

# THE FRESH-WATER NAIADES OF AUGLAIZE COUNTY, OHIO

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This paper deals with 30 collections of mussels taken at 24 stations (Fig. 1) in the drainage systems of Auglaize County during the past four years, 1938-42. The materials are of interest because: (1) no other naiad records have been published for this area; (2) rapid changes in stream ecology necessarily alter the mussel fauna; and (3) the proximity of headwater streams of the Ohio and Lake Erie drainages produce interesting distribution patterns for comparison. In the general vicinity, Goodrich (1914) reported on naiades from the Wabash River in Mercer County; Clark and Wilson (1912) surveyed the Maumee and Auglaize Rivers of Defiance County; Kirsch (1894) investigated the Maumee Basin; Ortmann (1919) reported on mussels from the St. Marys River, Beaver Creek, and Lake St. Marys in Mercer County, the Maumee River in Defiance County, the Scioto River in Hardin County, and Indian Lake in Logan County. These collections have been made in counties to the west, north and east of the region considered at present. Records of Sterki (1907) and those from the Carnegie Museum of Pittsburgh list specimens from the Great Miami drainage to the south. This paper presents data on the origin of the naiades of Auglaize County, the species involved, their distribution and ecology, together with a brief discussion on the future of naiades in the county.

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## PHYSIOGRAPHY OF AUGLAIZE COUNTY

Auglaize County occupies an area of 398 square miles on the top of the watershed between the Ohio and Lake Erie drainages in west central Ohio. During glacial times, the region was buried under the ice. Numerous halts characterized the retreat of the glacier and during these periods large beds of drift were deposited at the ice margin (Hobbs 1921: 311). Such deposits lend a sag and swell aspect to the county characterized by its broad moraines and interlying, rather level, plains. Because of the position of these moraines, the present drainage is in three directions: southward through tributaries of the Great Miami and Scioto Rivers in the eastern and southern parts of the county, northward through the Auglaize River in the center, and westward through the St. Marys River in the western part.

According to Winchell (1894: 406), "The soil of the county is essentially clay. Various local circumstances have caused accidental qualities to modify it." He also indicates that the St. Johns and Wabash moraines are characterized by a gravelly clay soil while that of the St. Marys is "simply a broad undulation, or thickening of the drift," and is composed of coarse heavy clay. Leverett (1902: 522 and 561) indicates that the plains between the ridges have a deep black soil which Dachnowski (1912: 104) describes as "retentive clay" with deep humus covering the clay.

Originally, the county was chiefly forested with the exception of a few wet prairies in the extreme eastern and western parts. The northwestern townships were on the border of the Black Swamp area and thus characterized by wet lowland forests. Today, the major portion of the county is under cultivation.

