pupilla | 7 | Crinifex | 1 |
| Vertigo | 4 | Planorbis | 12 |
| Strophia | 7 | Strepomatids | 60 |
| Stenogyra | 1 | Tulotoma | 1 |
| Alcadia | 1 | Vivipara | 4 |
| Clausilia | 4 | Lioplax | 2 |
| Chondropoma | 9 | Bartunia | 1 |
| Limnaea | 16 | Helix (Foreign) | 83 |
| Physa | 13 | (Varieties) | 40 |
| Ferussacia | 1 | Helicina (Foreign) | 2 |

| | | | |
|-------------|----|-------------|----|
| Melantho | 8 | Bythinia | 1 |
| Cyclostoma | 1 | Bythinella | 4 |
| Succinea | 12 | Amnicola | 5 |
| Pyrgulopsis | 1 | Vitina | 1 |
| Sphaerium | 12 | Ancylus | 3 |
| Pisidium | 5 | Pomatiopsis | 2 |
| Somatogyrus | 3 | Lacuna | 2 |
| Fluminicola | 1 | Achatinella | 40 |

Total 667 - some species not identified - some probably synonyms.

"24 Nov. I made and filled a tray with shells and labels which I will send to Washington to the National Museum tomorrow. -- 26 Nov. I sent to Prof. G. Brown Goode a sample of my system of labeling."

Letterhead stationery which Streator had printed in 1894 reads as follows:

George J. Streator, Horticulturist
Amateur Interests,
Land and Fresh Water Mollusca and Botany

His motto appeared in one corner. It reads "To see; to reason; to compare." According to his son, Sidney, Streator's favorite expression was, "If so, then why so."

On 6 December 1897, Streator recounts a visit from two young friends whom he encouraged in the study of nature as follows, "Roscoe Webb and Almon Rood called. We had a nice visit. Gave the boys a nice little start with the small land and fresh water shells. I am proud indeed to have such boys as friends." (Both of these boys became expert amateur naturalists. Webb's collection of plants was eventually given to Harvard University, and Rood's collection was recently sold to Kent State University).

In 1900, Streator recorded an interesting visit from Dr. Victor Sterki. "28 Sept. Dr. Victor Sterki came about 7 A. M. -- he seems a pleasing gentleman -- we went up Camp Creek and collected in the A. M. *Sphaerium fabalis*, *Pisidium abditus*, a few *P. compressus* in the creek and in the Combs' swamp. Collected in the woods a species not determined. After dinner we went to a point on the Cuyahoga River near George Davis where we collected *Unio luteolus*, *gibbosus*, *nasuta*, *pressius*,

Margarita rugosa, *Anodonta*?, and *A. subcylindrica*, a few *Amnicola* and other univalves. In the evening we looked over the collection of shells. A most delightful day. -- 29 Sept. We examined my shells. Dr. Sterki corrected my Sphaeriidae as to names. In the P. M. we made a trip down to Camp Creek and at the pond in the village. Collected a few *Pisidium* - 8 species of the little brown shells. 30 Sept. Dr. Sterki and I went through the shells in a few draws. Cleaned a few clams and he made a few dissections which was very interesting to me. Dr. Sterki and I made a P.M. trip to the Mahoning River on the Ropes farm. Collected a few *Sphaerium striatinum* and *Pisidium compressum* and a couple of species of the stickleback fishes."

The following excerpts, concerned largely with the transfer of Streator's shell collection to Stanford, were written in 1909. "2 Feb., Santa Cruz, Calif. The collection has been accepted by Dr. (David Starr) Jordan and Trustees of Stanford University who will pay my expenses to go (to Ohio) and prepare it for shipment. 5 Feb. Note from Dr. Jordan desiring me to unpack the collection when it reaches the University. 17 Feb. Started for Garrettsville, Ohio. 26 Feb. Mr. Luther and I worked all day packing the land shells. 28 Feb. Mr. Luther and I finished packing the univalve shells. Wrapped a few unios. I went to make Roscoe (Webb) a brief visit in early evening. He is one of the finest men in an intellectually keen group I ever knew -- 33 years old -- a master of the great problems of life (in spite of being severely crippled). 1 Mar. With Mr. Luther's help, we worked at packing the unios. I finished the wrapping of them at about 9 P. M. I was so glad that the 5 days work was the end of the job. 2 Mar.

Mr. Luther and I finished packing, marking the box. In early A. M. the expressman took them to the station and the cabinet to Mr. Luther's. 11 Mar. Good-bye Garrettsville. Good-bye Ohio. (Streator never returned to Ohio or to shell collecting again). 16 Mar., Palo Alto, Calif. Met Prof. Smith the paleontologist and in his department unpacked the shells which were in excellent condition, but few of them mislaid or broken. I was refunded the expenses of the trip by a check of \$168.90 -- courtesy on every hand was extended to me since arriving here."

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LATE CENOZOIC NON-MARINE MOLLUSCAN ASSOCIATIONS
IN EASTERN NORTH AMERICA

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(Continued from STERKIANA 11: 50)

MANITOBA - 13. Large lakes having outlet streams. Their outstanding characteristic is that they are of moderate depth (commonly up to 30 m.), and that their shores are subject to severe wave action. (2) Shoal Lake, eastern Manitoba (Mozley, 1938: 132), exposed rocky shores of Indian Bay.

Freshwater lung-breathing Gastropods:

Physa "ancillaria"

MANITOBA - 14. Same as Manitoba-13, but: Shoal Lake, eastern Manitoba (Mozley, 1938: 132), sandy shore of Indian Bay somewhat exposed to wave action.

Freshwater lung-breathing Gastropods:

Lymnaea stagnalis lillianae

MANITOBA - 15. Same as Manitoba-13, but: Shoal Lake, eastern Manitoba (Mozley, 1938: 132), protected shore of Indian Bay.

Freshwater lung-breathing Gastropods:

Fossaria obrussa exigua

MANITOBA - 16. Same as Manitoba-13, but Falcon Bay, in quiet water, on sand bottom and in small marshes.

Naiades:

Anodonta "kennicotti"

Sphaeriidae:

Sphaerium crassum

Freshwater lung-breathing Gastropods:

Gyraulus "arcticus"

G. hirsutus

Helisoma anceps sayi

MANITOBA - 16 (cont.)

Helisoma campanulatum wisconsinense

H. trivolvis "pilsbryi"

Lymnaea stagnalis jugularis

Planorbula crassilabris

Promenetus exacuus

MANITOBA - 17. Same as Manitoba-13, but: Lake Brereton, on exposed rocky shores subject to severe wave action (Mozley, 1938: 132).

Freshwater lung-breathing Gastropods:

Helisoma anceps sayi

H. campanulatum wisconsinense

Lymnaea stagnalis sanctaemariae

Physa gyrina

MANITOBA - 18. Same as Manitoba-13, but: Lake Brereton, on partly protected rocky shores. (Mozley, 1938: 132).

Freshwater lung-breathing Gastropods:

Promenetus exacuus

Pseudosuccinea columella "casta"

MANITOBA - 19. Same as Manitoba-13, but: Lake Brereton, on partly protected sandy shores, chiefly on Potamogeton (Mozley, 1938: 133).

Freshwater gill-breathing Gastropods:

Amnicola limosa

MANITOBA - 20. Same as Manitoba-13, but: Lake Brereton, on Potamogeton and other plants in bays protected from wave action (Mozley, 1938: 133).

Sphaeriidae:

Pisidium adamsi

¹ The page number in parentheses is that of the complete paper; the one to the right of it is that of this number of STERKIANA.

MANITOBA-20 (cont.)

Freshwater lung-breathing Gastropods:

- Bulimnea megasoma*
- Planorbula crassilabris*

MANITOBA - 21. Same as Manitoba-13, but: Lake Brereton, in *Typha* marsh at the mouth of the Rennie River (Mozley, 1938: 133).

Sphaeriidae:

- Sphaerium securis*

Freshwater lung-breathing Gastropods:

- Bulimnea megasoma*
- Ferrissia parallela*
- Gyraulus "arcticus"*
- G. hirsutus*
- Helisoma anceps sayi*
- Physa gyrina*
- Promenetus exacuus*
- Stagnicola lanceata*

MANITOBA - 22. Same as Manitoba-13, but: Lake Winnipeg, near Victoria Beach, on shore stones and boulders subject to severe wave action (Mozley, 1938: 133).

Freshwater lung-breathing Gastropods:

- Stagnicola catascopium*
- S. emarginata*

MANITOBA - 23. Same as Manitoba - 13, but: Lake Winnipeg, near Victoria Beach, sandy shore, species cast up from deeper water (Mozley, 1938: 133).

Naiades:

- Anodonta "kennicotti"*
- Lampsilis radiata siliquoidea "rosacea"*
- L. ventricosa*

Sphaeriidae:

- Sphaerium transversum*

Freshwater gill-breathing Gastropods:

- Amnicola limosa "porata"*
- A. walkeri*
- Valvata tricarinata*

MANITOBA - 24. Same as Manitoba - 13, but: Lake Winnipeg, near Victoria Beach, small shallow sandy bay containing very little vegetation (Mozley, 1938: 133).

MANITOBA - 24 (cont.)

Sphaeriidae:

- Sphaerium nitidum*

Freshwater lung-breathing Gastropods:

- Stagnicola palustris*

MANITOBA - 25. Same as Manitoba-13, but: Lake Winnipeg, near Victoria Beach, large marsh partly cut off from the lake proper (Mozley, 1938: 133).

Sphaeriidae:

- Pisidium casertanum*
- Sphaerium lacustre "ryckholti"*
- S. partumeium*

Freshwater gill-breathing Gastropods:

- Valvata lewisi*

Freshwater lung-breathing Gastropods:

- Aplexa hypnorum*
- Fossaria dalli*
- Gyraulus "arcticus"*
- G. hirsutus*
- Helisoma trivolvis*
- Lymnaea stagnalis*
- Physa gyrina*
- Planorbula crassilabris*
- Stagnicola palustris*

MANITOBA - 26. Same as Manitoba-13, but: Grand Marais, shore of Lake Winnipeg, about 15 miles south of Victoria Beach (Mozley, 1938: 133).

Freshwater gill-breathing Gastropods:

- Campeloma decisum*

MANITOBA - 27. The following data apply to Nos. Manitoba 28-30: Intermittent streams: many contain no water during the period of mid-summer drought, and this, coupled with the great force of flood waters when the snow melts in the spring, has an unfavorable effect upon the molluscan fauna. In some instances, however, where the inclination of the bed of the intermittent stream is slight, so that the freshet has not too great a scouring effect, a few species find suitable conditions. Where this is so, large numbers of individuals may occur. (Mozley, 1938: 133-134).

ERRATA

In the first part of this paper (Late Cenozoic non-marine Molluscan associations in Eastern North America, *STERKIANA* 11: 13-50, 1963) I listed as Yarmouth in age 20 assemblages (Nos. Y-1 to Y-20, pp. 13-20) which are generally considered to be of Kansan age. They were listed as Yarmouth under the mistaken impression that the age correction had not yet appeared in print. Both Prof. Claude W. Hibbard of the University of Michigan and Dr. Dwight W. Taylor of the U.S. Geological Survey have called my attention to a paper by Hibbard (1954: 249-252) which I had unfortunately overlooked. This paper clearly sets forth the Kansan age of these assemblages.

I had intended discussing the age of these and other assemblages in a later part of my paper but since this section of the work will not appear for some time, I thought it advisable to rectify my erroneous age assignments immediately by inserting this note here.

The pertinent passage from Hibbard's paper (1954: 251) is quoted here in order to clear up any doubts and to rectify my erroneous age assignment. "The Pearllette molluscan faunal assemblage of Frye, Swineford, and Leonard (1948, p. 516); the Yarmouthian molluscan fauna of Leonard (1950, p. 41); the molluscan assemblages of the Sappa silts (Leonard, 1952, p. 8); and the mollusks in the Kansan deposits (Frye and Leonard, 1952, pp. 158-159) are one and the same in Kansas. The mollusks listed by Leonard (1950, p. 41) as restricted to the Yarmouthian are the same species as listed by Frye and Leonard (1952, pp. 158-159) as being restricted to the Kansan, except for one recent species included in the Yarmouthian list. These molluscan assemblages in Kansas are, in part, the Cudahy, Tobin, and Wilson Valley vertebrate and invertebrate faunas which were considered by Hibbard (1943, p. 244) as glacial faunas, as indicated by the vertebrates. After making a detailed study of these faunas, Hibbard (1944, p. 742) stated, "... it seems evident that the Cudahy, Tobin and Wilson Valley faunas lived

in western Kansas near the close of a glacial stage. " "

Because these data did not come to my attention before printing of the first part of my paper, they must, unfortunately, be tagged with the prefix "Y" in the remainder of this study, but the reader should understand that this age assignment is incorrect and a notation to that effect will be made wherever these assemblages are referred to in later parts of this paper.

References cited by Hibbard in the quotation given above are listed here to facilitate the work of those who might wish to examine them.

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MANITOBA - 28. Same as Manitoba-27, plus: A small intermittent stream draining a group of poplar groves near Birtle. (Mozley, 1938: 134).

Freshwater lung-breathing Gastropods:
Promenetus umbilicatellus

MANITOBA - 29. Same as Manitoba-27, plus: Catfish Creek, near Winnipeg (Mozley, 1938: 134).

Freshwater lung-breathing Gastropods:
Physa "gyrina hildrethiana"
Stagnicola palustris

MANITOBA - 30. Same as Manitoba-27, plus: A shallow ditch near Mile 69, G. W. W. D. Ry. (Mozley, 1938: 134).

Sphaeriidae:
Sphaerium occidentale
Freshwater lung-breathing Gastropods:
Fossaria obrussa exigua
Stagnicola palustris

MANITOBA - 31. Permanent streams of the non-mountainous region: A small brook running into the Grand Marais; examined at a point 2 miles east of Balsam Bay. (Mozley, 1938: 134).

Freshwater lung-breathing Gastropods:
Fossaria obrussa exigua
Gyraulus "arcticus"
Physa gyrina
Planorbula crassilabris
Stagnicola palustris

MANITOBA - 32. Permanent streams of the non-mountainous region: Muckle Creek, near Clandeboye. (Mozley, 1938: 134).

Freshwater gill-breathing Gastropods:
Valvata tricarinata
Freshwater lung-breathing Gastropods:
Gyraulus "arcticus"
Lymnaea stagnalis jugularis
Physa integra
Stagnicola palustris

MANITOBA - 33. Permanent streams of the non-mountainous region: La Salle River, near St. Norbert. (Mozley, 1938: 134).

MANITOBA-33, (cont.)

Freshwater gill-breathing Gastropods:
Amnicola sp.
Valvata tricarinata
Freshwater lung-breathing Gastropods:
Fossaria obrussa exigua
Gyraulus "arcticus"
Lymnaea stagnalis jugularis

MANITOBA - 34. Permanent streams of the non-mountainous region: Jackfish Creek, east of Balsam Bay. (Mozley, 1938: 134).

Freshwater lung-breathing Gastropods:
Gyraulus "arcticus"
G. hirsutus
Lymnaea stagnalis jugularis
Stagnicola palustris

MANITOBA - 35. Permanent streams of the non-mountainous region: Whiteshell River, below Cross Lake. (Mozley, 1938: 135).

Freshwater gill-breathing Gastropods:
Campeloma decisum
Freshwater lung-breathing Gastropods:
Aplexa hypnorum
Bulimnea megasoma
Gyraulus hirsutus
Lymnaea stagnalis jugularis
Promenetus exacuus
Stagnicola lanceata

MANITOBA - 36. Permanent streams of the non-mountainous region: Birdtail Creek, near Birtle, on bottom of stream. (Mozley, 1938: 135).

Naiades:
Anodonta grandis "footiana"
Lampsilis radiata siliquoidea "rosacea"
Lasmigona complanata katherinae
Strophitus rugosus
Freshwater lung-breathing Gastropods:
Ferrissia rivularis
Helisoma anceps
Physa integra

MANITOBA - 37. Same as Manitoba-36, but "in small marshy areas along the banks of the stream." (Mozley, 1938: 135).

MANITOBA-37 (cont.)

Freshwater lung-breathing Gastropods:

- Fossaria parva sterkii*
F. umbilicata
Stagnicola palustris

MANITOBA - 38. Permanent streams of the non-mountainous region: Red River, near Winnipeg. (Mozley, 1938: 135).

Naiades:

- Amblema costata*
Anodonta grandis "footiana"
Lampsilis radiata siliquoidea "rosacea"
L. ventricosa
Lasmigona complanata katherinae
Ligumia recta latissima
Proptera alata megaptera
Strophitus rugosus

MANITOBA - 39. Churchill; airfield area, about 5 miles east of the town, approximately lat. 58° 45' N. and long. 94° 05' W. The northern limit of coniferous forests is a few miles south of Churchill. Stunted spruce trees, along with larch, dwarf birch, and willow, grow on drier ground all the way to the coast, but the low ground is almost entirely muskeg covered with scattered tundra ponds. The mean annual precipitation is 13 inches, of which 10 inches falls as rain and the mean annual temperature at Churchill is about -8° C. (19° F.). Mean July temperature is 13° C. (55° F.), mean summer (June through September) temperature is -28° C. (-19° F.).

Permanently frozen ground is reported to be continuous and is found to a depth of about 140 feet ... Land mollusks were moderately abundant on sedges in the muskeg and around the edges of tundra pools, and on the drier slopes as high as 3.0 meters above the muskeg, where they were found beneath rotting spruce logs, flat rocks, and cardboard and crating lumber debris. Collection of 106 individuals, of which 8 species of land mollusks and one species of aquatic snail. (Wayne, 1959: 90-95).

MANITOBA-39 (cont.)

Freshwater lung-breathing Gastropods: No. spns.

| | |
|---|----|
| <i>Stagnicola</i> cf. <i>S. "arctica"</i> | 35 |
| Land Gastropods: | |
| <i>Columella alticola</i> | 1 |
| <i>Deroceras laeve</i> | 10 |
| <i>Euconulus fulvus</i> | 12 |
| <i>Pupilla muscorum</i> | 3 |
| <i>Succinea avara</i> | 15 |
| <i>Oxyloma verrilli</i> | 19 |
| <i>Vertigo alpestris oughtoni</i> | 10 |
| <i>V. binneyana</i> | 1 |

MICHIGAN - 1. Cheboygan County, beech-maple hardwoods, in humus and under logs. (Archer, 1936: 4). Abbreviations: c, common; f, frequent; r, rare. These abbreviations are used for Michigan 1-8; no data are given for many species.

Land Gastropods:

| | |
|--|---|
| <i>Anguispira alternata</i> | c |
| <i>Cionella lubrica</i> | |
| <i>Columella edentula</i> | |
| <i>Deroceras laeve</i> | |
| <i>Discus cronkhitei catskillensis</i> | c |
| <i>Euconulus chersinus</i> | r |
| <i>E. fulvus</i> | r |
| <i>Haplotrema concavum</i> | |
| <i>Helicodiscus parallelus</i> | c |
| <i>Mesodon sayanus</i> | r |
| <i>M. thymoidus</i> | |
| <i>Nesovitrea binneyana</i> | f |
| <i>Retinella indentata</i> | f |
| <i>R. rhoadsi</i> | |
| <i>Stenotrema fraternum</i> | c |
| <i>Strobilops labyrinthica</i> | c |
| <i>Succinea avara</i> | |
| <i>S. ovalis</i> | |
| <i>Triodopsis albolabris</i> | |
| <i>Vitrina limpida</i> | r |
| <i>Zonitoides arboreus</i> | c |
| <i>Zoögenetes harpa</i> | f |

MICHIGAN - 2. Cheboygan County, bog woods: present on low, wet, cold ground, with Thuja occidentalis, Abies balsamea, Picea mariana, and Acer rubrum. Around the bases of trees, on "log rafts," in moss, and among ferns are the following snails. (Archer, 1936: 5). For abbreviations, see Michigan-1.

Land Gastropods:

| | |
|------------------------------|---|
| <u>Anguispira alternata</u> | c |
| <u>Carychium exiguum</u> | f |
| <u>Haplotrema concavum</u> | |
| <u>Mesodon sayanus</u> | r |
| <u>Planogyra asteriscus</u> | f |
| <u>Stenotrema fraternum</u> | c |
| <u>Triodopsis albolabris</u> | |

MICHIGAN - 3. Cheboygan County, pine woods, belonging to one of the successional stages following lumbering and fires. Pinus strobus, P. resinosa, P. banksiana, with understory species Myrica asplenifolium, Panicum depauperatum, Pteris aquilina, Vaccinium pennsylvanicum, and V. canadense. Lichens and Kladonia rangiferina are of some importance to the snail, Anguispira alternata. The mollusks which occur in the pine woods are listed. (Archer, 1936: 5).

Land Gastropods:

| | |
|---------------------------------|---|
| <u>Anguispira alternata</u> | c |
| <u>Philomycus caroliniensis</u> | |
| <u>Retinella indentata</u> | c |
| <u>Stenotrema fraternum</u> | |
| <u>Zonitoides arboreus</u> | |

MICHIGAN - 4. Cheboygan County, aspen woods, prone to spring up very soon after fires; they immediately precede the pine succession. They consist of Populus tremuloides, P. grandidentata, Betula alba papyrifera, and Prunus pennsylvanica with understory plants Diervilla lonicera, Rhus glabra borealis, Gaylussacia haccata, Vaccinium pennsylvanicum, Rubus idaeus, Epigaea repens, Gaultheria procumbens, and Pteris aquilina. (Archer, 1936: 6).

Land Gastropods:

| | |
|--|---|
| <u>Anguispira alternata</u> | c |
| <u>Discus cronkhitei catskillensis</u> | c |

MICHIGAN-4 (cont.)

Philomycus carolinensis (appears where the aspens are somewhat mixed with pines near the shores of lakes).

| | |
|--------------------------------|---|
| <u>Retinella indentata</u> | f |
| <u>Stenotrema fraternum</u> | c |
| <u>Strobilops labyrinthica</u> | |
| <u>Triodopsis albolabris</u> | |
| <u>Zonitoides arboreus</u> | c |

MICHIGAN - 5. Cheboygan County, open lake shores: treeless or nearly treeless areas covered with sedges, reeds, and grasses; they include a part of the beach. Among the plants are Eleocharis palustris, Scirpus americanus, Juncus balticus littoralis, Potentilla anserina, and sometimes seedlings of Acer rubrum and Salix. (Archer, 1936: 6).

Land Gastropods:

| | |
|------------------------------|---|
| <u>Gastrocopta contracta</u> | r |
| <u>Oxyloma retusa</u> | |
| <u>Succinea avara</u> | c |
| <u>Zoögenetes harpa</u> | c |

MICHIGAN - 6. Cheboygan County, meadows: only one type of meadow has been observed, and this occurs in various of the old marl bays. (Archer, 1936: 6).

Land Gastropods:

| | |
|-----------------------------|---|
| <u>Anguispira alternata</u> | c |
| <u>Stenotrema leai</u> | c |

MICHIGAN - 7. Cheboygan County, pastures and old fields, a type of community which is artificial in origin. It is a community of grasses and weeds, among which are milkweed, sumac, mullein, and blackberry. Wherever the open country has been burned, fireweeds spring up. Occasional invaders from the forests, such as bracken, appear. Snails live in grass and weeds, and seek shelter under planks, palings, rotten logs, and around stumps. (Archer, 1936: 7).

Land Gastropods:

| | |
|--|---|
| <u>Anguispira alternata</u> | c |
| <u>Discus cronkhitei catskillensis</u> | f |
| <u>Helicodiscus parallelus</u> | |
| <u>Mesodon sayanus</u> | r |

MICHIGAN-7 (cont.)

| | |
|-----------------------|---|
| Stenotrema fraternum | c |
| Succinea ovalis | |
| Triodopsis albolabris | f |
| Zonitoides arboreus | |

MICHIGAN - 8. Cheboygan County, roadsides: have much the same flora as do the open fields, and are often indistinguishable from them in general ecological features. Since they frequently occur along the edges of woods, they may contain invading plants from the woodlands. The snail fauna is a little different from that of the previous community (Michigan-7). (Archer, 1936: 7).

Land Gastropods:

| | |
|---------------------------------|---|
| Anguispira alternata | c |
| Discus cronkhitei catskillensis | c |
| Helicodiscus parallelus | f |
| Stenotrema fraternum | c |
| Succinea ovalis | |
| Triodopsis albolabris | |
| Vertigo ventricosa | r |
| Zonitoides arboreus | |

MICHIGAN - 9. Delta County: northwestern portion of the peninsula lying between Little Bay de Noc and Big Bay de Noc; vegetation largely of jack pine, with a few scattered Norway pine, spruce, red oak, and aspen. Bedrock of Cincinnati limestone. The collection is scarcely large enough to yield significant percentages.

It is given here because of the unusual nature of the vegetation and the limestone bedrock which apparently permitted sufficient lime-content in the soil to afford suitable habitat for the snails. (van der Schalie, 1940: 367-369).

Land Gastropods: No. of spns.

| | |
|---------------------------------|----|
| Discus cronkhitei catskillensis | 6 |
| Euconulus chersinus | 4 |
| E. fulvus | 7 |
| Pallifera dorsalis | 1 |
| Retinella indentata | 1 |
| Stenotrema fraternum | 14 |
| Strobilops labyrinthica | 1 |
| Triodopsis albolabris | 12 |
| Zonitoides arboreus | 5 |

MICHIGAN - 10. Livingston County: Edwin S. George Reserve, aquatic succession, bog-lake community. The bog lakes are mere remnants of their former selves, and are certainly in the process of disappearing. They are normally full of water, but in severe summer droughts they have been known to dry up. They are bordered by various types of floating mats which are indented by open pools. These pools have an acidity ranging from pH 5.9 to 6.0, but the open water varies from neutral to pH 8.0. The vegetation consists of *Lemna trisulca* and *Nymphaea* sp. (Archer, 1939: 3, 4). Relative abundance is indicated by the following abbreviations which apply to Michigan 10 - 39: a, abundant; c, common; r, rare; no symbol: abundance between common and rare, or uncertain.

Sphaeriidae:

| | |
|----------------------|---|
| Pisidium sp. | r |
| Sphaerium partumeium | r |

Freshwater gill-breathing Gastropods:

Amnicola walkeri

Freshwater lung-breathing Gastropods:

| | |
|----------------------------|---|
| <i>Armiger crista</i> | r |
| <i>Ferrissia?</i> sp. | |
| <i>Gyraulus deflectus</i> | c |
| <i>G. hirsutus</i> | a |
| <i>G. parvus</i> | c |
| <i>Helisoma anceps</i> | |
| <i>Physa "elliptica"</i> | |
| <i>Planorbula armigera</i> | r |
| <i>Promenetus exacuus</i> | r |

MICHIGAN - 11. Livingston County: Edwin S. George Reserve; aquatic succession, tamarack-bog pool community. A small-sized community is found in the pools of the tamarack bogs. The pools dry up during the summer. (Archer, 1939: 4). For abbreviations, see Mich. -10.

Sphaeriidae:

Pisidium sp.

Freshwater lung-breathing Gastropods:

| | |
|------------------------|---|
| <i>Aplexa hypnorum</i> | r |
| <i>Fossaria dalli</i> | |
| <i>Gyraulus parvus</i> | |

MICHIGAN - 12. Livingston County: Edwin S. George Reserve; aquatic succession, Polygonum pool community. These rather large, shallow pools have gravelly bottoms. They are characterized by Polygonum amphibium and Iris sp. (Archer, 1939: 4). For abbreviations, see Michigan-10.

Freshwater lung-breathing Gastropods:

| | |
|-----------------------------|---|
| <u>Aplexa hypnorum</u> | a |
| <u>Physa "elliptica"</u> | r |
| <u>Planorbula armigera</u> | |
| <u>Stagnicola palustris</u> | c |

MICHIGAN - 13. Livingston County: Edwin S. George Reserve; aquatic succession, marsh pool community. The pools located in open marshy ground sometimes dry up during the summer. Their waters are filled with rotting wind-carried leaves, and some algae are present. (Archer, 1939: 4). For abbreviations, see Michigan-10.

Freshwater lung-breathing Gastropods:

| | |
|-----------------------------|---|
| <u>Aplexa hypnorum</u> | r |
| <u>Fossaria dalli</u> | c |
| <u>Stagnicola palustris</u> | |

MICHIGAN - 14. Livingston County: Edwin S. George Reserve; aquatic succession, woods pool community. During summer droughts at least, the pools located in oak-hickory woods dry up and are choked with decaying oak and hickory leaves. (Archer, 1939: 4, 5). For abbreviations, see Michigan-10.

Sphaeriidae:

Sphaerium partumeium

Freshwater lung-breathing Gastropods:

| | |
|-----------------------------|---|
| <u>Planorbula armigera</u> | |
| <u>Promenetus exacuus</u> | c |
| <u>Stagnicola palustris</u> | |

MICHIGAN - 15. Livingston County: Edwin S. George Reserve; bog succession, floating sedge-mat community. This community occurs in the vicinity of the bog lakes and at times merges into the cat-tail marshes. It is characterized by the dominance of Carex filiformis. (Archer, 1939: 5). For abbreviations, see Michigan-10.

MICHIGAN-15 (cont.)

Land Gastropods:

Oxyloma retusa

MICHIGAN - 16. Livingston County: Edwin S. George Reserve; bog succession, leatherleaf community. This community, like the preceding one, occurs along the borders of bog lakes; it also has the same relative constancy of water level. It is, however, more acid in character (pH not higher than 5.0). The vegetation is Chamaedaphne calyculata and Sphagnum sp. (Archer 1939: 5). For abbreviations, see Mich.-10.

Land Gastropods:

Oxyloma retusa

MICHIGAN - 17. Livingston County: Edwin S. George Reserve; bog succession, tamarack bog community. This is the first terrestrial community in the series. It is essentially a swamp woods type of community, having a boreal aspect. It is liable to flooding in the spring. The soil is rather acid (pH 5.0). The characteristic vegetation includes Larix laricina, Acer rubrum, Rhus vernix, Cornus stolonifera, and Vaccinium sp. (high-bush blueberry). (Archer, 1939: 5). For abbreviations, see Michigan-10.

Land Gastropods:

| | |
|----------------------------|---|
| <u>Euconulus chersinus</u> | |
| <u>Oxyloma retusa</u> | |
| <u>Striatura milium</u> | |
| <u>Succinea ovalis</u> | |
| <u>Vertigo ovata</u> | c |
| <u>Zonitoides arboreus</u> | r |

MICHIGAN - 18. Livingston County: Edwin S. George Reserve; bog succession, birch-maple community. This swamp woods type is located between the tamarack swamps and the oak-hickory or sassafras woods. Soil tests show an acidity of pH 5.9 or 6.0. The community is subject to fluctuations in water level, such as flooding in the fall following droughts. The vegetation is characterized by Betula lutea, Acer rubrum, Vaccinium sp., and ferns. Mollusks are not common here, and only small species occur. (Archer, 1939: 5, 6). For abbreviations, see Michigan-10.

MICHIGAN-18 (cont.)

Land Gastropods:

| | |
|-----------------------------|---|
| <i>Euconulus chersinus</i> | |
| <i>Gastrocopta pentodon</i> | r |
| <i>Punctum minutissimum</i> | |
| <i>Striatura exigua</i> | r |
| <i>S. milium</i> | |
| <i>Vertigo ventricosa</i> | r |

MICHIGAN - 19. Livingston County: Edwin S. George Reserve; marsh succession, sedge marsh community. In this community the water level fluctuates; it differs in this respect from the floating sedge-mat community (Mich. -15). It is a terrestrial community located in low valleys, and is not in any way associated with the bog lakes. The predominant vegetation is *Carex filiformis*. (Archer, 1939: 6)¹

Land Gastropods:

| | |
|-----------------------|---|
| <i>Oxyloma retusa</i> | c |
| <i>Vertigo ovata</i> | |

MICHIGAN - 20. Livingston County: Edwin S. George Reserve; marsh succession, grass marsh community. This community is more completely terrestrial than the preceding one, and is dominated by tall grasses. It possesses a larger fauna than that of the sedge marshes. Ant nests are very common here. (Archer, 1939: 6)¹

Land Gastropods:

| | |
|-----------------------------|---|
| <i>Carychium exiguum</i> | c |
| <i>Euconulus chersinus</i> | r |
| <i>Nesovitrea electrina</i> | |
| <i>Strobilops affinis</i> | |
| <i>Succinea ovalis</i> | |
| <i>Zonitoides arboreus</i> | r |

MICHIGAN - 21. Livingston County: Edwin S. George Reserve; marsh succession, fern meadow community; located between Michigan-20, above, and the bases of eskers and moraines. It is characterized by the sensitive, chain, and marsh ferns, thistles, and grasses. Here, for the first time in this succession, the larger species of snails are found. (Archer, 1939: 6)¹

¹ For abbreviations, see Michigan-10.

MICHIGAN-21 (cont.)

Land Gastropods:

| | |
|------------------------------|---|
| <i>Euconulus chersinus</i> | r |
| <i>Gastrocopta contracta</i> | r |
| <i>Retinella indentata</i> | |
| <i>Stenotrema fraternum</i> | r |
| <i>S. hirsutum</i> | c |
| <i>Strobilops affinis</i> | r |
| <i>Triodopsis albolabris</i> | |

MICHIGAN - 22. Livingston County: Edwin S. George Reserve; marsh succession, willow-red osier-dogwood community. This community is located on low ground often near the larger pools, and is characterized by a shrubby cover of *Salix* sp., *Cornus stolonifera*, *C. paniculata*, and *Betula glandulosa*. The topsoil is black humus. (Archer, 1939: 7).¹

Land Gastropods:

| | |
|------------------------------|---|
| <i>Carychium exiguum</i> | r |
| <i>Deroceras laeve</i> | |
| <i>Euconulus chersinus</i> | r |
| <i>Gastrocopta contracta</i> | |
| <i>Hawaiiia minuscula</i> | |
| <i>Succinea avara</i> | |
| <i>Triodopsis albolabris</i> | |
| <i>Vertigo ovata</i> | |

MICHIGAN - 23. Livingston County: Edwin S. George Reserve; sand succession, sassafras community. This community, which begins a series of typically terrestrial communities, is located on predominantly sandy soils having a mixture of clays and coarser materials. The soil of the sassafras community has a pH of about 6.0. The vegetation is chiefly *Sassafras variifolium*, *Gaylussacia* sp., *Vaccinium* sp., *Vitis aestivalis*, *Pteris aquilina*, and ferns. A few *Quercus bicolor* and *Acer rubrum* are present at the lower borders of the community, which sometimes tend to shade off into a pyric succession of *Populus tremuloides*, *Rubus* sp., and *Equisetum arvense*. (Archer, 1939: 7).¹

Land Gastropods:

| | |
|------------------------------|---|
| <i>Anguispira alternata</i> | r |
| <i>Euconulus chersinus</i> | r |
| <i>Gastrocopta contracta</i> | r |

MICHIGAN-23 (cont.)

| | |
|----------------------|---|
| Stenotrema fraternum | r |
| Sriatura milium | |
| Zonitoides arboreus | |

MICHIGAN - 24. Livingston County: Edwin S. George Reserve; sand succession, oak-hickory community. This type of community is of wide extent and is located on moraines, eskers, and slopes too steep for satisfactory cultivation. It is the closest approach to a climax plant association in the area. The soil is somewhat calcareous, and has a pH of about 7.0. The community may be divided into three parts: Part 1: a wet zone at the base of the slopes borders the large pools. The vegetation consists chiefly of Ulmus americana, Quercus alba, and Cornus stolonifera. (Archer, 1939: 7-8).¹

Land Gastropods:

| | |
|--------------------|---|
| Oxyloma retusa | |
| Zonitoides nitidus | a |

MICHIGAN - 25. Livingston County: Edwin S. George Reserve: sand succession, oak-hickory community. For general description, see Michigan-24, above; part 2: the zone of the richer slopes has a vegetation made up of Quercus alba, Q. borealis maxima, Hicoria ovata, H. glabra, Acer saccharum, Prunus serotina, Cornus florida, Hamamelis virginiana, Podophyllum peltatum, Smilacina racemosa, Geranium maculatum, Viola spp., and ferns. (Archer, 1939: 8).¹

Land Gastropods:

| | |
|-------------------------|---|
| Anguispira alternata | |
| Carychium exiguum | |
| Euconulus chersinus | |
| Gastrocopta contracta | r |
| G. corticaria | |
| G. pentodon | c |
| Hawaiiia minuscula | r |
| Helicodiscus parallelus | c |
| Nesovitrea electrina | |
| Oxyloma retusa | r |
| Philomycus carolinianus | r |

MICHIGAN-25 (cont.)

| | |
|-----------------------|---|
| Philomycus rushi | |
| Punctum minutissimum | a |
| Retinella indentata | c |
| Stenotrema fraternum | |
| S. hirsutum | |
| Sriatura milium | r |
| Succinea ovalis | r |
| Triodopsis albolabris | |
| Ventridens suppressus | r |
| Zonitoides arboreus | |

MICHIGAN - 26. Livingston County: Edwin S. George Reserve; sand succession, oak-hickory community (for general description, see Michigan 24, above); part 3: the upper zone is dry and is more affected by fires than are the other zones. The vegetation is about the same as that lower down, but the mandrake and the ferns are lacking. Many of the mollusks of the preceding zone do not appear here. (Archer, 1939: 8).¹

Land Gastropods:

| | |
|-------------------------|---|
| Anguispira alternata | r |
| Euconulus chersinus | |
| Gastrocopta contracta | r |
| G. pentodon | |
| Helicodiscus parallelus | r |
| Nesovitrea electrina | |
| Philomycus rushi | |
| Punctum minutissimum | c |
| Retinella indentata | |
| Stenotrema fraternum | |
| Triodopsis albolabris | r |
| Zonitoides arboreus | |

MICHIGAN - 27. Livingston County: Edwin S. George Reserve; fire and clearing succession, oak-savanna community. This community, a modification of the preceding one, has been considerably cut over and fired. The trees are very much scattered, and the ground is covered with a carpet of grass and weeds. The vegetation consists of the usual oaks and hickories, Hamamelis virginiana, Vitis aestivalis, Galium aparine, Geranium maculatum, Smilacina racemosa, Fragaria virginiana, Poa, and other grasses. (Archer, 1939: 8-9).¹

¹ For abbreviations, see Michigan-10.

MICHIGAN-27 (cont.)

Land Gastropods:

| | |
|-----------------------|---|
| Anguispira alternata | c |
| Nesovitrea electrina | |
| Retinella indentata | |
| Stenotrema fraternum | |
| Triodopsis albolabris | |
| Ventridens suppressus | c |
| Zonitoides arboreus | c |

MICHIGAN - 28. Livingston County: Edwin S. George Reserve; fire and clearing succession, aspen-shrub community. This is the lowland equivalent of the preceding community (Michigan-27), as far as the factors of fire and clearing are concerned. It evidently belongs to a lowland woods succession, and the vegetation consists of Populus tremuloides, Ulmus americana, Acer rubrum, Cornus stolonifera, Viburnum alnifolium (?), and Vitis aestivalis. Inasmuch as this community is the woodland border type, the number of species is relatively large, and some of the largest-sized species here reach what is almost their maximum of abundance. (Archer, 1939: 9).¹

Land Gastropods:

| | |
|-----------------------|---|
| Anguispira alternata | c |
| Deroceras laeve | |
| Euconulus chersinus | |
| Hawaiiia minuscula | r |
| Philomycus rushi | |
| Retinella indentata | |
| Stenotrema fraternum | |
| S. hirsutum | |
| Succinea ovalis | c |
| Triodopsis albolabris | c |
| Ventridens suppressus | r |
| Zonitoides arboreus | |

MICHIGAN - 29. Livingston County: Edwin S. George Reserve; fire and clearing succession, lowland grass banks. This community occurs on banks along paths and the borders of pools in open clearings close to the preceding one but on slightly higher ground. (Archer, 1939: 9)¹

¹ For abbreviations, see Michigan-10.

MICHIGAN-29 (cont.)

Land Gastropods:

| | |
|-----------------------|---|
| Anguispira alternata | |
| Philomycus rushi | |
| Retinella indentata | |
| Stenotrema fraternum | c |
| S. hirsutum | c |
| Succinea ovalis | |
| Triodopsis albolabris | c |

MICHIGAN - 30. Livingston County: Edwin S. George Reserve; artificial communities, ditch community. This community occurs on ground that has been strongly altered by direct human factors. Here for the first time we find a species introduced by man. The vegetation consists of grasses, Rubus idaeus, and Iris sp. The ditch is a terrestrial habitat and is dry most of the time. (Archer, 1939: 9-10).¹

Land Gastropods:

| | |
|-----------------------|---|
| Cionella lubrica | r |
| Deroceras reticulatum | |
| Discus cronkhitei | |
| Stenotrema leai | c |
| Zonitoides nitidus | c |

MICHIGAN - 31. Livingston County: Edwin S. George Reserve; artificial communities, orchard community. Four rather old orchards are located on summit areas and characterized by apple trees, grasses, Rhus glabra, brambles, and wild roses. (Archer, 1939: 10-11).¹

Land Gastropods:

| | |
|----------------------|---|
| Anguispira alternata | r |
| Cionella lubrica | r |
| Deroceras laeve | |
| D. reticulatum | |
| Euconulus chersinus | |
| Stenotrema fraternum | r |
| Vallonia pulchella | |
| Zonitoides arboreus | c |

MICHIGAN - 32. Livingston County: Edwin S. George Reserve; artificial communities, roadside community. This is one of the most natural of the artificial communities. The two types intergrade. Nevertheless, this community appears

MICHIGAN - 32 (cont.)

to be a special modification of the ruderal type. It is not much subject to disturbance, and moreover it seems to be a highway for the dispersal of species in the culture zone. The vegetation is chiefly made up of grasses, tall annual weeds, brambles, Tanacetum vulgare, Rhus toxicodendron, R. glabra, Vitis aestivalis, Fragaria virginiana, Crataegus sp., with a few isolated Syringa vulgaris, elms, wild cherries, and white oaks. (Archer, 1939: 10).¹

Land Gastropods:

| | |
|--------------------------------|---|
| <u>Anguispira alternata</u> | |
| <u>Deroceras laeve</u> | |
| <u>Euconulus chersinus</u> | r |
| <u>Gastrocopta armifera</u> | c |
| <u>G. contracta</u> | r |
| <u>G. pentodon</u> | c |
| <u>Hawaiiia minuscula</u> | |
| <u>Helicodiscus parallelus</u> | r |
| <u>Philomycus rushi</u> | |
| <u>Punctum minutissimum</u> | r |
| <u>Pupoides albilabris</u> | r |
| <u>Retinella indentata</u> | |
| <u>Stenotrema fraternum</u> | c |
| <u>Succinea avara</u> | r |
| <u>S. ovalis</u> | |
| <u>Triodopsis albolabris</u> | r |
| <u>Vallonia costata</u> | |
| <u>V. pulchella</u> | c |
| <u>Ventridens suppressus</u> | |
| <u>Zonitoides arboreus</u> | |

MICHIGAN - 33. Livingston County: Edwin S. George Reserve; artificial communities, open-field communities, subdivision slopes and valleys. The most favorable type of open field community is to be found on the slopes and in the drier valley bottoms. The best mollusk habitats are in the relatively undisturbed fields having a sandy, calcareous soil (sometimes mixed with till). The best indicator of this optimum type of terrain is the presence of red cedars. The poorest habitat complex is to be found on east slopes which have considerable

¹ For abbreviations, see Michigan - 10.