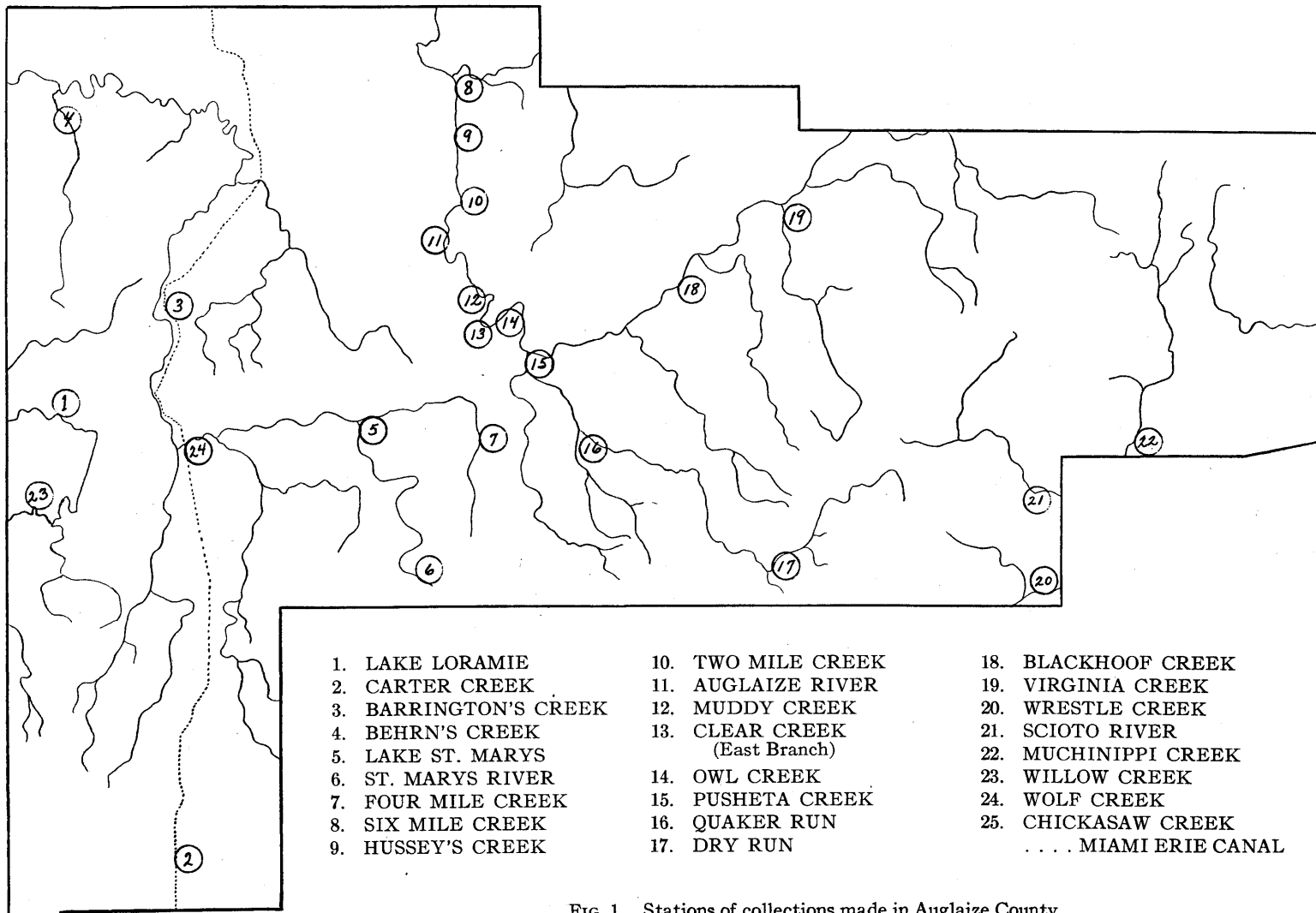


FIG. 1. Stations of collections made in Auglaize County.

## SOURCES OF AUGLAIZE COUNTY NAIAD FAUNA

Walker (1913: 58) states: ". . . the original pre-glacial fauna of the present St. Lawrence system was absolutely exterminated during the glacial period, and . . . the peculiar fauna now characteristic of Lake Erie is the result of a modification from environmental causes of the postglacial immigrants from the south, and not the result of any survival in that region of any part of the pre-glacial fauna."

Ortmann (1924: 101-117) reviews the theories on the stocking of Lake Erie with naiades and advances his own explanation. His theory postulates a Maumee River which flowed westward through the dry bed of what is now Lake Erie, and connected with the Wabash River. Later, with the closing of the Trent and Nipissing outlet stages, the waters flowed into the Lake Erie basin, "drowning the lower parts of the Maumee River and its tributaries, which then became tributaries to Lake Erie." Carrying these postulates farther, van der Schalie (1933: 11) states that the fauna in the flooded basin either died out or became modified to produce those forms which are recognized as lake forms of the earlier river types. Thus, we may say that the St. Marys and Auglaize Rivers received their original faunas as migrants up the Greater Maumee of Ortmann and into these tributary streams.