MICHIGAN-33 (cont.)

ground water; it is indicated by Equisetum hyemale. In general aspect these fields are characterized by open grassy areas dotted with patches of wild grape and old field growths of Juniperus virginiana, a few scattered hickories, elms, ash, and white oaks. Important vegetation cover includes Ostrya virginiana, Juniperus depressa, Rubus spp., Arctium minus, Leonurus cardiaca, Verbascum thapsus, grasses, and mosses. On the best types of land the mollusks occur with a frequency of about 5 individuals a square foot, or about 217,800 an acre. (Archer, 1939: 11)¹

Land Gastropods:

| | |
|--------------------------------|---|
| <u>Anguispira alternata</u> | c |
| <u>Deroceras laeve</u> | |
| <u>Euconulus chersinus</u> | |
| <u>Gastrocopta armifera</u> | c |
| <u>G. contracta</u> | r |
| <u>G. pentodon</u> | |
| <u>Hawaiiia minuscula</u> | |
| <u>Helicodiscus parallelus</u> | |
| <u>Nesovitrea electrina</u> | |
| <u>Philomycus rushi</u> | |
| <u>Punctum minutissimum</u> | r |
| <u>Pupoides albilabris</u> | |
| <u>Retinella indentata</u> | r |
| <u>Stenotrema fraternum</u> | c |
| <u>Succinea avara</u> | r |
| <u>S. ovalis</u> | |
| <u>Triodopsis albolabris</u> | |
| <u>Vallonia pulchella</u> | c |
| <u>Ventridens suppressus</u> | c |
| <u>Zonitoides arboreus</u> | |

MICHIGAN - 34. Livingston County: Edwin S. George Reserve; artificial communities, open-field communities, subdivision summits. The upland areas comprise open eroded uplands of sands and clays. Although cultivation and grazing have ceased on the summits and the slopes below, there is some browsing pressure exerted by deer, as indicated by the lack of any young ground hemlock (Juniperus depressa). Undoubtedly, the summits will be the last areas to revert to forest cover. The vegetation is characterized by grasses, mullein, milkweed, brambles, Rhus typhina, R.

MICHIGAN-34 (cont.)

glabra, Lespedeza, Tanacetum vulgare, and a few thickets of sassafras, oak, and hickory saplings. None of the mollusks are very abundant here. (Archer, 1939: 11-12).¹

Land Gastropods:

| | |
|-------------------------|---|
| Deroceras laeve | |
| Euconulus chersinus | |
| Gastrocopta pentodon | |
| Hawaiiia minuscula | |
| Helicodiscus parallelus | |
| Nesovitrea electrina | |
| Stenotrema fraternum | r |
| Succinea avara | |
| Triodopsis albolabris | r |
| Vallonia pulchella | |
| Zonitoides arboreus | |

MICHIGAN - 35. Livingston County: Edwin S. George Reserve; artificial communities, cultivated field community. No cultivated fields occur within the grounds of the Reserve today, but a good example of this community is to be found across the road on the south side of the property. Although snails and slugs are scarce or absent on recently plowed land, they are apt to be rather common on fallow land among the weeds. (Archer, 1939: 12).¹

Land Gastropods:

| | |
|----------------------|---|
| Deroceras laeve | r |
| Gastrocopta armifera | c |
| Vallonia costata | |
| V. pulchella | c |

MICHIGAN - 36. Livingston County: Edwin S. George Reserve; artificial communities, pasture community. Examples of this type of community are to be found adjacent to the preceding community. Most of them are overgrazed, and the grass cover has been partly replaced by other types of weeds. Snails are apt to be scarce in such pastures except where thickets of brambles, wild grape, thistles, witch hazel, and stumps and logs furnish protection. (Archer, 1939: 12).¹

¹ For abbreviations, see Michigan - 10.

MICHIGAN-36 (cont.)

Land Gastropods:

| | |
|-----------------------|---|
| Anguispira alternata | |
| Deroceras laeve | |
| Gastrocopta pentodon | r |
| Stenotrema hirsutum | |
| Oxyloma retusa | |
| Succinea avara | |
| Triodopsis albolabris | r |
| Zonitoides arboreus | |

MICHIGAN - 37. Livingston County: Edwin S. George Reserve; artificial communities, pasture pool community. The pools located in the pastures of Michigan - 36 are subject to some trampling by cattle that come for water. (Archer, 1939: 13).¹

Freshwater lung-breathing Gastropods:

| | |
|----------------------|---|
| Aplexa hypnorum | r |
| Fossaria parva | |
| Stagnicola palustris | |

MICHIGAN - 38. Livingston County: Edwin S. George Reserve; artificial communities, edificarian community. Although mollusks in southern Michigan seldom invade houses there are a few species that are associated with sheds and outhouses. A larger fauna is associated with the ruined foundations and cellars of old houses, and since these present xeric conditions, it is of interest to note the fauna that affects such habitats. There are very few buildings maintained in the Reserve, but under boards, stones, and bricks of a ruined farmhouse in the southwest corner of the area three species occur. (Archer, 1939: 13).¹

Land Gastropods:

| | |
|---------------------|---|
| Euconulus chersinus | |
| Vallonia pulchella | c |
| Zonitoides arboreus | c |

MICHIGAN - 39. Livingston County: Edwin S. George Reserve; erosion communities, rock piles and gullies. The sandy soil in Livingston County is somewhat susceptible to rapid erosion on unprotected slopes and seems to have a high ratio of silicon to iron and aluminum (molecular

MICHIGAN-39 (cont.)

ratio higher than 2). Most of the more actively eroding gullies on the Reserve have either been blocked by piles of rocks or else are being protected by a growth of grass or willow saplings. The rock piles are often overgrown by brambles and wild grape. (Archer, 1939: 13).¹

Land Gastropods:

| | |
|--------------------------------|---|
| <i>Anguispira alternata</i> | c |
| <i>Euconulus chersinus</i> | |
| <i>Hawaiia minuscula</i> | |
| <i>Helicodiscus parallelus</i> | |
| <i>Stenotrema fraternum</i> | |
| <i>Zonitoides arboreus</i> | |

MICHIGAN - 40. Delta County: banks of the Bark River, about 5.5 miles southeast of the town of Bark River. (van der Schalie, 1939: 3). This list is of interest for two reasons; first because of the careful listing of associates of *Hendersonia occulta* in the northernmost reaches of its range, and second because of the quantitative data given. The percentages calculated, based on 116 individuals, are only approximate since no statement is made on the number of *H. occulta* collected and only its associates are listed.

Freshwater gill-breathing Gastropods:

| | |
|----------------------------------|------|
| <i>Campeloma decisum</i> (drift) | 0.85 |
|----------------------------------|------|

Land Gastropods:

| | |
|--|-------|
| <i>Allogona profunda</i> | 7.75 |
| <i>Anguispira alternata</i> | 17.25 |
| <i>Cionella lubrica</i> | 0.85 |
| <i>Columella edentula</i> | 0.85 |
| <i>Deroceras laeve</i> | 2.58 |
| <i>Discus cronkhitei catskillensis</i> | 14.66 |
| <i>Euconulus chersinus polygyratus</i> | 1.73 |
| <i>Gastrocopta contracta</i> | 0.85 |
| <i>Helicodiscus parallelus</i> | 3.45 |
| <i>Hendersonia occulta</i> | - |
| <i>Nesovitrea binneyana</i> | 5.18 |
| <i>Oxyloma retusa</i> | 1.73 |
| <i>Stenotrema fraternum</i> | 1.73 |
| <i>Strobilops labyrinthica "virgo"</i> | 6.04 |
| <i>Succinea avara</i> | 1.73 |

¹ For abbreviations, see Michigan - 10.

MICHIGAN-40 (cont.)

| | |
|------------------------------|-------|
| <i>Triodopsis albolabris</i> | 3.45 |
| <i>Vertigo elatior</i> | 3.45 |
| <i>Zonitoides arboreus</i> | 25.87 |

MICHIGAN - 41. Huron River, habitat type 1: Lakes without an outlet, and lacking solid shoals. This type of marshy lake is surrounded by very soft shoals on which only shells of the "floater" type seem to be able to live. There are not many of these lakes in the Huron River drainage. Two examples, Harvey Lake and Wolverine Lake, may be cited. Such lakes harbor but one species, ... a thin-shelled swollen form, capable of maintaining itself on a soft substratum. (van der Schalie, 1938: 24 and table III, p. 29). The study just cited was concerned only with the Naiades. It is scarcely necessary to mention that Sphaeriidae and freshwater gastropods also occur in these associations (Michigan 41-54).

Naiades:

| | |
|-------------------------|--------|
| <i>Anodonta grandis</i> | common |
|-------------------------|--------|

MICHIGAN - 42. Huron River, habitat type 2: Lakes without an outlet and having at least one firm shoal. The shoal may be composed of sand or gravel, or a combination of both, or, at times, a mixture of fine sand, mud, and marl. The important condition, however, is that there be a firm shoal, the texture of which is not too hard for the mussels to embed themselves in and move through. A majority of the lakes in the system belong to this type. Examples are: Duck, Grass, Wild Goose, Pleasant, Cedar, Cooley, Oxbow, and Whitmore lakes. Invariably the fauna of a lake of this kind consists of only two species. (van der Schalie, 1938: 24 and table III, p. 29).

Naiades:

| | |
|--------------------------------------|----------|
| <i>Anodonta grandis</i> | common |
| <i>Lampsilis radiata siliquoidea</i> | abundant |

MICHIGAN - 43. Huron River, habitat type 3: Larger lakes having a sizable outlet, and usually, an inlet. In these lakes there are usually more or less firm shoals composed of sand and

MICHIGAN-43 (cont.)

gravel, or of a fine mud. White, Reed, and Union are lakes of this type. They produce, in addition to the two species common to lakes of Type 2, a third species.

Naiades:

| | |
|--------------------------------------|--------|
| <i>Anodonta grandis</i> | common |
| <i>Lampsilis radiata siliquoidea</i> | " |
| <i>L. ventricosa</i> | rare |
| <i>Strophitus undulatus</i> | common |

MICHIGAN - 44. Huron River, habitat type 4: Lakes arranged to form a chain series. These might well be classed under the previous type (Type 3), because most of the physical and chemical conditions are the same. Yet, in such lakes we find a slight change in the fauna in that *Strophitus undulatus*, though it may be present, often is not. In its stead is *Lampsilis ventricosa* (Barnes), a species common to the river, but entering lakes arranged in a chain series. An example of such a series of lakes is Lower, Middle, and Upper Straits. (van der Schalie, 1938: 24-25, and table III, p. 29).

Naiades:

| | |
|--------------------------------------|--------|
| <i>Anodonta grandis</i> | common |
| <i>Lampsilis radiata siliquoidea</i> | common |
| <i>L. ventricosa</i> | common |
| <i>Strophitus undulatus</i> | rare |

MICHIGAN - 45. Huron River, habitat type 5: Lakes of the river-lake type. R. E. Coker (1914: 9) has defined this type of lake as follows: "By 'river-lake,' I mean such a body of relatively still water as would ordinarily be called a lake, which is yet intimately connected with a river, either as interpolated in the course of a river, or as an arm of a river." Within the Huron drainage there are several of these lakes: Commerce, Proud, Strawberry, Gallagher, Whitewood, and Base Line. Each of these appears as an expansion of the river. The physical features are, for the most part, similar to those of other lakes, but the one outstanding distinction is regular renewal of water. There is a marked increase in the number of species. (van der Schalie, 1938: 25 and table III, p. 29).

MICHIGAN-45 (cont.)

Naiades:

| | |
|--------------------------------------|--------|
| <i>Anodonta grandis</i> | common |
| <i>Dysnomia triquetra</i> | rare |
| <i>Elliptio dilatatus</i> | rare |
| <i>Lampsilis radiata siliquoidea</i> | common |
| <i>L. ventricosa</i> | common |
| <i>Strophitus undulatus</i> | common |
| <i>Villosa iris</i> | rare |

MICHIGAN - 46. Huron River, habitat type 6: Very small creeks or brooks, about three feet wide. Creeks which seem almost too small to be of any faunistic significance, with mud, sand, or a sand and gravel bottom, constitute this type. Ordinarily, such streams yield very little, but they may contain one species, provided they have a constant flow such as would be supplied by a permanent spring. Within the drainage there are two examples of this type which have been investigated, Brewery Creek, which flows into the Huron at Ann Arbor, and a small creek north of Williamsville Lake in Livingston County. Both have yielded *Lasmigona compressa*. Where such a stream becomes just a little larger, *Anodontoides ferussacianus* is usually added to the fauna. (van der Schalie, 1938: 25 and table III, p. 29).

Naiades:

| | |
|-----------------------------------|--------|
| <i>Anodontoides ferussacianus</i> | rare |
| <i>Lasmigona compressa</i> | common |

MICHIGAN - 47. Huron River, habitat type 7: small creeks, about ten feet in width. Creeks of this type have a depth of one to three feet, a constant supply of clear water, and flow over a mud, sand, or sand and gravel bottom. Examples are: Davis Creek and Honey Creek above Pinckney, both in Livingston County, and Fleming Creek, Washtenaw County. The fauna of these streams is very characteristic and usually includes all or any of four species. (van der Schalie, 1938: 25 and table III, p. 29).

Naiades:

| | |
|-----------------------------------|----------|
| <i>Alasmidonta calceolus</i> | abundant |
| <i>Anodontoides ferussacianus</i> | abundant |
| <i>Lasmigona compressa</i> | abundant |

MICHIGAN-47 (cont.)

| | |
|-----------------------------|--------|
| <i>Strophitus undulatus</i> | common |
| <i>Villosa iris</i> | rare |

MICHIGAN - 48. Huron River, habitat type 8: Large creeks having a width of about ten feet. These streams have a depth of one to three feet; the bottom is mud, sand, sand and gravel, or glacial till. This type has practically the same conditions as the one which precedes it, but it differs mainly in size. In fact, the headwaters of a creek may be of Type 7, while the lower reaches may become Type 8. This is true of Honey Creek, above and below Pinckney. The lower reaches of Mill Creek, Washtenaw County, also belong to this type. With an increase in size, two species are added. Whereas normally four species live in a stream of Type 7, six commonly inhabit a stream of Type 8. (van der Schalie, 1938: 26 and table III, p. 29).

Naiades

| | |
|--------------------------------------|----------|
| <i>Alasmidonta calceolus</i> | abundant |
| <i>A. marginata</i> | rare |
| <i>Anodonta grandis</i> | rare |
| <i>Anodontoides ferussacianus</i> | common |
| <i>Elliptio dilatatus</i> | common |
| <i>Lampsilis radiata siliquoidea</i> | rare |
| <i>Lasmigona compressa</i> | common |
| <i>Strophitus undulatus</i> | common |
| <i>Villosa iris</i> | common |

MICHIGAN - 49. Huron River, habitat type 9: small river. These conditions are exhibited in Portage River, Livingston County, and in the Huron River from Commerce Lake through Milford to the backwaters of Kent Lake. Much variation exists in such long stretches of river and yet the general habitat conditions and the fauna are rather typical in these areas. The stream has now assumed the appearance of a small river. It has a width of twenty to fifty feet, and there is an abundant supply of water which flows uniformly at a rate of four to five miles an hour over a solid bottom of sand and gravel and a mixture of mud and sand. The depth is not uniform, varying from broad shoal areas covered with only six inches of water to pools four or five feet

MICHIGAN-49 (cont.)

deep and lined with sand or mud. There is a remarkable increase in the number of species which occupy such a habitat. Not only do all the species common to the larger creeks remain, but also several which are characteristic of small-river conditions are added. (van der Schalie, 1938: 26 and table III, p. 29).

Naiades:

| | |
|------------------------------------|----------|
| <i>Alasmidonta calceolus</i> | rare |
| <i>A. marginata</i> | common |
| <i>Anodonta grandis</i> | rare |
| <i>A. imbecillis</i> | rare |
| <i>Anodontoides ferussacianus</i> | common |
| <i>Dysnomia triquetra</i> | rare |
| <i>Elliptio dilatatus</i> | abundant |
| <i>Lampsilis fasciola</i> | abundant |
| <i>L. radiata siliquoidea</i> | rare |
| <i>L. ventricosa</i> | rare |
| <i>Lasmigona compressa</i> | common |
| <i>Ptychobranchnus fasciolaris</i> | abundant |
| <i>Strophitus undulatus</i> | common |
| <i>Villosa iris</i> | abundant |

MICHIGAN - 50. Huron River, habitat type 10: medium-sized river. Conditions of this character are exhibited in the part of the main river which lies between the Ann Arbor-Brighton highway (U. S. 23) bridge north of Whitmore Lake and the backwaters of Strawberry Lake. The river here has a width of from fifty to seventy feet. There is a steady current which flows about four miles an hour over the shoals and becomes very sluggish where the river widens and deepens in the marshy areas. The solid shoals are largely composed of a mixture of gravel and sand, and the vegetation is typically sparse. Under such conditions the largest number of mussels, both in species and in individuals, are found. In other places the bottom becomes somewhat irregular and is then often composed of patches of weed on a muddy substratum. These situations are usually less productive. There are also areas where the shores become marshy, the river deepens, the bottom is covered with a dense mat of vegetation, and the current is sluggish. Usually, such places harbor considerably fewer species

MICHIGAN-50 (cont.)

than do the hard shoals. (van der Schalie, 1938: 27 and table III, p. 29).

Naiades:

| | |
|-----------------------------------|----------|
| <i>Alasmidonta marginata</i> | common |
| <i>A. calceolus</i> | rare |
| <i>Anodonta grandis</i> | rare |
| <i>Dysnomia triquetra</i> | common |
| <i>Elliptio dilatatus</i> | abundant |
| <i>Lampsilis fasciola</i> | common |
| <i>L. radiata siliquoidea</i> | rare |
| <i>L. ventricosa</i> | common |
| <i>Lasmigona compressa</i> | rare |
| <i>L. costata</i> | common |
| <i>Ligumia recta latissima</i> | rare |
| <i>Ptychobranthus fasciolaris</i> | common |
| <i>Strophitus undulatus</i> | common |
| <i>Villosa iris</i> | abundant |

MICHIGAN - 51. Huron River, habitat type 11: river of fairly large size. This zone, found in the region between the outlet of Base Line Lake and Ann Arbor, somewhat resembles that discussed under Type 10. It differs in that the river is without the pools, the low marshy areas, and the lake-like river expansions common to that zone. The water, except when artificially dammed, flows over a hard bottom of stones, coarse gravel, and sand. Rapids occur in several places. The width varies from 90 to 125 feet, and the depth in the productive areas is six inches to about four feet. The vegetation in these areas is sparse. The list of species is similar to that given under Type 10, but with the addition of *Cyclonaias tuberculata*, which is abundant among the stones and coarse gravel in the rapids. Some of the species enumerated under Type 10 become scarce in this zone. (van der Schalie 1938: 27 and table III, p. 29).

Naiades:

| | |
|-------------------------------|----------|
| <i>Alasmidonta marginata</i> | rare |
| <i>Anodonta grandis</i> | rare |
| <i>A. imbecillis</i> | rare |
| <i>Cyclonaias tuberculata</i> | abundant |
| <i>Dysnomia triquetra</i> | rare |
| <i>Elliptio dilatatus</i> | abundant |
| <i>Lampsilis fasciola</i> | common |

MICHIGAN-51 (cont.)

| | |
|-----------------------------------|--------|
| <i>L. radiata siliquoidea</i> | rare |
| <i>L. ventricosa</i> | rare |
| <i>Lasmigona costata</i> | rare |
| <i>Ligumia recta latissima</i> | rare |
| <i>Ptychobranthus fasciolaris</i> | common |
| <i>Strophitus undulatus</i> | rare |
| <i>Villosa iris</i> | common |

MICHIGAN - 52. Huron River, habitat type 12: large river. Much of this zone, which lies between the Ford dam above Rawsonville and Flat Rock, has been changed by power dams and by pollution from the garbage reduction plant at French Landing. However, those areas in the river itself which are still productive have a characteristic ecology and fauna. The width of the river varies from 100 to 150 feet. The bottom is not hard gravel as in the previous zone, but is sandy mud, sand, or clay, with relatively little vegetation. The depth is normally from four to eight feet. (van der Schalie, 1938: 27-28 and table III, p. 29).

Naiades:

| | |
|-----------------------------------|--------|
| <i>Actinonaias carinata</i> | common |
| <i>Alasmidonta marginata</i> | rare |
| <i>Anodonta grandis</i> | rare |
| <i>A. imbecillis</i> | common |
| <i>Carunculina parva</i> | common |
| <i>Cyclonaias tuberculata</i> | common |
| <i>Elliptio dilatatus</i> | rare |
| <i>Fusconaia flava</i> | common |
| <i>Lampsilis fasciola</i> | rare |
| <i>L. radiata siliquoidea</i> | rare |
| <i>L. ventricosa</i> | rare |
| <i>Lasmigona complanata</i> | common |
| <i>L. costata</i> | rare |
| <i>Ligumia recta latissima</i> | rare |
| <i>Ptychobranthus fasciolaris</i> | rare |
| <i>Villosa fabalis</i> | common |
| <i>V. iris</i> | rare |

In this zone *Elliptio dilatatus* and *Ptychobranthus fasciolaris* become very scarce, and *Lampsilis fasciola* and *Lampsilis radiata siliquoidea* almost disappear entirely. *Dysnomia triquetra* is absent.

MICHIGAN - 53. Huron River, habitat type 13: impounded waters above artificial dams. These are found within the zone delimited under Type 12. The bottom in these backwaters is of fine mud. This habitat is peculiar in that *Alasmidonta calceolus* and *Anodontoides ferussacianus*, which are typical creek forms, were found. They were scarce and their occurrence must be considered at least unusual, if not abnormal. (van der Schalie, 1938: 28 and table III, p. 29).

Naiades:

| | |
|-----------------------------------|----------|
| <i>Alasmidonta calceolus</i> | rare |
| <i>Anodonta grandis</i> | rare |
| <i>A. imbecillis</i> | rare |
| <i>Anodontoides ferussacianus</i> | rare |
| <i>Carunculina parva</i> | abundant |
| <i>Lampsilis ventricosa</i> | rare |
| <i>Lasmigona complanata</i> | abundant |
| <i>Ligumia recta latissima</i> | rare |

MICHIGAN - 54. Huron River, habitat type 14: lower river. Close to the mouth of the river an invasion of Lake Erie species occurs. Some of these invading species go upstream as far as Flat Rock. This zone contains a fauna which is somewhat different from that discussed under Type 12. The river between Flat Rock and Rockwood is deep, about 80 feet wide, and flows over a more or less firm bottom of patches of clay and gravel. Vegetation is very sparse. There are practically no shells in the clay areas, but there is a rich fauna in the gravel. In addition to the species listed under Type 12, the following are found as invaders from Lake Erie:

Naiades:

| | |
|-----------------------------|--------|
| <i>Actinonaias carinata</i> | common |
| <i>Anodonta grandis</i> | rare |
| <i>A. imbecillis</i> | rare |
| <i>Carunculina parva</i> | common |
| <i>Dysnomia triquetra</i> | rare |
| <i>Elliptio dilatatus</i> | rare |
| <i>Fusconaia flava</i> | common |
| <i>Lampsilis fasciola</i> | rare |
| <i>L. ventricosa</i> | rare |
| <i>Lasmigona costata</i> | rare |
| <i>Ligumia nasuta</i> | rare |

MICHIGAN-54 (cont.)

| | |
|-----------------------------------|------|
| <i>Ligumia recta latissima</i> | rare |
| <i>Obovaria subrotunda</i> | rare |
| <i>Ptychobranchus fasciolaris</i> | rare |
| <i>Quadrula pustulosa</i> | rare |
| <i>Villosa fabalis</i> | rare |
| <i>V. iris</i> | rare |

Apparently *Lasmigona complanata*, which was very common in Types 12 and 13, does not occur in this zone. (van der Schalie 1938: 28 and table III, p. 29).

MICHIGAN - 55. Hillsdale County: St. Joseph River, 1 mile south of Litchfield. (van der Schalie, 1936: 526). Only the Naiades are listed by van der Schalie for this series of associations (Mich. 55-68). Sphaeriids and freshwater gastropods also occur, of course, but they were outside the scope of his study. Numbers of specimens are too small to yield significant percentages but they are a measure of relative abundance in each association.

Naiades:

| | |
|-----------------------------|---|
| <i>Anodonta grandis</i> | 1 |
| <i>Elliptio dilatatus</i> | 1 |
| <i>Fusconaia flava</i> | 2 |
| <i>Lasmigona compressa</i> | 3 |
| <i>L. costata</i> | 8 |
| <i>Strophitus undulatus</i> | 3 |

MICHIGAN - 56. Calhoun County: St. Joseph River, 6 miles northeast of Tekonsha. (van der Schalie, 1936: 526).

Naiades:

| | |
|------------------------------|----|
| <i>Actinonaias carinata</i> | 1 |
| <i>Alasmidonta calceolus</i> | 4 |
| <i>A. marginata</i> | 1 |
| <i>Elliptio dilatatus</i> | 8 |
| <i>Fusconaia flava</i> | 1 |
| <i>Lampsilis ventricosa</i> | 4 |
| <i>Lasmigona costata</i> | 2 |
| <i>Strophitus undulatus</i> | 2 |
| <i>Villosa iris</i> | 10 |

MICHIGAN - 57. Calhoun County: St. Joseph River at Tekonsha. (van der Schalie, 1936: 526).

Naiades:

MICHIGAN-57 (cont.)

| | |
|-----------------------------------|----|
| <i>Actinonaias carinata</i> | 16 |
| <i>A. ellipsiformis</i> | 9 |
| <i>Alasmidonta calceolus</i> | 3 |
| <i>A. marginata</i> | 1 |
| <i>Anodontoides ferussacianus</i> | 1 |
| <i>Elliptio dilatatus</i> | 20 |
| <i>Fusconaia flava</i> | 4 |
| <i>Lampsilis ventricosa</i> | 19 |
| <i>Lasmigona costata</i> | 1 |
| <i>Strophitus undulatus</i> | 10 |
| <i>Villosa iris</i> | 2 |

MICHIGAN - 58. Branch County: Hog Creek, 2 miles southeast of Union City. (van der Schalie 1936: 526).

Naiades:

| | |
|-----------------------------|---|
| <i>Actinonaias carinata</i> | 2 |
| <i>A. ellipsiformis</i> | 1 |
| <i>Elliptio dilatatus</i> | 2 |
| <i>Villosa iris</i> | 2 |

MICHIGAN - 59. St. Joseph County: St. Joseph River, 2 miles south of Leonidas. (van der Schalie, 1936: 526).

Naiades:

| | |
|--------------------------------------|----|
| <i>Actinonaias carinata</i> | 11 |
| <i>A. ellipsiformis</i> | 15 |
| <i>Alasmidonta marginata</i> | 3 |
| <i>Dysnomia triquetra</i> | 1 |
| <i>Elliptio dilatatus</i> | 8 |
| <i>Lampsilis ventricosa</i> | 1 |
| <i>Pleurobema cordatum coccineum</i> | 1 |
| <i>Strophitus undulatus</i> | 3 |
| <i>Villosa iris</i> | 13 |

MICHIGAN - 60. St. Joseph County: St. Joseph River drainage, Nottawa Creek, 2 miles west of Leonidas. (van der Schalie, 1936: 526).

Naiades:

| | |
|--------------------------------------|---|
| <i>Actinonaias carinata</i> | 2 |
| <i>A. ellipsiformis</i> | 1 |
| <i>Lampsilis radiata siliquoidea</i> | 2 |
| <i>L. ventricosa</i> | 3 |
| <i>Strophitus undulatus</i> | 6 |

MICHIGAN - 61. St. Joseph County: St.

MICHIGAN-61 (cont.)

Joseph River, 3 miles northwest of Three Rivers. (van der Schalie, 1936: 526).

Naiades:

| | |
|----------------------------------|----|
| <i>Actinonaias ellipsiformis</i> | 23 |
| <i>Alasmidonta marginata</i> | 1 |
| <i>Anodonta grandis</i> | 1 |
| <i>Elliptio dilatatus</i> | 2 |
| <i>Fusconaia flava</i> | 1 |
| <i>Strophitus undulatus</i> | 1 |

MICHIGAN - 62. St. Joseph County: St. Joseph River drainage, Portage River, 4 miles north-east of Three Rivers. (van der Schalie, 1936: 526).

Naiades:

| | |
|----------------------------------|----|
| <i>Actinonaias ellipsiformis</i> | 6 |
| <i>Elliptio dilatatus</i> | 1 |
| <i>Lampsilis ventricosa</i> | 4 |
| <i>Villosa iris</i> | 14 |

MICHIGAN - 63. St. Joseph County: St. Joseph River drainage, Prairie River, 2 miles south-east of Three Rivers. (van der Schalie, 1936: 526).

Naiades:

| | |
|-------------------------------|----|
| <i>Actinonaias carinata</i> | 12 |
| <i>A. ellipsiformis</i> | 3 |
| <i>Alasmidonta marginata</i> | 2 |
| <i>Cyclonaias tuberculata</i> | 2 |
| <i>Elliptio dilatatus</i> | 5 |
| <i>Fusconaia flava</i> | 1 |
| <i>Strophitus undulatus</i> | 1 |
| <i>Villosa iris</i> | 3 |

MICHIGAN - 64. St. Joseph County: St. Joseph River drainage, White Pigeon River, at White Pigeon. (van der Schalie, 1936: 526).

Naiades:

| | |
|-----------------------------|---|
| <i>Actinonaias carinata</i> | 2 |
| <i>Elliptio dilatatus</i> | 2 |
| <i>Fusconaia flava</i> | 2 |
| <i>Lampsilis ventricosa</i> | 1 |
| <i>Villosa iris</i> | 3 |

MICHIGAN - 65. St. Joseph County: St. Joseph River at Mottville. (van der Schalie, 1936: 526).

MICHIGAN-65 (cont.)

Naiades:

| | |
|--------------------------------------|----|
| <i>Actinonaias carinata</i> | 16 |
| <i>A. ellipsiformis</i> | 7 |
| <i>Alasmidonta marginata</i> | 2 |
| <i>Anodontoides ferussacianus</i> | 1 |
| <i>Cyclonaias tuberculata</i> | 1 |
| <i>Elliptio dilatatus</i> | 8 |
| <i>Fusconaia flava</i> | 14 |
| <i>Lampsilis ventricosa</i> | 1 |
| <i>Lasmigona costata</i> | 3 |
| <i>Pleurobema cordatum coccineum</i> | 4 |
| <i>Strophitus undulatus</i> | 18 |
| <i>Villosa iris</i> | 1 |

MICHIGAN - 66. Cass County: St. Joseph River drainage, Spring Run, 3 miles west of Mottville. (van der Schalie, 1936: 526).

Naiades:

| | |
|----------------------------|---|
| <i>Elliptio dilatatus</i> | 2 |
| <i>Lasmigona compressa</i> | 1 |
| <i>Villosa iris</i> | 5 |

MICHIGAN - 67. Berrien County: St. Joseph River drainage, Dowagiac Creek at Niles. (van der Schalie, 1936: 526).

Naiades:

| | |
|-----------------------------------|---|
| <i>Anodontoides ferussacianus</i> | 1 |
| <i>Elliptio dilatatus</i> | 4 |
| <i>Lasmigona complanata</i> | 1 |
| <i>Villosa iris</i> | 2 |

MICHIGAN - 68. Berrien County: St. Joseph River at St. Joseph. (van der Schalie, 1936: 526).

Naiades:

| | |
|-------------------------|---|
| <i>Anodonta grandis</i> | 1 |
|-------------------------|---|

MINNESOTA - 1. Itasca County, north end of North Star Lake. Forest of pine, spruce, hemlock, maple, white cedar or arbor vitae, balsam fir, aspen, birch, all mostly second growth; soil rich in forest debris, with a few patches of moss and rotting stumps of trees. Land snails collected from mat of forest debris. (Baker, 1935: 260, his station 1). No data on abundance.

MINNESOTA-1 (cont.)

Land Gastropods:

| |
|--------------------------------|
| <i>Cionella lubrica</i> |
| <i>Discus cronkhitei</i> |
| <i>Euconulus fulvus</i> |
| <i>Nesovitrea binneyana</i> |
| <i>Strobilops labyrinthica</i> |
| <i>Zonitoides arboreus</i> |

MINNESOTA - 2. Itasca County, south end of Little North Star Lake. Forest of birch, aspen, maple, cedar, fir, hemlock. Forest floor with little vegetation but covered with mat of leaves and debris. Many fallen tree trunks and old stumps. Snails abundant in the debris, under started bark, and about old stumps. (Baker, 1935: 260-261, his station 2). No data on abundance.

Land Gastropods:

| |
|--------------------------------|
| <i>Discus cronkhitei</i> |
| <i>Euconulus fulvus</i> |
| <i>Helicodiscus parallelus</i> |
| <i>Nesovitrea binneyana</i> |
| <i>Strobilops labyrinthica</i> |
| <i>Vallonia gracilicosta</i> |
| <i>Zonitoides arboreus</i> |

MINNESOTA - 3. Itasca County, hillside woodland north of Camp Idlewild, between North Star Lake and Little North Star Lake. Forest as in station 1 (Minn. -1), mollusks collected from forest floor in debris. The largest number of land mollusks was found at this station. (Baker, 1935: 261, his station 3). No data on abundance.

Land Gastropods:

| |
|------------------------------------|
| <i>Carychium "exile canadense"</i> |
| <i>Cionella lubrica</i> |
| <i>Discus cronkhitei</i> |
| <i>Gastrocopta tappaniana</i> |
| <i>Hawaii minuscula</i> |
| <i>Nesovitrea binneyana</i> |
| <i>Striatura milium</i> |
| <i>Strobilops labyrinthica</i> |
| <i>Succinea ovalis</i> |
| <i>Vertigo ventricosa</i> |
| <i>Vitrina limpida</i> |
| <i>Zonitoides arboreus</i> |

MINNESOTA - 4. Itasca County, low, marshy woods north of Little North Star Lake; forest of birch, cedar, tamarack; ostrich ferns, nodding trillium, horsetail, most abundant ground vegetation at edge of forest. Forest itself dark with little or no ground vegetation but with many logs and stumps. The ground is very uneven, filled with deep holes, largely the root cavity of fallen trees. Mollusks abundant under started bark, under wet pieces of bark or wood and under debris. (Baker, 1935: 261-262, his station 4). No data on abundance.

Land Gastropods:

Anguispira alternata
Carychium "exile canadense"
Cionella lubrica
Discus cronkhitei
Euconulus fulvus
Gastrocopta tappaniana
Helicodiscus parallelus
Nesovitrea binneyana
Strobilops labyrinthica
Vertigo ventricosa
Zonitoides arboreus

MINNESOTA - 5. Itasca County, north end of North Star Lake; same location as Minn. -1. Snails under rotting stumps of birch. (Baker, 1935: 262, his station 5). No data on abundance.

Land Gastropods:

Carychium "exile canadense"
Cionella lubrica
Discus cronkhitei
Euconulus fulvus
Helicodiscus parallelus
Nesovitrea binneyana
Strobilops labyrinthica
Vallonia gracillicosta
Zonitoides arboreus

MINNESOTA - 6. Itasca County, shore of North Star Lake at Camp Idlewild. Grass-covered shore about three feet above water line. Snails on pieces of bark and wood. (Baker, 1935: 262, his stations 6 and 9). No data on abundance.

MINNESOTA - 6 (cont.)

Land Gastropods:

Oxyloma retusa
Strobilops labyrinthica
Zonitoides arboreus

MINNESOTA - 7. Itasca County, rolling, hilly woodland south of Camp Idlewild, morainic in character, high ground interspersed with low areas bordering the lake. Forest (of upland) of pine, spruce, cedar, hemlock, aspen, birch, maple, basswood. Ground cover (in August) of asters, several species of ferns, goldenrod, several species of violets, jewel weed, and, rarely, nodding trillium. Ground material of forest debris. Snails found under logs and in forest debris, quite abundant. (Baker, 1935: 262, his stations 7 and 10). No data on abundance.

Land Gastropods:

Discus cronkhitei
Euconulus fulvus
Helicodiscus parallelus
Nesovitrea binneyana
Planogyra asteriscus
Striatura milium
Strobilops labyrinthica
Succinea ovalis
Vitrina limpida
Zonitoides arboreus

MINNESOTA - 8. Itasca County, rolling, hilly woodland south of Camp Idlewild; rather high hills rising from low, swampy areas. Summit of hills with pine, birch, aspen, and basswood, all second growth. An occasional pine of the original forest. Logged and burned over. Woods rather open and ground with little vegetation, usually. Low areas with willow, birch, and aspen, bordering bogs with sedge, cattails, horsetails, etc. Snails absent from higher hills and apparently rare in low places under debris. (Baker, 1935: 262, his station 8).

Land Gastropods:

Cionella lubrica
Discus cronkhitei
Strobilops labyrinthica
Zonitoides arboreus

MINNESOTA - 9. Itasca County, west shore of North Star Lake; water one foot deep, mud bottom, vegetation *Chara* and *Potamogeton*. (Baker, 1935: 262, 263, his station 11). No data on abundance.

Freshwater gill-breathing Gastropods:

Amnicola limosa
A. lustrica "decepta"
Valvata tricarinata

Freshwater lung-breathing Gastropods:

Acella haldemani
Bulimnea megasoma
Ferrissia parallela
Gyraulus parvus
Physa gyrina

MINNESOTA - 10. Itasca County, west shore north bay, North Star Lake; water 2-3 feet deep (1 m.), sandy silt and mud bottom. Vegetation of *Chara*, *Potamogeton*, *Vallisneria*, *Scirpus*, *Lemna*, *Nymphaea*, *Castalia*, *Myriophyllum*. *Amnicola* and *Valvata* obtained by sweeping *Chara* with Walker dredge; *Pisidium* and *Sphaerium* in mud bottom. *Physa* and *Helisoma* in vegetation. (Baker, 1935: 263, his stations 12, 14, and 18). No data on abundance.

Sphaeriidae:

Pisidium, 2 species
Sphaerium sulcatum

Freshwater gill-breathing Gastropods:

Amnicola limosa
A. lustrica "decepta"
Valvata tricarinata

Freshwater lung-breathing Gastropods:

Gyraulus parvus
Helisoma anceps striatum
H. campanulatum
H. trivolvis "macrostomum"
Lymnaea stagnalis jugularis
Physa gyrina

MINNESOTA - 11. Itasca County; north shore of north bay, North Star Lake; water 2-3 feet deep. Vegetation same as at stations 12, 14, 18; snails mostly on underside of water lily leaves; *Amnicola* on *Chara*. (Baker, 1935: 263,

MINNESOTA-11 (cont.)

264, his stations 16 and 17). No data on abundance.

11a. On bottom:

Sphaeriidae:
Pisidium, 2 species
Sphaerium sulcatum

11b. On *Chara*:

Freshwater gill-breathing Gastropods:

Amnicola limosa
A. lustrica "decepta"
Valvata tricarinata

Freshwater lung-breathing Gastropods:

Helisoma anceps striatum
H. campanulatum
Physa gyrina

11c. On pond lily leaves:

Freshwater lung-breathing Gastropods:

Helisoma anceps striatum
H. campanulatum
H. trivolvis "macrostomum"
Laevapex fuscus
Lymnaea stagnalis jugularis
Physa gyrina

MINNESOTA - 12. Itasca County; ditch beside road near Camp Idlewild, North Star Lake; water 2-8 inches deep; bottom of leaf debris in soft mud; mollusks in debris. (Baker, 1935: 264, his station 13). No data on abundance.

Sphaeriidae:

Pisidium sp.

Freshwater lung-breathing Gastropods:

Gyraulus circumstriatus

MINNESOTA - 13a. Itasca County; bay northeast side of North Star Lake; water 2-3 feet deep (1 m.), rocky bottom near point, sand and sandy silt east of point. Bottom shelves off very gradually into deep water, depth increasing very slowly. Sandy and rocky areas with *Scirpus*, bottom with much debris, including dead shells of mussels and gastropods. Living mussels abundant on sandy bottom where there is some *Chara*. The following species were collected from the bottom. (Baker, 1935: 264-265, his station 19). Naiades:

MINNESOTA-13a (cont.)

Anodonta "kennicotti"
 Anodontoides modesta
 Lampsilis radiata siliquoidea "rosacea"

Sphaeriidae:

Pisidium (4 species)
 Sphaerium sulcatum

Freshwater gill-breathing Gastropods:

Amnicola limosa

Freshwater lung-breathing Gastropods:

Fossaria obrussa decampi
 Helisoma campanulatum

MINNESOTA - 13b. Itasca County, bay northeast side of North Star Lake; eastward from the point (13a) the bottom changes to sandy silt, almost mud, and the vegetation assumes the character of that recorded in stations 12, 14, and 18. Gastropods were abundant at this station, mostly on the vegetation. (Baker, 1935: 265, his station 19).

Freshwater gill-breathing Gastropods:

Amnicola limosa
 Valvata tricarinata

Freshwater lung-breathing Gastropods:

Fossaria obrussa decampi
 Gyraulus deflectus obliquus
 G. parvus
 Helisoma anceps striatum
 H. campanulatum
 Physa gyrina
 Promenetus exacuus

Land Gastropods:

Oxyloma retusa (on pond lily leaves)

MINNESOTA - 14. Itasca County; shallow bar between upper lake and west bay of North Star Lake. Water from one to three feet in depth, bottom soft muck composed of lake detritus from animal and plant debris. Vegetation very thick, consisting of Scirpus, several species of Potamogeton, water lilies (Nymphaea and Castalia), Vallisneria, Lemna, Myriophyllum, Chara, Nitella; Typha bordering shore. Mollusks from 4 sub-associations (14a - 14d). (Baker, 1935: 266, his station 20).

MINNESOTA-14 (cont.)

a) from Chara and Nitella:

Freshwater gill-breathing Gastropods:

Amnicola limosa
 Valvata tricarinata

Freshwater lung-breathing Gastropods:

Helisoma campanulatum (rare).

b) From pond lily leaves:

Freshwater gill-breathing Gastropods:

Amnicola limosa

Freshwater lung-breathing Gastropods:

Gyraulus parvus
 Helisoma anceps striatum
 H. campanulatum
 Physa gyrina

c) From Potamogeton and general mass vegetation:

Freshwater lung-breathing Gastropods:

Helisoma anceps striatum
 H. campanulatum
 Lymnaea stagnalis jugularis
 Physa gyrina

d) From muddy shore, water one foot deep, snails on bottom or floating on top of water.

Bank of shore here is a floating log.

Freshwater lung-breathing Gastropods:

Bulimnaea megasoma (laying eggs at this time, mid-August)
 Helisoma trivolvis "macrostomum"
 Lymnaea stagnalis jugularis

MINNESOTA - 15. Itasca County, Little North Star Lake, bordering shore. Water shallow (one to three feet), bottom mud or silt, in most places mucky; vegetation of Typha, Scirpus, Potamogeton, Nymphaea, Castalia, Lemna, Chara. (Baker, 1935: 266, his station 21). No data on abundance.