"The Wabash and Erie Canal," according to Clark and Wilson (1912: 7), "became a channel of communication which during its half century of existence must have resulted in the exchange of many species of mussels." The Miami and Erie Canal must have acted in a similar way for mussel migration from the Auglaize River through the canal into Lake St. Marys and into the Wabash River. Goodrich (1914: 132) states: "There is excellent reason for believing that the Unione fauna of the Maumee has received additions, by means of this canal [Wabash and Erie], since the days when the upper part of what is now the Maumee water course served as a southward flowing outlet for the glacial Lake Maumee."

Clark and Wilson (1912: 4-5) elaborate on this confluence: "Even at present day the headwaters of the Little Wabash River approach within three miles of the St. Marys and still nearer to small affluents of that stream. . . . There is no perceptible divide between the two basins, and a large open country ditch still unites them through an old flat lake plain known locally as the 'prairie.' A careful examination of this ditch revealed no mussels at all, and it is not likely they could live in the mucky bottom, though it is possible that glochidia might be carried through the stream by migrating fishes." Finally Ortmann (1924: 114-115) states, "There is, indeed, the possibility, that in other rivers in the state of Ohio some faunal elements of the upper Ohio drainage may have reached the lake-tributaries by stream-piracy in the region of the headwaters."

According to Goodrich (1914: 131-132) flood waters from the St. Marys River spread across "the prairies" mentioned above by Clark and Wilson, connecting the Wabash and St. Marys River systems during the great flood of March-April, 1913. He also states: "The Naiades of the Maumee and the upper parts of the Wabash now very nearly approximate one another, counting the recent additions for which the Wabash and Erie canal may be thanked."

The Ohio tributaries in Auglaize County have continuously been open to migrations of naiades from the Ohio and Mississippi Rivers.

## DRAINAGE SYSTEMS OF AUGLAIZE COUNTY

1. Auglaize River: The Auglaize River is the largest drainage system in the county. Its upper portion in Auglaize County is now dredged and has a fine sand bottom, with only a few inches of water. The remainder is a series of pools and riffles with gravel and rubble bottom, and bordered with water willow (*Dianthera americana*) and lizard's tail (*Saururus cernuus*). The stream is characterized by

broad shallow pools of less than 6 feet of water and a gradient of about 4 feet per mile throughout the county.

2. St. Marys River: The St. Marys River above the city of St. Marys is composed of a group of small, clear and shallow tributaries with sand and silt bottoms, and a gradient from 8 to 10 feet per mile. The river below the city is a comparatively shallow sluggish stream, with gravel and deep silt substrata, and less than 3 feet fall per mile.

3. Muchinippi Creek: This creek is a tributary of Wolf Creek belonging to the Great Miami River system. It arises in the prairies of eastern Auglaize County and flows southward. The upper portion, because of dredging, is a straight, mud-bottom ditch. Near the Shelby County line, it takes on the appearance of a creek with relatively clear pools and sand and gravel riffles.

4. Wolf Creek: Only a short stretch of this creek, now dredged and ditch-like, has a sand bottom and a permanent flow of water. It is very shallow and narrow in this county.

5. Lake St. Marys: This is an artificial body of water formed by impounding tributaries of the St. Marys and Wabash Rivers and flooding the prairie divide. It occupies an area of 15,700 acres with less than 10 feet of turbid water over a bottom composed chiefly of blue-gray silt containing some sand and gravel. The south shore is made irregular by the dense mass of emergent vegetation, chiefly cattails (*Typha angustifolia* and *latifolia*). The north shore is more regular with little vegetation and much more affected by heavy wave action.

6. Miami-Erie Canal: The water levels in the canal are maintained by a series of dams and abandoned locks. A series of wide-waters of which 40 Acre Pond is the largest are included in this area. In general, the canal depth is less than 6 feet with the exception of a two mile stretch below New Bremen where dredging has produced 8 feet of water. A deep silt bottom characterizes the canal proper, but sandy-clay shore lines occur along the wide-waters.