Naiades:

Anodonta grandis "footiana"
 A. marginata

Sphaeriidae:

Pisidium (four species)
 Sphaerium partumeium
 S. securis

MINNESOTA-15 (cont.)

S. sulcatum

Freshwater gill-breathing Gastropods:

*Amnicola limosa**A. lustrica* "decepta"*Valvata tricarinata* (000)

Freshwater lung-breathing Gastropods:

*Acella haldemani**Armiger crista**Bulimnea megasoma**Gyraulus parvus**Helisoma anceps striatum**H. trivolvis* "macrostomum"*Lymnaea stagnalis jugularis**Planorbula armigera**Promenetus exacuus**Stagnicola exilis*

MINNESOTA - 16. Itasca County; shallow near south end of Little North Star Lake; water three feet deep. Vegetation as in station 21 (Minn. -15); muck bottom; life on vegetation, obtained by sweeping with Walker dredge. (Baker, 1935: 266, his station 22).

Sphaeriidae:

Pisidium (2 species)*Sphaerium securis*

Freshwater gill-breathing Gastropods:

*Amnicola limosa**A. lustrica* "decepta"*Valvata tricarinata* (000 and 100)

Freshwater lung-breathing Gastropods:

*Fossaria obrussa decampi**Gyraulus deflectus obliquus**G. parvus**Helisoma anceps striatum**H. trivolvis* "macrostomum"*H. campanulatum**Physa gyrina**Promenetus exacuus*

Land Gastropods:

Oxyloma retusa

MINNESOTA - 17. Itasca County; Little North Star Lake, marl bed under peat-like stratum; water 3 feet deep; marl bed of unknown depth. (Baker, 1935: 266-267, his station 23). The species

MINNESOTA-17 (cont.)

listed here are either very recent fossils or dead shells on a marl bottom; the context does not indicate which is meant.

Sphaeriidae:

*Sphaerium partumeium**S. securis*

Freshwater gill-breathing Gastropods:

*Amnicola limosa**A. walkeri**Valvata tricarinata* (000)

Freshwater lung-breathing Gastropods:

*Armiger crista**Ferrissia parallela**Fossaria obrussa decampi**Gyraulus altissimus**G. deflectus obliquus**Helisoma campanulatum**Promenetus exacuus* "megas"

MINNESOTA - 18. Itasca County; North Bay, North Star Lake; shore at Camp Idlewild. Sand bottom, water 2-4 feet deep. Vegetation of *Chara* and *Scirpus*. (Baker, 1935: 267, his stations 24 and 25).

Naiades:

Anodonta "kennicotti"*A. marginata**Anodontoides modesta**Lampsilis radiata siliquoidea*

Freshwater gill-breathing Gastropods:

Amnicola limosa (on *Chara*)*Valvata tricarinata* (on *Chara*)

Freshwater lung-breathing Gastropods:

Ferrissia parallela (in mussel shell)

MINNESOTA - 19. Itasca County; summer-dry pool between North Star Lake and Little North Star Lake; dry in August and filled with sedge; bottom of leaf debris baked hard by sun. (Baker, 1935: 267, his station 26).

Sphaeriidae:

Sphaerium occidentale

Freshwater lung-breathing Gastropods:

Gyraulus circumstriatus

MINNESOTA - 20. Itasca County; swale in woods one mile east of Camp Idlewild. Dry in August and covered with dried pond scum (*Spirogyra*). Shells under *Spirogyra*. (Baker, 1935: 267).

Sphaeriidae:

Pisidium (2 species)

Freshwater lung-breathing Gastropods:

Aplexa hypnorum

Promenetus umbilicatellus

MINNESOTA - 21. Itasca County; stagnant pool on roadside one-half mile east of Camp Idlewild; shallow, with muck bottom; water covered with *Spirogyra*. Mollusks abundant and but one species represented. (Baker, 1935: 267, his station 28).

Freshwater lung-breathing Gastropods:

Helisoma trivolvis

MINNESOTA - 22. Koochiching County; Big Falls of Big Fork River; above falls in mud bottom near shore. No vegetation. (Baker, 1935: 268, his station 29).

Naiades:

Lampsilis radiata siliquoidea

L. ventricosa "occidens"

Sphaeriidae:

Sphaerium striatinum

Freshwater gill-breathing Gastropods:

Amnicola limosa

Campeloma rufum

Freshwater lung-breathing Gastropods:

Ferrissia rivularis (in empty valve of

Lampsilis).

F. tarda (same situation)

Land Gastropods: (under logs, near shore)

Helicodiscus parallelus

Zonitoides arboreus

NEW YORK - 1. Ontario County; large beach pond, east side of Canandaigua Lake, about 3 miles south of Canandaigua. The pond is about three acres in area and is surrounded by about 2 acres of vegetation, grading from forest trees and bushes to small water plants. Depth of the pond

NEW YORK-1 (cont.)

is two to four feet, with water-weed and water milfoil. This is the type locality of *Stagnicola palustris elodes* (Say) described by Baker (1932). No quantitative data are given. The association is rather unusual as the species marked with an asterisk below are not usually found in beach ponds; it is explained by Baker as probably a small bay cut off from the main lake by a bar or beach. (Baker, 1932: 288).

Sphaeriidae:

Pisidium casertanum *

Sphaerium occidentale

S. securis *

Freshwater gill-breathing Gastropods:

Valvata lewisi *

Freshwater lung-breathing Gastropods:

Aplexa hypnorum

Gyraulus "arcticus" *

G. circumstriatus walkeri *

G. deflectus obliquus *

G. parvus *

Helisoma trivolvis

Physa gyrina elliptica *

Promenetus exacuus *

P. rubellus *

Stagnicola palustris elodes

NEW YORK - 2. Oneida Lake: Nicholson Bay. This bay contains two characteristic and diverse habitats.

2a. Habitat 1, west side of bay, bottom hard sand, with few boulders, several very large. Water from 12 to 30 inches deep. Vegetation *Dianthera*, cattails and sedge. At the outer or lake border there is an area of Lake Bulrush which extends into deeper water. Clams burrowing among the stones and gastropods living on the stones and boulders. (Baker, 1916: 36-39).

Naiades:

Elliptio complanatus

Lampsilis radiata

Freshwater lung-breathing Gastropods:

Helisoma anceps

H. campanulatum

NEW YORK-2 (cont.)

2b. Habitat 2, east side of bay, bottom sandy or silty. Water 2 to 5 feet deep. Vegetation abundant. Animal life notably abundant on the upper and lower sides of pond-lily leaves and among submerged vegetation. (Baker, 1916: 36-39).

Freshwater gill-breathing Gastropods:

Amnicola lustrica

Freshwater lung-breathing Gastropods:

Acella haldemani

Gyraulus hirsutus

Helisoma campanulatum

H. trivolvis

Physa "ancillaria warreniana"

Pseudosuccinea columella

NEW YORK - 3. Oneida Lake, Fitzgerald Point. This point extends into the lake with shallow water for a distance of nearly 500 feet, when it drops more or less suddenly to 9 feet in depth; bottom of hard sand with many stones and boulders; water 10 to 30 inches deep; vegetation, *Scirpus*. (Baker, 1916: 40-42).

3a. Clams in sand between stones; gastropods on stones and sand. The latter are so abundant as to give a "peppered" aspect to the bottom, and the clams are notably abundant, the posterior or siphon end protruding from the sand between the rocks.

Naiades:

Anodonta grandis "footiana"

A. implicata

Elliptio complanatus

Lampsilis radiata

Sphaeriidae:

Sphaerium striatinum

Freshwater gill-breathing Gastropods:

Goniobasis livescens

Freshwater lung-breathing Gastropods:

Stagnicola catascopium

3b. Washed in from other habitats:

Freshwater gill-breathing Gastropods:

Bulimus tentaculatus

Somatogyrus altilis

S. subglobosus

NEW YORK-3b (cont.)

Valvata tricarinata

Viviparus concoloratus

Freshwater lung-breathing Gastropods:

Helisoma campanulatum

Physa "ancillaria warreniana"

P. "integra"

NEW YORK - 4. Oneida Lake, bay between Fitzgerald and Milton Points. Several distinct habitats characterized by varying depths and diverse vegetation (4a-c). (Baker, 1916: 42-45).

4a. Sheltered bay at west end of station, protected from the rough waters of the lake by the heavy fringe of Water Willow, Sedge, and Bulrush, which forms an effectual barrier; bottom sandy silt, varying in hardness; water one to 4 feet in depth; vegetation, zonal and variable; snails on leaves of water lily.

Freshwater lung-breathing Gastropods:

Acella haldemani

Helisoma campanulatum

Physa "ancillaria warreniana"

Pseudosuccinea columella

4b. Cat-tail shore facing lake. There are three distinct cat-tail associations, each separated by a rounded point free from shore vegetation. There is little protection from the rough waters of the lake. Zone C (the only one with Mollusca): bottom, sandy silt; water, 2-4 feet deep.

Sphaeriidae:

Pisidium compressum "laevigatum"

P. variable

Pisidium (2 species)

Sphaerium striatinum

Freshwater gill-breathing Gastropods:

Amnicola lustrica

Campeloma integrum

Somatogyrus altilis

S. subglobosus

Valvata bicarinata normalis

Freshwater lung-breathing Gastropods:

Gyraulus hirsutus

Helisoma campanulatum

NEW YORK - 4 (cont.)

4c. Zone D, bottom sand or gravel with occasional boulders; water 2-4 feet deep; vegetation pickerel weed, bulrush, floating pond-weed, Naiades:

| | |
|---------------------------------------|----------|
| <i>Elliptio complanatus</i> | common |
| Sphaeriidae: | |
| <i>Pisidium compressum</i> | rare |
| <i>Sphaerium striatinum</i> | rare |
| Freshwater gill-breathing Gastropods: | |
| <i>Amnicola lustrica</i> | rare |
| <i>Campeloma integrum</i> | rare |
| <i>Somatogyris atilis</i> | common |
| Freshwater lung-breathing Gastropods: | |
| <i>Physa "ancillaria warreniana"</i> | uncommon |
| <i>Stagnicola catascopium</i> | uncommon |

NEW YORK - 5. Oneida Lake, bay between Fitzgerald and Milton Points, habitat 3: rounded points separating NY-4 habitats. The shores of these locations are bare; in one place the lake has undermined the shore, forming an overhanging bank about one foot above the water. The base of this bank, in a few inches of water, was the optimum habitat of *Campeloma integrum*. Two conspicuous zones are apparent (5a, 5b). (Baker, 1916: 46-47).

5a. Zone A, overhanging or vertical bank; water six inches deep; bottom sandy or stony; no vegetation, but in one place water celery has been washed on shore forming a mat in which mollusks were abundant, eating the plant.

| | |
|---------------------------------------|----------|
| Freshwater gill-breathing Gastropods: | |
| <i>Campeloma integrum</i> | abundant |
| Freshwater lung-breathing Gastropods: | |
| <i>Helisoma "binneyi"</i> | common |
| <i>Lymnaea stagnalis lillianae</i> | rare |
| <i>Physa "ancillaria warreniana"</i> | rare |
| <i>Stagnicola catascopium</i> | rare |

5b. Zone B, bottom of hard sand with rocks and boulders; water 12 to 36 inches deep; vegetation of bulrushes, pickerel-weed, water celery.

| | |
|-----------------------------|------------|
| Naiades: | |
| <i>Anodonta cataracta</i> | not common |
| <i>Elliptio complanatus</i> | common |

NEW YORK 5b. (cont.)

| | |
|---------------------------------------|------------|
| <i>Lampsilis radiata</i> | not common |
| Freshwater gill-breathing Gastropods: | |
| <i>Goniobasis livescens</i> | abundant |
| Freshwater lung-breathing Gastropods: | |
| <i>Gyraulus hirsutus</i> | rare |
| <i>Helisoma campanulatum</i> | common |
| <i>Physa "ancillaria warreniana"</i> | abundant |
| <i>Stagnicola catascopium</i> | abundant |

5c. On the shelving shore of Zone A the dead shells of many clams were observed, showing that these animals are abundant on the sandy bottom of Zone B. Four species were noted:

| | |
|------------------------------|--|
| Naiades: | |
| <i>Anodonta cataracta</i> | |
| <i>A. grandis "footiana"</i> | |
| <i>Elliptio complanatus</i> | |
| <i>Lampsilis radiata</i> | |

NEW YORK - 6. Oneida Lake, station IV, Milton Point, a narrow wedge-shaped piece of land extending well into the lake. It is fully exposed to the winds and waves from the south and east. The land is quite low and is doubtless covered with water during storms and periods of high water. Shallow water extends for a considerable distance into the lake. Bottom very bouldery on hard sand; water one to two feet deep. (Baker, 1916: 47).

| | |
|---------------------------------------|--------|
| Naiades: | |
| <i>Elliptio complanatus</i> | common |
| <i>Lampsilis radiata</i> | common |
| Freshwater gill-breathing Gastropods: | |
| <i>Goniobasis livescens</i> | common |
| Freshwater lung-breathing Gastropods: | |
| <i>Helisoma anceps</i> | rare |
| <i>H. campanulatum</i> | rare |
| <i>Physa "ancillaria warreniana"</i> | rare |
| <i>Stagnicola catascopium</i> | common |

Baker stated that *Helisoma* and *Physa* were "evidently migrants from Station V." (New York - 7).

NEW YORK - 7. Oneida Lake, Station V, Ice House Bay. A small round indentation or bay, well protected from the winds and waves on the

south, west, and north sides, but widely open on the east side. The water on the south and west shores is shallow, ranging from one to three feet in depth. The bottom is bouldery except in small spots which are of hard sand. The vegetation is fairly uniform, consisting of bulrush, pondweed in Habitat 1, the only one for which Mollusca are listed. The mollusks covered the bottom of this bay in great abundance.

Naiades:

- Anodonta cataracta
- Elliptio complanatus

Freshwater gill-breathing Gastropods:

- Goniobasis livescens

Freshwater lung-breathing Gastropods:

- Helisoma campanulatum
- H. trivolvis
- Lymnaea stagnalis lillianae
- Physa "ancillaria warreniana"
- Stagnicola catascopium
- S. emarginata

NEW YORK - 8. Oneida Lake, Station VI, head of Big Bay. The zonal character of the vegetation at this location was marked. For the distance of several hundred feet, an area of clear water, about 25 feet in width, bordered the shore, the water being about 20 inches in depth. No mollusks were observed in this sandy strip. This area is bordered by a wide zone of plants, in about four feet of water. The plants noted were bulrush, pickerel-weed, floating pond-weed, sweet-scented Water Lily, and Cow Lily. Where the water became shallower, in spots 2 - 2.5 feet deep, the Water Willow grows abundantly. Mollusks were noted here in but one situation. (Baker, 1916: 50-51).

Freshwater lung-breathing Gastropods:

- Physa "ancillaria warreniana" on the upper surface of *Castalia odorata*.

NEW YORK - 9. Oneida Lake, Station VII, Big Bay Creek. Big Bay Creek extends for over a mile into the swampy shore bordering the east side of Big Bay. At its mouth the water is five feet deep and about 20 to 25 feet wide. As the water extends into the country for a long distance,

NEW YORK-9 (cont.)

forming a vast swamp, it is impossible to judge of the original size of the creek. The bottom is of fine, sandy silt. The vegetation is zonal in arrangement. Mollusca only in Zone B, water five feet deep; Cow Lily, Floating pond-weed, Claspingleaved pond-weed, all mollusks on the upper and under surface of the Cow Lily. (Baker, 1916: 51).

Freshwater lung-breathing Gastropods:

- Helisoma campanulatum
- Physa "ancillaria warreniana"
- P. gyrina
- Pseudosuccinea columella

NEW YORK - 10. Oneida Lake, Station VIII, Dry Land Point, Big Bay. This habitat is a low point of land situated at about the middle of the east shore, extending well into Big Bay. The bottom gradually slopes toward the deeper water of the bay. It is somewhat protected by the lake-ward zone of vegetation. Bottom, hard, sandy; water, 18 to 30 inches deep; vegetation, none for 30 feet, where a zone of *Scirpus* occurs. Mollusks on or in the sand. (Baker, 1916: 52).

Naiades:

- Elliptio complanatus

Sphaeriidae:

- Sphaerium striatinum

Freshwater gill-breathing Gastropods:

- Bulimus tentaculatus (dead, washed in from water plants)
- Campeloma integrum (buried in sand)

Freshwater lung-breathing Gastropods:

- Helisoma campanulatum
- Stagnicola catascopium

NEW YORK - 11. Oneida Lake, Station IX, Deer Point, Big Bay. This habitat is bordered by low, swampy land about a foot above lake level, in most places. The bank has been undermined and overhangs a trifle, forming a perpendicular wall ten to fifteen inches high. Bottom, sandy silt, rather soft; water, 18 to 30 inches deep; vegetation, zonal; Zone A has cattails, bur-reed, and arrowhead. All of the animal life was from Zone B on the sandy bottom,

NEW YORK-11 (cont.)

vegetation water willow, bulrush, pickerel-weed. (Baker, 1916: 52-53).

Sphaeriidae:

| | |
|---------------------------------------|--------|
| <i>Pisidium compressum laevigatum</i> | common |
| <i>Pisidium</i> sp. | rare |
| <i>Sphaerium striatinum</i> | common |

Freshwater gill-breathing Gastropods:

| | |
|---------------------------|--------|
| <i>Amnicola lustrica</i> | common |
| <i>Campeloma integrum</i> | common |

Freshwater lung-breathing Gastropods:

| | |
|------------------------------|--------|
| <i>Helisoma campanulatum</i> | common |
|------------------------------|--------|

NEW YORK - 12. Oneida Lake, Station X, Poddygut Bay, Big Bay. Poddygut Bay is a rounded indentation at the entrance to Big Bay. It is partly enclosed by Willow Point on the north and Poddygut Point on the south. These points are sandy, bouldery, and shallow. The bay is 5 to 7 feet deep and is filled with water plants. It is entirely surrounded by a deep swamp. The vegetation is zonal in arrangement; Mollusca are from Zone B, *Nymphaea*-*Potamogeton* association: bulrush, sweet-scented water lily, cow lily, floating pond-weed. (Baker, 1916: 53-54).

Freshwater gill-breathing Gastropods:

Amnicola lustrica

Freshwater lung-breathing Gastropods:

Acella haldemani
Ferrissia parallela

NEW YORK - 13. Oneida Lake, Station XI, Poddygut Point, Big Bay. This habitat extends well into the bay. It is shallow for a considerable distance, averaging about 18 inches, but becomes abruptly deeper, especially on the Poddygut Bay side where a depth of six feet occurs. The bottom is very stony and boudery on a hard sandy substratum. The habitat is open and fully exposed to the violence of the waves. (Baker, 1916: 54).

Naiades:

| | |
|----------------------------------|--------|
| <i>Elliptio complanatus</i> | common |
| <i>Margaritana margaritifera</i> | rare |

Freshwater lung-breathing Gastropods:

Stagnicola emarginata (dead) rare

NEW YORK - 14. Oneida Lake, Station XII. Second bay-like indentation west of Shaw Point. The shore line of this habitat is usually devoid of vegetation. A ridge of debris, washed in by the waves, usually borders the edge of the shore at the distance of a foot inland. The water is from 10 to 30 inches deep, the bottom is hard sand with some boulders, and the vegetation consists of bulrush and water willow, the latter in a patch on the shoreward edge of the *Scirpus* association. The shore debris contained the following species, all dead and representing several habitats. (Baker, 1916: 54-56).

Naiades:

Anodonta cataracta
A. grandis "footiana"
A. marginata
Elliptio complanatus

Sphaeriidae:

Sphaerium striatinum

Freshwater gill-breathing Gastropods:

Bulimus tentaculatus
Somatogyryus subglobosus

Freshwater lung-breathing Gastropods:

Helisoma anceps
H. "binneyi"
H. campanulatum
Physa "ancillaria warreniana"
Stagnicola catascopium
S. emarginata

NEW YORK - 15. Oneida Lake, Station XIII. First bay-like indentation west of Shaw Point; this habitat is similar to that of station XII (New York - 14), except that the land bordering the shore is higher (about 10 feet) and contains several large trees. Bottom, hard, sandy, gravelly and bouldery in spots; water, 10 to 48 inches deep; vegetation, water willow, American bulrush, Lake bulrush.

15a. Mollusks living on and between stones:

Naiades:

Elliptio complanatus
Lampsilis radiata
L. radiata siliquioidea
Margaritana margaritifera

NEW YORK-15a (cont.)

Freshwater gill-breathing Gastropods:

Goniobasis livescens

Freshwater lung-breathing Gastropods:

Stagnicola catascopium

15b. Beach debris, shells washed in from 15a and other areas of the lake. (Baker, 1916: 57).

Naiades:

Elliptio complanatus common*Lampsilis radiata* common*Margaritana margaritifera* rare*Villosa iris* rare

Sphaeriidae:

Sphaerium striatinum common

Freshwater gill-breathing Gastropods:

Bulimus tentaculatus common*Campeloma integrum* rare*Goniobasis livescens* common*Somatogyrus altilis* common

Freshwater lung-breathing Gastropods:

Helisoma anceps rare*H. campanulatum* very common*H. trivolvis* rare*Physa "ancillaria warreniana"* common*Stagnicola catascopium* very common

NEW YORK - 16. Oneida Lake, Station XIV, Shaw Point. This habitat is a bold point of land extending well into the lake. The shore is rather high (about 6 feet above the lake) and is without vegetation. Bottom, very bouldery; water, 6 to 24 inches deep; vegetation, Bulrush. A green filamentous alga covers the rocks near the shore and in this *Helisoma trivolvis*, *Goniobasis livescens*, and *Lymnaea stagnalis lillianae* were found abundantly, feeding. (Baker, 1916: 57).

Naiades:

Elliptio complanatus

Freshwater gill-breathing Gastropods:

Goniobasis livescens

Freshwater lung-breathing Gastropods:

*Gyraulus hirsutus**Helisoma trivolvis* "binneyi"

NEW YORK-16 (cont.)

*Helisoma campanulatum**Lymnaea stagnalis lillianae**Physa "ancillaria warreniana"*

NEW YORK - 17. Oneida Lake, Station XV, Baker Point. On the sandy and bouldery beach at this locality, Adams and Hankinson collected the following species. (Baker, 1916: 58).

Naiades:

Anodonta grandis "footiana"*A. implicata**Elliptio complanatus**Margaritana margaritifera*

NEW YORK - 18. Oneida Lake, Station XVI, Scriba Creek, Constantia. Scriba Creek is 18 miles long and is a large, clear, rapid flowing stream emptying into Oneida Lake at the village of Constantia. Its headwaters arise in the Town of Amboy. At its mouth it is upward of 6 feet deep and the bottom is sandy; north of the bridge, and above the junction of Frederick Creek, the bottom is very rocky, the current swift and the water shallow (6 to 15 inches deep). Beneath the rocks and clinging to them occur a number of mollusks. (Baker, 1916: 58-59).

18a. Clinging to rocks:

Freshwater lung-breathing Gastropods:

Ferrissia tarda

18b. Small pool formed by caving in of bank, protected from rapid moving water by portion of bank and by stones. Bottom, muddy; water, 8-12 inches deep; vegetation, algae.

Freshwater lung-breathing Gastropods:

*Gyraulus hirsutus**Helisoma trivolvis**Physa gyrina*

18c. In Scriba Creek and its tributary, Frederick Creek, at and near junction of these two streams. Bottom, muddy; water, 2-3 feet deep.

Naiades:

Elliptio complanatus

NEW YORK - 19. Oneida Lake, Station XVII. Frederick Creek, Constantia. This creek is a tributary of Scriba Creek. Near its head the State Fish Hatchery buildings are situated. The creek varies in its physical relations, in some places forming quiet pools and in others running rapidly over stones. Near the hatchery buildings the bottom is composed of fine, impalpable mud. On and in this mud three species of mollusks were observed. (Baker, 1916: 59).

Naiades:

Elliptio complanatus

Strophitus undulatus

Freshwater gill-breathing Gastropods:

Campeloma decisum

NEW YORK - 20. Oneida Lake, Station XVIII. Large pond above Hatchery Buildings. This pond was formed by damming Frederick Creek above the hatchery buildings. Its depth was not ascertained but probably does not exceed a few feet. (Baker, 1916: 60).

Naiades:

Anodonta grandis

Freshwater gill-breathing Gastropods:

Campeloma decisum

NEW YORK - 21. Oneida Lake, Station XIX. Bay-like indentation one-half mile west of Shepard Point. In this habitat the shore is devoid of vegetation, except in limited areas where there are clumps of black willow, buttonbush, and Iris. The shallow water near the shore in such places usually contains a fringe of Swamp loosestrife. Occasionally a mass of vegetation extends into the lake, forming a point. This consists of pickerel weed, American bulrush, and water willow. Away from the shore, where the water is from 2 to 4 feet deep, there is an association of water willow, bulrush, and pickerel weed. The bottom is of hard sand with a few boulders. The sandy bottom contains a large number of species of mollusks. The large number of *Pisidia* present is noteworthy. The abundance of small mollusks and the large number of species of this group shows this habitat to be good feeding ground for bottom feeding fish, such as

NEW YORK-21 (cont.)

pumpkinseed and suckers, as well as turtles. (Baker, 1916: 61-62).

Naiades:

Elliptio complanatus abundant

Margaritana margaritifera rare

Sphaeriidae:

Pisidium aequilaterale rare

P. compressum laevigatum common

P. henslowanum common

P. variabile common

Pisidium sp. rare

Sphaerium striatinum common

Freshwater gill-breathing Gastropods:

Amnicola limosa rare

A. lustrica abundant

Bulimus tentaculatus abundant

Goniobasis livescens rare

Valvata tricarinata common

Freshwater lung-breathing Gastropods:

Gyraulus hirsutus ?

Helisoma anceps common

H. campanulatum rare

Physa "ancillaria warreniana" rare

Stagnicola catascopium abundant

NEW YORK - 22. Oneida Lake, Station XX, Shepard Point. The Shepard Point region is not characterized by a sharp projection of land, as is the case with other localities called "points" but is a fairly uniform, rounded area about a mile or less in length. The banks here are very steep and bluff-like, rising some 20 feet above the level of the lake. A sandy, gravelly or bouldery beach lies at the foot of this bluff. Bottom, very bouldery; water, gradually deepening from 6 inches to 4 feet; vegetation, water willow, lake bulrush. The Bulrush society borders the lakeward side of the water willow society. (Baker, 1916: 62-63).

Naiades:

Anodonta implicata common

Elliptio complanatus abundant

Strophitus undulatus rare

Villosa iris rare

Freshwater gill-breathing Gastropods:

Bulimus tentaculatus rare

NEW YORK-22 (cont.)

| | |
|---------------------------------------|------------|
| <i>Campeloma integrum</i> | rare |
| <i>Goniobasis livescens</i> | abundant |
| Freshwater lung-breathing Gastropods: | |
| <i>Helisoma anceps</i> | rare |
| <i>H. "binneyi"</i> | rare |
| <i>H. campanulatum</i> | abundant |
| <i>Lymnaea stagnalis lillianae</i> | rare |
| <i>Physa "ancillaria warreniana"</i> | not common |
| <i>Stagnicola catascopium</i> | abundant |

NEW YORK - 23. Oneida Lake, Station XXI, Muskrat Bay. Three habitats, listed here as New York - 23-25. Habitat 1: point at west entrance to bay. This habitat includes the area extending from the rounded point of land which forms the west shore of Muskrat Bay, well into the western side of the bay, as it all belongs to the same character of habitat. The shore here is bare of vegetation and forms in some places an overhanging bank upwards of a foot above the water, and in other places a smooth sloping beach. Bottom, bouldery, sandy in the deeper water; water, 6 to 36 inches deep. (Baker, 1916: 63-64).

Naiades:

| | |
|-------------------------------|----------|
| <i>Anodonta cataracta</i> | common |
| <i>A. grandis "footiana"</i> | rare |
| <i>A. implicata</i> | common |
| <i>Elliptio complanatus</i> | abundant |
| <i>Lampsilis radiata</i> | abundant |
| <i>L. radiata siliquoidea</i> | rare |

Sphaeriidae:

| | |
|-----------------------------|------|
| <i>Sphaerium striatinum</i> | rare |
|-----------------------------|------|

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----------|
| <i>Amnicola lustrica</i> | rare |
| <i>Goniobasis livescens</i> | abundant |

Freshwater lung-breathing Gastropods:

| | |
|--------------------------------------|---------------|
| <i>Gyraulus hirsutus</i> | rare |
| <i>Helisoma campanulatum</i> | rare |
| <i>Physa "ancillaria warreniana"</i> | rare |
| <i>Stagnicola emarginata</i> | 1 only, dead. |

NEW YORK - 24. Oneida Lake, Station XXI, Muskrat Bay, Habitat 2, western part of Muskrat Bay. Bottom, sandy silt near shore, bouldery near center; water 2-3 feet deep; vegetation,

NEW YORK-24 (cont.)

zonal; mollusks only in Zone B, lake bulrush. (Baker, 1916: 64).

Naiades:

| | |
|------------------------------|--------|
| <i>Alasmidonta undulata</i> | rare |
| <i>Anodonta cataracta</i> | common |
| <i>A. grandis "footiana"</i> | common |
| <i>A. implicata</i> | common |
| <i>A. marginata</i> | rare |

Sphaeriidae:

| | |
|-----------------------------|--------|
| <i>Sphaerium striatinum</i> | common |
|-----------------------------|--------|

Freshwater gill-breathing Gastropods:

| | |
|---------------------------|--------|
| <i>Campeloma integrum</i> | common |
|---------------------------|--------|

NEW YORK - 25. Oneida Lake, Station XXI, Muskrat Bay, Habitat 3, southeast side of Muskrat Bay. Bottom sandy with occasional boulders; water 2-3 feet deep; vegetation zonal; mollusks only in Zone B, water weed, hornwort, water milfoil, water celery, clasping-leaved pondweed, stonewort (submerged), and pickerelweed, lake bulrush, sweet-scented water lily, cow lily, floating pond-weed. (Baker, 1916: 65).
Naiades:

| | |
|---------------------------|---|
| <i>Anodonta cataracta</i> | ? |
|---------------------------|---|

Sphaeriidae:

| | |
|-----------------------------|------------|
| <i>Sphaerium striatinum</i> | infrequent |
|-----------------------------|------------|

Freshwater gill-breathing Gastropods:

| | |
|--------------------------|--------|
| <i>Amnicola lustrica</i> | common |
|--------------------------|--------|

Freshwater lung-breathing Gastropods:

| | |
|-------------------------------|--------|
| <i>Helisoma campanulatum</i> | ? |
| <i>Stagnicola catascopium</i> | common |

NEW YORK - 26. Oneida Lake, Station XXII, Fliegel Point. Fliegel Point marks the eastern boundary of Muskrat Bay. It is a bare, wind-swept area, the vegetation a heavy growth of water willow in water 1-3 feet deep; bottom gravelly or bouldery. (Baker, 1916: 66).

Naiades:

| | |
|-----------------------------|--------|
| <i>Anodonta cataracta</i> | common |
| <i>A. implicata</i> | common |
| <i>Elliptio complanatus</i> | common |

Sphaeriidae:

| | |
|-----------------------------|--------|
| <i>Sphaerium striatinum</i> | common |
|-----------------------------|--------|

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|--------|
| <i>Goniobasis livescens</i> | common |
|-----------------------------|--------|

NEW YORK-26 (cont.)

Freshwater lung-breathing Gastropoda:

| | |
|--------------------------------------|----------|
| <i>Physa</i> "ancillaria warreniana" | rare |
| <i>Stagnicola catascopium</i> | abundant |

NEW YORK - 27. Oneida Lake, Station XXIII, Walnut Point. This habitat is a long, narrow point extending in a northerly direction for a distance of over a quarter of a mile into the lake. The point itself turns to the northeast almost at a right angle. The water about this point is from 1 to 3 feet deep and the bottom is very bouldery. The only vegetation is water willow. (Baker, 1916: 66).

Naiades:

| | |
|-----------------------------|--------|
| <i>Elliptio complanatus</i> | common |
|-----------------------------|--------|

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----------|
| <i>Goniobasis livescens</i> | abundant |
|-----------------------------|----------|

Freshwater lung-breathing Gastropods:

| | |
|-------------------------------|----------|
| <i>Stagnicola catascopium</i> | abundant |
|-------------------------------|----------|

NEW YORK - 28. Oneida Lake, Station XXIV, bay east of Walnut Point, a wide bay, lying between Walnut and Old Man Points. It is well filled with vegetation which is arranged in zones. Bottom, sandy, with occasional boulders; water, 2-3 feet deep; vegetation, zonal. (Baker, 1916: 68).

Naiades:

| | |
|-----------------------------|--------|
| <i>Elliptio complanatus</i> | common |
|-----------------------------|--------|

Freshwater lung-breathing Gastropods:

| | |
|------------------------------|--------|
| <i>Helisoma campanulatum</i> | common |
|------------------------------|--------|

NEW YORK - 29. Oneida Lake, Station XXV, Old Man Point. A broadly rounded point extending into the lake between Walnut Point and Long Point. Bottom, bouldery and gravelly; water, 1-3 feet deep; vegetation, water willow, American bulrush. (Baker, 1916: 69).

Naiades:

| | |
|------------------------------------|------------|
| <i>Anodonta grandis</i> "footiana" | not common |
|------------------------------------|------------|

| | |
|-----------------------------|--------|
| <i>Elliptio complanatus</i> | common |
|-----------------------------|--------|

| | |
|--------------------------|--------|
| <i>Lampsilis radiata</i> | common |
|--------------------------|--------|

| | |
|-------------------------------|------|
| <i>L. radiata siliquoidea</i> | rare |
|-------------------------------|------|

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----------|
| <i>Goniobasis livescens</i> | abundant |
|-----------------------------|----------|

NEW YORK-29 (cont.)

Freshwater lung-breathing Gastropods:

| | |
|--------------------------|------------|
| <i>Gyraulus hirsutus</i> | not common |
|--------------------------|------------|

| | |
|------------------------------|----------|
| <i>Helisoma campanulatum</i> | abundant |
|------------------------------|----------|

| | |
|------------------------------------|----------|
| <i>Lymnaea stagnalis lillianae</i> | abundant |
|------------------------------------|----------|

| | |
|--------------------------------------|----------|
| <i>Physa</i> "ancillaria warreniana" | abundant |
|--------------------------------------|----------|

| | |
|-------------------------------|----------|
| <i>Stagnicola catascopium</i> | abundant |
|-------------------------------|----------|

NEW YORK - 30. Oneida Lake, Station XXVI, Long Point, a narrow point of land extending into the lake eastward for about three-quarters of a mile. It is about one-eighth of a mile wide and is bordered on both sides by shallow bays filled with vegetation. The habitat under discussion is at the extreme end of the point, on the north side. Bottom, bouldery on point, sandy in western part of embayment; water, 1-2 feet deep; vegetation, water willow, American bulrush, Lake bulrush. (Baker, 1916: 70).

Naiades:

| | |
|---------------------------|--------|
| <i>Anodonta cataracta</i> | common |
|---------------------------|--------|

| | |
|---------------------|------|
| <i>A. implicata</i> | rare |
|---------------------|------|

| | |
|-----------------------------|--------|
| <i>Elliptio complanatus</i> | common |
|-----------------------------|--------|

| | |
|--------------------------|--------|
| <i>Lampsilis radiata</i> | common |
|--------------------------|--------|

Sphaeriidae:

| | |
|-----------------------------|------------|
| <i>Sphaerium striatinum</i> | not common |
|-----------------------------|------------|

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----------|
| <i>Goniobasis livescens</i> | abundant |
|-----------------------------|----------|

Freshwater lung-breathing Gastropods:

| | |
|------------------------|------|
| <i>Helisoma anceps</i> | rare |
|------------------------|------|

| | |
|------------------------|--------|
| <i>H. campanulatum</i> | common |
|------------------------|--------|

| | |
|------------------------------------|------|
| <i>Lymnaea stagnalis lillianae</i> | rare |
|------------------------------------|------|

| | |
|--------------------------------------|---|
| <i>Physa</i> "ancillaria warreniana" | ? |
|--------------------------------------|---|

| | |
|-------------------------------|----------|
| <i>Stagnicola catascopium</i> | abundant |
|-------------------------------|----------|

NEW YORK - 31. Oneida Lake, Station XXVII, Lower South Bay, Habitat 1, Steamboat Wharf. Mollusks on stones and loose timbers in a few inches of water, on protected side. (Baker, 1916: 70-71).

Naiades:

| | |
|---------------------------|---|
| <i>Anodonta marginata</i> | ? |
|---------------------------|---|

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----------|
| <i>Bulimus tentaculatus</i> | abundant |
|-----------------------------|----------|

Freshwater lung-breathing Gastropods:

| | |
|---------------------------|----------|
| <i>Helisoma trivolvis</i> | abundant |
|---------------------------|----------|

| | |
|----------------------|--------|
| <i>Physa integra</i> | common |
|----------------------|--------|

NEW YORK - 32. Oneida Lake, debris on shore, near Thierre's landing. The shore in several places was paved with the dead shells of mollusks, clearly attesting the abundance of these animals in the bay. Species marked * were very abundant. (Baker, 1916: 70-71).

Naiades:

Elliptio complanatusLampsilis radiata*

Sphaeriidae:

Sphaerium striatinum

Freshwater gill-breathing Gastropods:

*Campeloma integrum**Goniobasis livescens**Somatogyrus altilis**S. subglobosus**Amnicola lustrica**Bulimus tentaculatus**Valvatā bicarinata normalis*

Freshwater lung-breathing Gastropods:

*Helisoma anceps***H. campanulatum**Physa "ancillaria warreniana"**P. "integra"**Stagnicola catascopium*

NEW YORK - 33. Oneida Lake, Station XXIX, Chittenango Creek. East of mouth of Chittenango Creek, on sandy beach, from knee deep to shore on firm sand or firm black mud. (Baker, 1916: 71).

Naiades:

*Elliptio complanatus**Lampsilis siliquoidea*

NEW YORK - 34. Oneida Lake, Station XXX, Frenchman Island, northeast side. The island is about a mile east of Long Point; it is a high body of land rising about 11 feet above the surface of the lake. On the west, north and east sides there are strong wave-cut terraces but the south side is low and lacks this bold character. A shallow zone, or terrace, surrounds the island. This is notably broad on the north, east, and south sides, where the water is from 2 to 4 feet deep, but on the west side there is an abrupt drop to 8 feet. A quarter of a mile west of the island the water

NEW YORK-34 (cont.)

is 15 feet deep, and east of the island it is 20 feet deep. Two habitats (New York 34 and 35) are distinguished. (Baker, 1916: 71-74).

Habitat 1, quiet water, pond-like tract, separated from the open lake by a ridge, in some places subaqueous, upon which the following plants grow: buttonbush, water willow, swamp loosestrife. Inside this lakeward barrier the water lies in a long shallow pool, not exceeding 20 inches in depth. The bottom is soft silt in spots, for the depth of a few inches, then hard sand or clay. It is mostly of firm material. The vegetation is very dense and consists of broad-leaved arrow-head, Smith's bulrush, water willow, sedge, and large blue flag.

Naiades:

Elliptio complanatus: rare, emigrants from 35.

Freshwater lung-breathing Gastropods:

Helisoma campanulatum not common*H. trivolvis* "var." abundant*Lymnaea stagnalis lillianae* common*Physa "ancillaria warreniana"* not common*Stagnicola catascopium* abundant

Land Gastropods:

Oxyloma retusa, in pool, on water willow

NEW YORK - 35. Oneida Lake, same locality as N.Y. -34, Habitat 2: begins near the barrier mentioned in habitat 1, where the water is six inches deep and extends lakeward gradually deepening for 500 feet until a depth of 5 feet is reached, at which point the bottom drops suddenly to 12 and then to 20 feet. The shoreward margin is lined with water willow which extends lakeward, in patches, for a distance of several hundred feet. The bottom is very bouldery for over a hundred feet from the barrier, where it becomes sandy with an occasional boulder. (Baker, 1916: 71-74).

Naiades:

Actinonaias carinata 1 only*Anodonta cataracta* common*A. implicata* common*A. marginata* common*Elliptio complanatus* abundant*Lampsilis radiata* common*L. radiata siliquoidea* rare

NEW YORK-35 (cont.)

Sphaeriidae:

| | |
|---------------------------|------|
| <i>Sphaerium lacustre</i> | rare |
| <i>S. securis</i> | rare |

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----------|
| <i>Goniobasis livescens</i> | abundant |
|-----------------------------|----------|

Freshwater lung-breathing Gastropods:

| | |
|--------------------------------------|----------|
| <i>Helisoma "binneyi"</i> | common |
| <i>H. trivolvis</i> , "var." | abundant |
| <i>Lymnaea stagnalis lillianae</i> | common |
| <i>Physa "ancillaria warreniana"</i> | common |
| <i>Stagnicola catascopium</i> | abundant |

NEW YORK - 36. Oneida Lake, Station XXXI, Frenchman Island, south side. For a distance of a third of a mile southeast of the island a shallow terrace extends, which ranges from 1 to 4 feet in depth. On the edges of this area the water abruptly drops to 6 and 8 feet in depth. The two islands, Frenchman and Dunham, are joined by a submerged ridge which is not deeper than 4 feet, near the latter island. The vegetation bordering Frenchman Island is abundant and varied and the station is divisible into several habitats, listed here under N.Y. 36 to 40.

Habitat 1, east of Typha association; zone B, burreed-Arrowhead-Nymphaea association; bottom, sandy silt, rather soft; water, 12-24 inches deep. (Baker, 1916: 76-78).

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|------------|
| <i>Amnicola limosa</i> | rare |
| <i>Bulimus tentaculatus</i> | not common |

Freshwater lung-breathing Gastropods:

| | |
|--------------------------------------|----------|
| <i>Acella haldemani</i> | common |
| <i>Helisoma campanulatum</i> | common |
| <i>H. trivolvis</i> | common |
| <i>Laevapex fuscus</i> | common |
| <i>Lymnaea stagnalis lillianae</i> | abundant |
| <i>Physa "ancillaria warreniana"</i> | rare |
| <i>Stagnicola catascopium</i> | rare |

NEW YORK - 37. Same locality as N.Y. -36, Habitat 1, zone C; bottom hard, sandy, with an occasional boulder; water 2-3 feet deep; American bulrush, Smith's bulrush, water willow, pickerel-weed. (Baker, 1916: 76-78).

NEW YORK-37 (cont.)

Sphaeriidae:

| | |
|--------------------------|--------|
| <i>Sphaerium securis</i> | rare |
| <i>S. striatinum</i> | common |

Freshwater gill-breathing Gastropods:

| | |
|------------------------------------|----------|
| <i>Amnicola lustrica</i> | common |
| <i>Bulimus tentaculatus</i> | abundant |
| <i>Valvata bicarinata normalis</i> | rare |

Freshwater lung-breathing Gastropods:

| | |
|--------------------------------------|------------|
| <i>Gyraulus hirsutus</i> | rare |
| <i>Helisoma anceps</i> | common |
| <i>H. campanulatum</i> | abundant |
| <i>H. trivolvis</i> , "var." | common |
| <i>Physa "ancillaria warreniana"</i> | rare |
| <i>Stagnicola catascopium</i> | not common |

NEW YORK - 38. Same locality as N.Y. -36, Habitat 2, Typha association; bottom, muddy, with accumulation of dead plant debris; water 16-24 inches deep. Species marked * are considered by Baker to be normal inhabitants of this habitat. (Baker, 1916: 80-82).

Naiades:

| | |
|---------------------------|--------|
| <i>Anodonta cataracta</i> | 1 only |
| <i>Lampsilis radiata</i> | 1 only |

Freshwater gill-breathing Gastropods:

| | |
|------------------------------------|--------|
| <i>Bulimus tentaculatus</i> | 2 only |
| <i>Valvata bicarinata normalis</i> | 1 only |

Freshwater lung-breathing Gastropods:

| | |
|--------------------------------------|----------|
| * <i>Gyraulus parvus</i> | common |
| * <i>Helisoma trivolvis</i> | abundant |
| * <i>Laevapex fuscus</i> | abundant |
| * <i>Lymnaea stagnalis lillianae</i> | ? |
| * <i>Promenetus exacuus</i> | common |

NEW YORK - 39. Same locality as N.Y. -36, Habitat 3, Nymphaea-Pontederia association; lies west of the Typha association. The vegetation is unusually thick; bottom, sandy mud; water, 12-24 inches deep; vegetation, pickerel-weed, cow lily, sweet-scented water lily. (Baker, 1916: 80-82).

Freshwater lung-breathing Gastropods:

| | |
|------------------------------------|----------|
| <i>Helisoma trivolvis</i> | abundant |
| <i>Lymnaea stagnalis lillianae</i> | common |

NEW YORK - 40. Same locality as N.Y.-36, Habitat 4, an area comparatively free from water plants, not far from shore, subject to moderate wave action, although protected by a zone of water willow about 100 feet from shore. Bottom, hard, stony and bouldery, on sand; water, 6-15 inches deep. (Baker, 1916: 80-82).

40a. Living Mollusca:

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----------|
| <i>Amnicola lustrica</i> | abundant |
| <i>Bulimus tentaculatus</i> | abundant |
| <i>Campeloma integrum</i> | 1 only |

Freshwater lung-breathing Gastropods:

| | |
|--------------------------------------|--------|
| <i>Ferrissia parallela</i> | common |
| <i>Gyraulus hirsutus</i> | 1 only |
| <i>Helisoma anceps</i> | 2 only |
| <i>H. "binneyi"</i> | 3 only |
| <i>H. campanulatum</i> | 4 only |
| <i>Physa "ancillaria warreniana"</i> | common |
| <i>Stagnicola catascopium</i> | common |

40b. Dead shells of clams, probably brought in from deeper water, some of them containing *Ferrissia*, *Amnicola*, and *Bulimus*.

Naiades:

| |
|------------------------------------|
| <i>Anodonta grandis "footiana"</i> |
| <i>A. implicata</i> |
| <i>A. marginata</i> |
| <i>Elliptio complanatus</i> |
| <i>Lampsilis radiata</i> |

NEW YORK - 41. Oneida Lake, Station XXXIII, Long Island, a long, low body of land, a trifle more than a mile south of Constantia. It is situated in the center of a cluster of 5 large islands and shoals and lies in a northwest by southeast direction. It is a trifle more than an eighth of a mile long and about 20 feet wide. The water immediately surrounding the island is shallow (1-2 feet deep), but drops to 8 and then to 18-24 feet in a short distance. The shallowest spots are at the north and south ends, where they extend eastward and westward for the distance of an eighth of a mile. Sedges and other plants are growing upon the narrow islet and slowly adding to its surface. The

NEW YORK-41 (cont.)

bottom in the shallow water is bouldery and the vegetation consists of water willow and bulrushes. Animal life is exceedingly abundant, covering the boulders and clinging to the water plants. The island is exposed on all sides to the rough waves of the lake, which, however, are modified in spots by the thickness of the colonies of water willow, which form a dense barrier 20-25 feet from the shore. (Baker, 1916: 82-83).

Naiades:

| | |
|----------------------------------|----------|
| <i>Elliptio complanatus</i> | abundant |
| <i>Lampsilis radiata</i> | common |
| <i>Margaritana margaritifera</i> | rare |

Freshwater lung-breathing Gastropods:

| | |
|--------------------------------------|----------|
| <i>Helisoma "binneyi"</i> | common |
| <i>H. campanulatum</i> | common |
| <i>Lymnaea stagnalis lillianae</i> | abundant |
| <i>Physa "ancillaria warreniana"</i> | common |
| <i>Stagnicola catascopium</i> | common |

NEW YORK - 42. Oneida River, below Brewerton, Station XXXVIII. This station is about three-quarters of a mile west of the railroad bridge at Brewerton, on the south bank of the river. Near shore the water is from 1-2 feet deep and the bottom is muddy. The river rapidly deepens to 14 feet. Such plants as the following border the shore: narrow-leaved cat-tail, broad-leaved arrow-head, and blue flag. Mollusks live in the shallow water but do not appear to be very abundant. (Baker, 1916: 87).

Naiades:

| |
|-----------------------------|
| <i>Elliptio complanatus</i> |
| <i>Lampsilis radiata</i> |

Freshwater gill-breathing Gastropods:

| | |
|-------------------------------|------------|
| <i>Bulimus tentaculatus</i> | not common |
| <i>Campeloma integrum</i> | |
| <i>Viviparus contectoides</i> | |

Freshwater lung-breathing Gastropods:

| | |
|--------------------------------------|---------|
| <i>Helisoma campanulatum</i> | common |
| <i>H. trivolvis</i> | common |
| <i>Physa "ancillaria warreniana"</i> | 1, dead |
| <i>Stagnicola catascopium</i> | 1, dead |

Land Gastropods:

Succinea avara, on *Typha*.

NEW YORK - 43. Oneida Lake, dredgings in the open lake, made with crowfoot dredge. Station XXXIX, from a point on the north shore of the outlet, 200 feet east of the railroad bridge, southeastward three-eighths of a mile. Bottom, sandy silt to mud; water, 3 to 10 feet deep; vegetation, all submerged, clasping-leaved pondweed, various-leaved pondweed, water celery, water weed, hornwort, water milfoil, stonewort. (Baker, 1916: 87-88).

43a. Gastropods:

Freshwater gill-breathing Gastropods:

Bulimus tentaculatus, "6 times as abundant as all other species combined."

Valvata bicarinata normalis, rare.

Freshwater lung-breathing Gastropods:

Ferrissia parallela not common

Gyraulus parvus rare

Helisoma campanulatum common

Physa "ancillaria warreniana" abundant

43b. Clams from 5 feet of water, crowfoot dredge:

Naiades:

Lampsilis borealis

Margaritana margaritifera

NEW YORK - 44. Oneida Lake, dredgings in open lake, made with crowfoot dredge. Station XL, Big Bay; bottom, sandy or muddy, with occasional boulders; water, 8-10 feet deep; vegetation, water celery, clasping-leaved pondweed, various-leaved pondweed, water weed, hornwort, water milfoil, stonewort. (Baker, 1916: 88-89).

Freshwater lung-breathing Gastropods:

Helisoma campanulatum

Physa "ancillaria warreniana"

NEW YORK - 45. Oneida Lake, dredgings in open lake, made with crowfoot dredge. Station XLI, middle of lake. Bottom, hard sand, with occasional boulder; water, 10-16 feet deep; below a depth of 10 feet, no vegetation was observed, but clams were numerous. As many as 8 were brought up at one time on the crowfoot dredge. (Baker, 1916: 89-90).

NEW YORK-45 (cont.)

Naiades:

Elliptio complanatus - "most abundant species"

Lampsilis radiata

OHIO - 1. West Sister Island, Lake Erie. Land snails were abundant before 1915 but have since become scarce, possibly because of cattle, chickens, turkeys, and Belgian hares introduced by the lighthouse keeper. (Goodrich, 1916: 530).

Land Gastropods:

Allogona profunda strontiana

Anguispira alternata eriensis

A. kochi

Carychium exiguum

Discus cronkhitei

Gastrocopta armifera

G. contracta

G. holzingeri

G. pentodon

G. tappaniana

Hawaiiia minuscula

Helicodiscus parallelus

Mesodon elevatus

M. inflectus

M. zaletus

Punctum minutissimum

Retinella indentata

Stenotrema fraternum

Triodopsis albolabris

Vallonia parvula

V. pulchella

Vertigo milium

Zonitoides arboreus

OHIO - 2. Green Island, Lake Erie. Snails abundant on an uninhabited island; chickens are confined and there is no cattle. Compare with Ohio-1. Conditions described are those obtaining in 1915. (Goodrich, 1916: 530).

Land Gastropods:

Allogona profunda strontiana

Anguispira alternata eriensis

A. kochi strontiana

Mesodon inflectus

M. zaletus

OHIO - 3. Mouse Island, Lake Erie, visited by Goodrich in 1912. No details on abundance of snails, but notable because this is the type locality of *Anguispira kochi mynesites*. (Goodrich, 1916: 531).

Land Gastropods:

Allogona profunda
Anguispira alternata
Mesodon inflectus
Triodopsis albolabris
Zonitoides arboreus

OHIO - 4. South Bass Island, Lake Erie, "Put-in-Bay" Island of Allen (1915). "Nearly all cultivated, with orchard and vineyard, but retaining some rocky forest. It is of limestone formation, contains caves, and at places is faced with cliffs, and in the wilder parts is adorned with brilliant flowers, scarlet *Silene* and blue *Pentstemon*. Nearly the whole breadth of this isthmus is occupied by a pool, which until lately was bordered on one side by a little patch of woods. (Allen, 1915: 19). The island is much more thickly populated, at least in summer, than it was in Allen's day. Collections were made here in 1958 by the writer in the "wilder parts" of the island where dead shells of most of the species listed by Allen were to be found but very few living mollusks.

Land Gastropods:

Deroceras laeve
Gastrocopta armifera
G. contracta
G. holzingeri
G. pentodon
Hawaiiia minuscula
Nesovitrea electrina
Oxyloma "retusa var. higginsii"
Retinella indentata
Stenotrema leai
Triodopsis albolabris
T. multilineata
Vallonia excentrica
V. parvula
V. pulchella
Zonitoides arboreus

OHIO - 5. South Bass Island, Lake Erie, "Put-in-Bay" Island of Allen (1915). Still farther west (of Ohio-4) a considerable piece of dry, rocky woods extends along the shore and contains: (Allen, 1915: 19).

Land Gastropods:

Allogona profunda
Anguispira kochi
Mesodon inflectus
M. thyroidus
M. zaletus
Philomycus carolinianus
Succinea ovalis Say ?
Triodopsis albolabris
T. fraudulentula vulgata

OHIO - 6. South Bass Island, Lake Erie, "Elsewhere on Put-in-Bay Island." (Allen, 1915: 19).

Land Gastropods:

Anguispira alternata
Carychium exiguum
Discus cronkhitei
Helicodiscus parallelus

OHIO - 7. Kelley's Island, about 5 miles southeast of Put-in-Bay. (Allen, 1915: 20).

Land Gastropods:

Allogona profunda
Anguispira alternata
A. kochi
Gastrocopta armifera
G. contracta
G. holzingeri
Helicodiscus parallelus
Mesodon inflectus
M. thyroidus
M. zaletus
Oxyloma retusa
Stenotrema leai
Succinea avara
Triodopsis albolabris
T. fraudulentula vulgata
T. multilineata
Vallonia pulchella
Zonitoides arboreus

OHIO - 8. Ottawa County; Bass Islands, Lake Erie. Station 1, a rocky shore, Buckeye Island: really an extension of the eastern end of South Bass Island as it is separated from the larger island by only a few feet of shallow water. Station 1 is protected on the northwest by the bar which connects Buckeye with South Bass Island, on the east and southeast it is protected by a spur of Buckeye Island, to the south and southwest the only protection is the mainland, three miles away, and in heavy gales from these directions fairly large waves reach this station; this condition occurs only rarely. As a whole the station is very well protected. The substratum was composed of stones averaging 30 cubic inches. The stones were all covered with algae. There was some submerged vegetation in zone 2 and some sediment in zones 2, 3, and 4. Substratum rocky throughout. The gradient at this station is rather low, 3 feet in 20. (Dennis, 1928: 4-5).

8a. Zone 1, at shore, water 24° C, water 2 inches deep, pH 7.8.

Freshwater lung-breathing Gastropods:

| | |
|--|------------------|
| <i>Fossaria humilis</i> | 110 ¹ |
| <i>Physa "ancillaria magnalacustris"</i> | 151 |

8b. Zone 2, 8 feet from shore, water 24° C, depth of water 6 inches, pH 7.8.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----|
| <i>Goniobasis livescens</i> | 21 |
|-----------------------------|----|

8c. Zone 3, 15 feet from shore, water 23° C, water 2.5 feet deep, pH 7.8.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----|
| <i>Goniobasis livescens</i> | 20 |
|-----------------------------|----|

Freshwater lung-breathing Gastropods:

| | |
|--|---|
| <i>Physa "ancillaria magnalacustris"</i> | 1 |
|--|---|

8d. Zone 4, 25 feet from shore, water 23° C, 3.5 feet deep; pH 7.8.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----|
| <i>Goniobasis livescens</i> | 10 |
|-----------------------------|----|

OHIO - 9. Ottawa County; Bass Islands, Lake Erie. Station 2, Buckeye Island, an eroding rocky shore, somewhat protected to the southwest but otherwise open. The substratum is of flat,

OHIO-9 (cont.)

solid rock with a few crevices. There are a few small boulders and stones lying near the shore line and these as well as the solid rocks were covered with algae. The gradient here is very low, only 42 inches in 100 feet. All samples from a rocky substratum, temperature of water 22° C, pH 7.8. Ohio 9 a-d are from 1 square foot; e-f, 5 square yards; g, 2 square feet. (Dennis, 1928: 5-6).

9a. At shore, depth of water 1 inch, no snails.

9b. Two feet from shore, depth of water 6 inches.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|---|
| <i>Goniobasis livescens</i> | 1 |
|-----------------------------|---|

Freshwater lung-breathing Gastropods:

| | |
|---------------------------|----|
| <i>Fossaria humilis</i> | 44 |
| <i>Physa "ancillaria"</i> | 28 |

9c. Ten feet from shore, water 9 inches deep.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|---|
| <i>Goniobasis livescens</i> | 3 |
|-----------------------------|---|

9d. Twenty feet from shore, water 16 inches deep.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|---|
| <i>Goniobasis livescens</i> | 9 |
|-----------------------------|---|

9e. Forty feet from shore, water 29 inches deep.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|---|
| <i>Goniobasis livescens</i> | 9 |
|-----------------------------|---|

9f. One hundred feet from shore, water 42 inches deep.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----|
| <i>Goniobasis livescens</i> | 20 |
|-----------------------------|----|

9g. Five hundred feet from shore, water 14 feet deep.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|--------|
| <i>Goniobasis livescens</i> | "many" |
|-----------------------------|--------|

OHIO - 10. Ottawa County, Bass Islands, Lake Erie. Station 3, Buckeye Island, an approaching pond condition. This station is on the north side of Buckeye Island, protected on the north, northeast, east and west. Sediment here covers all but the larger rocks and boulders, vegetation has secured a good foothold. It consists

¹ Number of individuals

OHIO-10 (cont.)

of *Castalia odorata*, *Typha latifolia*, and *Scirpus*. Rocks not covered by sediment are covered with algae. The gradient is very low, 14 inches in 35 feet. There is practically no wave action. The pH throughout is 7.8. (Dennis, 1928: 7-8).

10a. At shore, water 27°, 2 inches deep.

Freshwater lung-breathing Gastropods:

| | |
|--|-----|
| <i>Fossaria humilis</i> | 117 |
| <i>Gyraulus parvus</i> | 4 |
| <i>Physa "ancillaria magnalacustris"</i> | 21 |

10b. Four feet from shore, water 27° C, 4 inches deep.

Freshwater lung-breathing Gastropods:

| | |
|---------------------------|---|
| <i>Fossaria humilis</i> | 5 |
| <i>Physa "ancillaria"</i> | 1 |

10c. Thirty feet from shore, water 27° C, 14 inches deep.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|------------|
| <i>Goniobasis livescens</i> | "numerous" |
|-----------------------------|------------|

10d. One hundred fifty feet from shore, water 26.5° C, 20 inches deep.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----------|
| <i>Goniobasis livescens</i> | "common" |
|-----------------------------|----------|

10e. Eight hundred feet from shore, water 26° C, 12 feet deep.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|---|
| <i>Goniobasis livescens</i> | 6 |
|-----------------------------|---|

OHIO - 11. Ottawa County, Bass Islands, Lake Erie. Station 4, Buckeye Island, a very rocky shore on the east point of the island, protected on the north but exposed on the east and south, where there is considerable wave action in storms. Substratum very rocky; gradient 3 feet in 30; pH 7.6 throughout; water temperature 22° C. (Dennis, 1928: 8-9).

11a. At shore, water 2 inches deep.

Freshwater lung-breathing Gastropods:

| | |
|--|-----|
| <i>Fossaria humilis</i> | 36 |
| <i>Physa "ancillaria magnalacustris"</i> | 151 |

11b. Twenty feet from shore, water 2 feet deep.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|---|
| <i>Goniobasis livescens</i> | 4 |
|-----------------------------|---|

11c. Thirty feet from shore, water 30

OHIO-11c (cont.)

inches deep.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|--------|
| <i>Goniobasis livescens</i> | "many" |
|-----------------------------|--------|

OHIO - 12. Ottawa County, Bass Islands, Lake Erie, Station 5, Middle Bass Island, a rubble beach (gravel). This station is located on the west side of Middle Bass near a point where the shore makes a sharp turn to the west. The wave action is greatly reduced by this curve in the shore, but the station is exposed to waves from the west and northwest. The substratum is rubble; the gradient is steep, 5 feet in 30. This allows the waves to break very close to shore line and the result is a constant grinding of the rubble. Large waves carry it for some distance and throw it high up on the beach, and even the very small waves shift it back and forth. There is practically no sediment or vegetation. Water temperature 22° C except 50 feet from shore, where it is 21° C. No snails at shore and 5, 20, and 30 feet from shore. The only collections were made 50 feet from shore, as follows:

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----|
| <i>Goniobasis livescens</i> | 12 |
|-----------------------------|----|

These were collected with a bottom sampler in water 6 feet deep, over 5 square feet of bottom. Snails were absent farther away from shore. (Dennis, 1928: 9-10).

OHIO - 13. Ottawa County, Bass Islands, Lake Erie, Station 6, Gibraltar Island, a well-protected stony shore. This station is located on the east or bay side of Alligator Bar, which extends south from Gibraltar Island into Put-in-Bay; it is about 80 feet long and 30 feet wide at the widest point. The station is protected on all sides and the water is quiet except in very severe storms. The substratum is composed of rocks averaging 48 cubic inches. There is some sediment and the rocks are covered with algae. There is considerable submerged vegetation (*Cladophora*) starting at the 15-foot level. The gradient is 5 feet in 20. Temperature throughout 23° C; pH 7.8.

13a. Zone 1, at shore, rocky substratum,

OHIO-13a (cont.)

depth of water 1 inch.

Freshwater lung-breathing Gastropods:

| | |
|-------------------------|----|
| <i>Fossaria humilis</i> | ? |
| <i>Physa ancillaria</i> | 18 |

13b. Zone 2, 10 feet from shore, rocky substratum, depth of water 2.5 feet.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|---|
| <i>Goniobasis livescens</i> | 3 |
|-----------------------------|---|

Freshwater lung-breathing Gastropods:

| | |
|-------------------------|---|
| <i>Fossaria humilis</i> | 1 |
| <i>Physa ancillaria</i> | 2 |

OHIO - 14. Ottawa County; Bass Islands, Lake Erie, Station 7, Gibraltar Island, an exposed stony shore. This station is just across the bar from station 6. It is partly protected from the open lake by bars and a projection of Gibraltar and yet during storms from the north and northwest waves break with considerable force near the shore line. The rocks near the shore line are rolled about during storms. The substratum is composed of stones which range in size from pebbles to those 10 inches across. In contrast to those on the opposite side of the bar they are smooth and not covered with algae. There is no sediment. The gradient is about 2.5 feet in 20. The rocks that make up the substratum range in size from coarse gravel to small boulders. Temperature of water 24° C throughout; pH 8.0. (Dennis, 1928: 12-13).

14a. Zone 1, at shore, substratum rocky, depth of water 1 inch.

Freshwater lung-breathing Gastropods:

| | |
|-------------------------|---|
| <i>Physa ancillaria</i> | 5 |
|-------------------------|---|

14b. Zone 2, 10 feet from shore, substratum rocky, depth of water 12 inches; no snails.

14c. Zone 3, 15 feet from shore, substratum rocky, depth of water 2 feet.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----|
| <i>Goniobasis livescens</i> | 23 |
|-----------------------------|----|

14d. Zone 4, 25 feet from shore, substratum gravel and sediment, depth of water 6 feet, no snails.

OHIO - 15. Ottawa County, Bass Islands, Lake Erie, Station 8, Middle Bass Island, a sandy beach with rocky shore line. This station is a sandy shore on Middle Bass Island. It is fairly well protected on all but the east side; in case of storm from this direction the waves come in with some force. The substratum is fine sand except at the shore line where, for a width of two feet, there are rocks which are partly covered with sand. These rocks will average 50 cubic inches in size. The gradient here is very gradual, only 30 inches in 50 feet. (Dennis, 1928: 13-14).

Freshwater lung-breathing Gastropods:

| | |
|-------------------------|----|
| <i>Fossaria humilis</i> | 71 |
| <i>Physa ancillaria</i> | 25 |

OHIO - 16. Ottawa County, Bass Islands, Lake Erie, Station 9, Gibraltar Island, rocky shore with steep gradient. This station is on the north side of Gibraltar Island. The shore line is at the foot of a cliff some 40 or 50 feet high. There is no protection from the open lake to the north and large waves strike the foot of the cliff with great force. There are very few times when the waves are not breaking at the foot of this cliff. The substratum is of stones which vary in size from large gravel to huge boulders. All are bare as the action of the waves prohibits the growth of algae. The smaller stones near the shore line are rolled around a great deal by wave action. The gradient here is very steep, 7 feet in 25. Area of all samples is 1 square foot, substratum rocky, temperature of water 21° C, pH 8.0.

16a. Zone 1, at shore, depth of water 3 inches; no snails.

16b. Zone 2, 5 feet from shore, depth of water 2 feet.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|---|
| <i>Goniobasis livescens</i> | 1 |
|-----------------------------|---|

16c. Zone 3, 10 feet from shore, depth of water 3 feet.

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|---|
| <i>Goniobasis livescens</i> | 3 |
|-----------------------------|---|

OHIO-16 (cont.)

16d. Zone 4, 20 feet from shore, depth of water 5 feet.

Freshwater gill-breathing Gastropods:

Goniobasis livescens 6

16e. Zone 5, 20 feet from shore, depth of water 5 feet.

Freshwater gill-breathing Gastropods:

Goniobasis livescens 3

OHIO - 17. Ottawa County, Bass Islands, Lake Erie, Station 10, East Harbor, Catawba Island, a sand beach. The sand is very fine and is constantly shifting; it settles in long ridges parallel to shore. The station is protected in all directions except the east. The gradient is so gradual that waves break a long way from shore. At a distance of 100 feet from shore it is only 3.5 feet deep and one can walk out nearly a quarter of a mile. Substratum, sand throughout; temperature of water, 25° C throughout; pH 7.8 throughout. No snails at shore or up to 90 feet away. Beyond 90 feet, the following occur (Dennis, 1928: 15-16).

Freshwater gill-breathing Gastropods:

Goniobasis livescens 3

Pleurocera acutum 22

OHIO - 18. Ottawa County, Bass Islands, Lake Erie, Station 11, East Harbor, Catawba Island, an open pond. It has but one opening, about 40 feet wide, to the lake, which allows very few waves to enter. The depth is 10 feet near the opening but the average depth of the channel worked was 3.5 feet. The substratum near the opening is sand but in the pond it gradually changes to muck. The temperature of water is quite variable, probably because of so much vegetation. (Dennis, 1928: 17-19).

18a. Zone 1, at entrance; distance from shore 4 feet, substratum sand, water 22° C, 2 feet deep, pH 7.8.

Freshwater gill-breathing Gastropods:

Campeloma subsolidum 3

Goniobasis livescens 5

Pleurocera acutum 1

OHIO-18 (cont.)

18b. Zone 2, in reeds 100 yards from the mouth of the harbor; distance from shore 10 feet, substratum muck, temperature of water 20° C, depth 1 foot, pH 7.6.

Freshwater gill-breathing Gastropods:

Campeloma subsolidum 1

18c. Zone 3, just across channel from zone 2; distance from shore 3 feet, substratum muck and sand, temperature of water 24° C, depth 18 inches, pH 7.6.

Freshwater gill-breathing Gastropods:

Campeloma subsolidum 5

Goniobasis livescens 2

Pleurocera acutum 3

Freshwater lung-breathing Gastropods:

Helisoma trivolvis 2

18d. Zone 4, an isolated clump of cat-tails about 0.5 mile from the mouth of the harbor; distance from shore 300 feet, substratum muck, temperature of water 25° C, depth 15 inches, pH 7.5.

Freshwater gill-breathing Gastropods:

Campeloma subsolidum 4

Freshwater lung-breathing Gastropods:

Helisoma trivolvis 1

18e. Zone 5, in a growth of lily pads about a mile from the opening of the harbor. *Goniobasis* and *Campeloma* on the bottom, *Amnicola* and *Ferrissia* on lily pads.

Freshwater gill-breathing Gastropods:

Amnicola limosa 20

Campeloma subsolidum 5

Goniobasis livescens 4

Freshwater lung-breathing Gastropods:

Ferrissia parallela 3

Laevapex fuscus 4

OHIO - 19. Ottawa County, Bass Islands, Lake Erie, Station 12, Squaw Harbor, South Bass Island, an approaching pond condition. The site is on the north side of South Bass Island, well protected on all sides and with the water consequently always quiet. The water is constantly changed due to the large opening to the lake. There is some emergent vegetation and a great

OHIO-19 (cont.)

deal of submerged vegetation. The bottom is almost level except near the banks which are steep. The temperature of the water is about that of the lake as the effect of the sun on the quiet water is offset by the shade of the vegetation. (Dennis, 1928: 19-21).

19a. Zone 1, at the water line; snails clinging to rocks which make up a wall for the support of a road; water only an inch or two deep on some of the rocks and a foot deep on others. Temperature of water 22° C, pH 7.8.

Freshwater gill-breathing Gastropods:

Goniobasis livescens 10

Freshwater lung-breathing Gastropods:

Fossaria humilis 3

Helisoma trivolvis 4

Physa ancillaria 3

Land Gastropods:

Oxyloma retusa "higginsii" 5

19b. Zone 2, in dense submerged vegetation, substratum of muck and very soft; temperature of water 22° C, depth of water 18 inches, pH 7.8, no snails.

19c. Zone 3, a bar about 300 feet from shore, exposed to the lake to the north and east and reached by fairly large waves. Substratum of stones ranging in size from coarse gravel to small boulders. Temperature of water 22° C, depth 3 feet, pH 7.8.

Freshwater gill-breathing Gastropods:

Goniobasis livescens 28

19d. Zone 4, a patch of water-lily pads about 100 feet from shore; substratum rocky, area well protected from waves. Substratum muck, temperature of water 22° C, depth 3 feet, pH 7.8.

Freshwater gill-breathing Gastropods:

Amnicola limosa 8

Freshwater lung-breathing Gastropods:

Ferrissia parallela 5

Fossaria humilis 3

Gyraulus parvus 8

Laevapex fuscus 4

Physa ancillaria 1

OHIO-19 (cont.)

19e. Zone 5, a growth of reeds; substratum muck; snails on stems of reeds; temperature of water 22° C, depth 8 inches, pH 7.6.

Freshwater gill-breathing Gastropods:

Amnicola limosa 8

Freshwater lung-breathing Gastropods:

Ferrissia parallela 2

Laevapex fuscus 3

OHIO - 20. Ottawa County, Bass Islands, Lake Erie, Station 13, Fisher's Pond, Middle Bass Island, a pond separated from the lake by only a gravel bank some 30 feet wide. It has evidently been separated from the lake for some time because several large willow trees grow on the bank and the pond bottom is a foot of muck. Vegetation is rank; close to shore is a belt of water lilies, followed by a dense growth of *Sagittaria*; beyond this, another belt of water lilies, which thins out and stops near the middle of the pond to leave a small area of open water with submerged vegetation near the center. Depth is about the same throughout, 12 inches at shore and 15 at the center. Water is colder than in the lake (17° C) due to the great amount of vegetation. (Dennis, 1928: 21-22).

20a. Zone 1, at water line, in a dense growth of water lilies, substratum muck, water 2 inches deep, pH 7.4. Snails clinging to stems or lower surface of water lilies.

Freshwater lung-breathing Gastropods:

Fossaria humilis 4

Gyraulus parvus 2

Helisoma trivolvis 3

Physa ancillaria 2

Promenetus exacuus 4

20b. Zone 2, a dense growth of emergent vegetation (*Scirpus*), bottom muck, depth of water 4 inches, pH 7.4; no snails.

20c. Zone 3, another belt of water lilies, same conditions as 20a except water 3 inches deeper in zone 3.

Freshwater lung-breathing Gastropods:

Fossaria humilis 2

OHIO-20c(cont.)

| | |
|---------------------------|---|
| <i>Gyraulus parvus</i> | 1 |
| <i>Helisoma trivolvis</i> | 2 |
| <i>Physa ancillaria</i> | 1 |

20d. Zone 4, middle of pond, substratum muck, dense growth of submerged vegetation; water 6 inches deep, pH 7.4. No snails either on bottom or vegetation.

OHIO - 21. Ottawa County, Bass Islands, Lake Erie, Station 14, lake channel. Depth of water 30 to 35 feet, temperature two degrees colder than at top (22 at top, 20 at bottom). Snails dredged from steamboat channel between South Bass and Middle Bass Islands. (Dennis, 1928: 22, 23).

Freshwater gill-breathing Gastropods:

| | |
|-----------------------------|----|
| <i>Goniobasis livescens</i> | 1 |
| <i>Pleurocera acutum</i> | 16 |
| <i>Valvata tricarinata</i> | 1 |

Freshwater lung-breathing Gastropods:

| | |
|-----------------------------|---|
| <i>Stagnicola woodruffi</i> | 2 |
|-----------------------------|---|

OHIO - 22. Jefferson County: Steubenville. A river bluff at the edge of the city. The rocky bluffs are covered with a rather rank growth of tall weeds and some shrubs such as sumac and wild grape. A level area along the street is covered with grasses, burdocks and other weeds, and the ground is rather stony. The soil along this side of the Ohio River is impregnated with soot, and is somewhat acid. The snails live in the grass and weeds and under stones and rocks both on the bluff and along the street. (Archer, 1937: 56).

Land Gastropods:

| | |
|-------------------------------|---------------|
| <i>Allogona profunda</i> | occasional |
| <i>Haplotrema concavum</i> | occasional |
| <i>Mesomphix inornatus</i> | occasional |
| <i>M. perlaevis</i> | rare |
| <i>Retinella indentata</i> | |
| form <i>paucilirata</i> | not common |
| <i>Triodopsis albolabris</i> | not common |
| <i>T. tridentata</i> | very common |
| <i>Ventridens intertextus</i> | rare |
| <i>V. ligerus</i> | very abundant |

OHIO - 23. Jefferson County: New Alexandria. This locality consists of a series of steep ledges, thinly wooded, above level open fields on either side of a small stream. The leaf mold is thick; logs are numerous; and the woods are composed of oaks, hickories, and maples. The snails are not very common. They live in leaf mold, under bark, and under logs. (Archer, 1937: 56).

Land Gastropods:

| |
|-------------------------------|
| <i>Allogona profunda</i> |
| <i>Haplotrema concavum</i> |
| <i>Mesodon thyroidus</i> |
| <i>Retinella wheatleyi</i> |
| <i>Stenotrema fraternum</i> |
| <i>S. hirsutum</i> |
| <i>Triodopsis denotata</i> |
| <i>T. tridentata</i> |
| <i>Ventridens intertextus</i> |
| <i>V. ligerus</i> |

OHIO - 24. Jefferson County: New Alexandria. The fields below the ledges (Ohio-23, above) contain only two less species. The vegetation consists of grasses, tall annual weeds, such as goldenrod, mint, and patches of wild grapes. (Archer, 1937: 58).

Land Gastropods:

| |
|--|
| <i>Haplotrema concavum</i> : under logs, in tall weeds; not common. |
| <i>Mesodon clausus</i> : in mint patches. |
| <i>M. thyroidus</i> : in grass, occasional. |
| <i>Stenotrema fraternum</i> : in grass, uncommon. |
| <i>S. hirsutum</i> : in grass, tall weeds; in wild grape patches, under logs. The commonest species in the open. |
| <i>Triodopsis tridentata</i> : under logs; in wild grape; in tall weeds. Next in abundance. |
| <i>Ventridens intertextus</i> : under logs, rare. |
| <i>V. ligerus</i> : in grass, tall weeds, and wild grape. |

OHIO - 25. Belmont County: Lloydsville. This locality is an area of pastured hills. One of the hills contains a patch of oak-hickory woods near the summit; some of the trees are

OHIO-25 (cont.)

white oak, yellow oak, shellbark hickory, rock maple, and beech. The soil is a yellowish clay, and the outcropping rocks are sandstone and shale. The snails are concentrated in leaf pockets, around stumps, and under logs. (Archer, 1937: 59).

Land Gastropods:

- Haplotrema concavum*: occasional.
Helicodiscus parallelus: rare.
Stenotrema fraternum: around stumps, rare.
S. hirsutum: in leaf pockets, occasionally, but commonest hibernating in brambles and around stumps.
Triodopsis albolabris: rare.
T. tridentata: under logs and stones, occasional.
Ventridens demissus: rare.

OHIO - 26. Belmont County: Lloydsville.

In contrast with the seven species above, 14 species were found in the open fields, and some of them are abundant. They live in grass and weeds as well as among stones, and are especially common on the lower slopes. Only 10 species are listed. (Archer, 1937: 57-59).

Land Gastropods:

- | | |
|------------------------------|-----------------|
| <i>Anguispira alternata</i> | rare |
| <i>Haplotrema concavum</i> | occasional |
| <i>Nesovitrea electrina</i> | rare |
| <i>Retinella wheatleyi</i> | rare |
| <i>Stenotrema fraternum</i> | rather frequent |
| <i>S. hirsutum</i> | abundant |
| <i>Triodopsis albolabris</i> | not common |
| <i>T. tridentata</i> | common |
| <i>Ventridens demissus</i> | common |
| <i>Zonitoides arboreus</i> | rare |

OHIO- 27. Guernsey County: three miles west of Fairview. In this locality the woods are largely confined to deep ravines. The trees are white oaks and maples with an understory of seedlings, brambles, and wild grape patches. The humus has been trampled by cattle, and apparently in consequence of this the snails occurring belong mostly to small species. The snails live under fallen bark and logs, in leaf mold,

OHIO-27 (cont.)

and in wild grape. (Archer, 1937: 59).

Land Gastropods:

- | | |
|---------------------------------------|-----------------|
| <i>Anguispira alternata</i> | uncommon |
| <i>Mesodon inflectus</i> | uncommon |
| <i>Stenotrema hirsutum</i> | quite common |
| <i>Triodopsis fraudulenta vulgata</i> | uncommon |
| <i>Ventridens ligerus</i> | rather frequent |

OHIO - 28. Guernsey County: Three miles west of Fairview. In the shrubby, grassy roadsides and fields above the ravines. (Archer, 1937: 59-60).

Land Gastropods:

- Anguispira alternata*: in trash, among shrubs, uncommon.
Mesodon inflectus: in shrubs and grass, occasional.
Stenotrema fraternum: common in grass, but avoiding shrubs.
Triodopsis fraudulenta vulgata: mostly in shrubs, the commonest species.

OHIO - 29. Portage County: Dollar Lake, a basic bog lake. Water for the most part basic (alkaline) rather than acidic. Roughly circular in outline, about 6 acres in area, maximum depth 23 feet; no drainage; temperature range from 0 to 28° C at the surface and 3 to 23° C at the bottom. Ice, about one foot, forms on the surface from December to March each winter. Water level fluctuates a maximum of 18 inches depending on rainfall; pH 6.8 in spring to 8.6 in summer; range of temperature and pH varies with spring and fall overturn (spring average 4° C, pH 7.1; fall average 6° C, pH 7.3). During the summer the water is stratified from the surface (28° C; pH 8.6) to the bottom (23° C, pH 6.7). During the winter there is less pronounced stratification from just under the ice (0° C, pH 7.8) to the bottom (4° C; pH 6.9). Bottom, soft black silt composed of fine organic detritus (ooze) mixed with clay. It has a gelatinous consistency. Mollusca collected from 12 zones, described in detail by Dexter (1950: 19-26).

Zone 1. Chara-Myriophyllum zone

OHIO - 29 (cont.)

Zone 2. Potamogeton zone
 Zone 3. Castalia zone
 Zone 4. Nymphaea-Pontederia zone
 Zone 5. Decodon zone
 Zone 6. Toxicodendron-Vaccinium zone
 Zone 7. Larix zone
 Zone 8. Typha zone.

Zone 9. Cephalanthus zone
 Zone 10. Alnus zone
 Zone 11. Salix zone
 Zone 12. Quercus-Fagus-Ulmus zone.

Mollusca were collected by Dexter from all zones; his table, with slight changes in taxonomy, is reproduced below.

| Species | Zones | | | | | | | | | | | |
|------------------------------|-------|---|---|---|---|----|---|---|----|----|----|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| <i>Promenetus exacuus</i> | S | C | S | S | C | . | . | N | HS | . | . | . |
| <i>Valvata tricarinata</i> | C | C | C | C | C | . | . | C | HS | HS | . | . |
| <i>Amnicola limosa</i> | A | A | A | A | A | HS | . | C | HS | HS | . | . |
| <i>Helisoma campanulatum</i> | C | C | C | N | C | HN | . | C | HS | HN | . | . |
| <i>Physa heterostropha</i> | S | N | N | N | C | HS | . | C | HN | HN | . | . |
| <i>Gyraulus parvus</i> | N | C | N | N | S | HN | . | C | HN | HC | HS | . |
| <i>Pisidium</i> spp. | S | N | N | N | S | HS | . | S | HN | HN | HS | . |
| <i>Ferrissia</i> sp. | . | N | . | S | . | . | . | . | . | . | . | . |
| <i>Sphaerium</i> spp. | . | S | . | S | N | . | . | S | . | HS | . | . |
| <i>Fossaria obrussa</i> | . | N | . | . | N | . | . | S | HS | HN | . | . |
| <i>Stagnicola palustris</i> | . | N | . | . | N | . | . | N | HN | HS | . | . |
| <i>Sphaerium</i> spp. | . | C | . | N | C | HS | . | C | HN | HN | HS | . |
| <i>Oxyloma retusa</i> | . | S | . | N | N | . | . | C | C | N | N | . |
| <i>Deroceras</i> (2 spp.) | . | . | . | S | S | N | S | N | N | C | C | C |
| <i>Hawaii minuscula</i> | . | . | . | . | . | S | N | . | . | N | N | . |
| <i>Pallifera</i> sp. | . | . | . | . | . | S | . | . | . | . | . | S |
| Immature land snails | . | . | . | . | . | . | S | . | . | N | C | N |
| <i>Stenotrema hirsutum</i> | . | . | . | . | . | . | . | . | . | N | C | S |
| <i>Anguispira alternata</i> | . | . | . | . | . | . | . | . | . | N | C | C |
| <i>Discus patulus</i> | . | . | . | . | . | . | . | . | . | . | N | . |
| <i>Mesodon thyroidus</i> | . | . | . | . | . | . | . | . | . | . | N | N |
| <i>Triodopsis tridentata</i> | . | . | . | . | . | . | . | . | . | . | S | S |
| <i>Strobilops aenea</i> | . | . | . | . | . | . | . | . | . | . | . | S |

A = abundant; C = common; N = numerous; S = scarce; H = during high water.

OHIO - 30-42. Portage and Stark Counties, temporary pools and ponds. Collected by Dexter (1953: 26-33), detailed separately here (Ohio 30-42).

OHIO - 30. Stark County, a roadside ditch. (Dexter, 1953: 30).
 Sphaeriidae:
Pisidium sp.

Freshwater lung-breathing Gastropods:
Helisoma trivolvis
Physa gyrina

OHIO - 31. Portage County, ditch of a railroad fill. (Dexter, 1953: 30).

Sphaeriidae:

Pisidium sp.

Freshwater lung-breathing Gastropods:

Fossaria obrussa

F. parva

Gyraulus parvus

Physa gyrina

Stagnicola palustris

Land Gastropods:

Oxyloma retusa

OHIO - 32. Portage County, field pond. (Dexter, 1953: 30).

Sphaeriidae:

Sphaerium, 2 sp.

Freshwater lung-breathing Gastropods:

Aplexa hypnorum

Fossaria obrussa

Gyraulus parvus

Physa gyrina

Stagnicola palustris

Land Gastropods:

Deroceras reticulatum

OHIO - 33. Portage County, a pasture pool. (Dexter, 1953: 30).

Sphaeriidae:

Sphaerium sp.

Freshwater lung-breathing Gastropods:

Aplexa hypnorum

Fossaria obrussa

Gyraulus parvus

Pseudosuccinea columella

OHIO - 34. Stark County, a pasture pond. (Dexter, 1953: 30).

Sphaeriidae:

Sphaerium sp.

Freshwater lung-breathing Gastropods:

Fossaria obrussa

Gyraulus parvus

Stagnicola palustris

OHIO-34 (cont.)

Land Gastropods:

Deroceras laeve

D. reticulatum

OHIO - 35. Summit County, a sedge pond. (Dexter, 1953: 30).

Sphaeriidae:

Sphaerium 2 sp.

Freshwater lung-breathing Gastropods:

Fossaria obrussa

Gyraulus parvus

Physa gyrina

Pseudosuccinea columella

OHIO - 36. Summit County, a cattail pond. (Dexter, 1953: 30).

Sphaeriidae:

Sphaerium sp.

Freshwater lung-breathing Gastropods:

Gyraulus parvus

Physa gyrina

Pseudosuccinea columella

OHIO - 37. Stark County, a grassy swamp pond. (Dexter, 1953: 30).

Sphaeriidae:

Pisidium sp.

Sphaerium, 2 sp.

Freshwater lung-breathing Gastropods:

Fossaria obrussa

Gyraulus parvus

Helisoma trivolvis

Stagnicola palustris

Land Gastropods:

Deroceras reticulatum

OHIO - 38. Summit County, a buttonbush swamp pond. (Dexter, 1953: 30).

Sphaeriidae:

Sphaerium, 2 sp.

Freshwater lung-breathing Gastropods:

Fossaria obrussa

Gyraulus parvus

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