7. Lake Loramie: The upper part of the Minster Branch of Lake Loramie is in Auglaize County, but is not discussed because no naiades were taken there.

#### ANNOTATED LIST OF SPECIES

##### *Quadrula quadrula* (Rafinesque)

This species is found in both the Lake Erie and Ohio drainages according to Sterki (1907: 390). It was taken in the Maumee River in Defiance County by Clark and Wilson (1912: 41). Ortmann (1919: 42), speaking of this species, remarks: "In western Ohio it is widely distributed. Here it crosses over into the Lake Erie-drainage (Ohio Canal, Sterki) and into the lake (Sterki and Walker, 1913)." It is locally common and found partly buried in the sand of wave swept areas of Lake St. Marys. It is probably the most abundant naiad inhabiting the lake. One specimen was taken in the canal at station 24.

##### *Amblema costata* (Rafinesque)

Sterki (1907: 390) lists this mussel as generally common in both the Ohio and Lake Erie drainages. Clark and Wilson (1912: 42) state that it is the second most abundant species of mussel in the Maumee Basin and quite abundant in the Auglaize River in Defiance County. Ortmann (1919: 30) reports it from the St. Marys River in Mercer County. In Auglaize County, I have found this naiad in only the Auglaize River, where it ranks as one of the most abundant species. Due to dredging in the upper reaches of the river, large beds of this species have been destroyed and its present distribution is chiefly confined to that portion of the stream below Wapakoneta. Specimens were secured at stations 8, 9, 11, 12, 13, 14 and 18, and were especially common at 13, 14 and 18. In general, this species was found in the more quiet pool-like areas with two to four feet of turbid water over a sandy-silt bottom.

***Elliptio dilatatus* (Rafinesque)**

Sterki (1907: 392) records this naiad as found throughout the state. Clark and Wilson (1912: 14) report it fairly common in the Maumee and common in the Auglaize River. I have only a single specimen taken at station 11 in the Auglaize River.

***Fusconaia flava* (Rafinesque)**

Both Sterki (1907: 392) and Clark and Wilson (1912: 39) list this species as a widely distributed naiad. Clark and Wilson state: "It is fairly common all along the Maumee and its tributaries." This species is represented in the St. Marys, Auglaize and Great Miami drainages (stations 10, 13, 14, 18, and 20), although nowhere found in abundance. Ortmann (1919: 30) reports it from the St. Marys River in Mercer County. This naiad is usually found in shallow water over firm sand with either winding trails or only the exposed siphons of the buried mollusk to indicate its presence.

***Pleurobema cordatum coccineum* (Conrad)**

A state-wide distribution of this species is claimed for it by Sterki (1907: 392). However, Clark and Wilson (1912: 39) took only 31 specimens in the Maumee drainage. I found it at only two stations, 18 and 12, in Auglaize County. At the latter station, a dozen specimens were taken from the fine gravel bottom covered by less than 18 inches of water.

***Anodonta grandis* Say**

Sterki (1907: 394) lists this species as state wide in distribution, but Clark and Wilson (1912: 46) found only occasional specimens in the rivers which they investigated. Ten specimens were taken by them from the Auglaize River in Defiance County. Ortmann (1919: 144) reports specimens collected by Goodrich from the St. Marys in Mercer County. I found *A. grandis* to be the most abundant naiad in Auglaize County. It was taken at stations 3, 4, 7, 8, 10, 11, 12, 14, 15, 18, 19, 22, 23 and 24.

This species abounds in sluggish pools with deep soft silt bottoms. The thinner shelled specimens are often found resting on top of the mud while heavier shelled forms may be buried in the riffles.

A great deal of variation in this species is noted by Sterki (1907: 394) and van der Schalie (1938: 51). The latter states, "We do not have sufficient ecological and life-history data to enable us to solve the systematic difficulties which arise from this group. For instance, specimens occurring in lakes tend to be more inflated anteriorly and in the region of the beaks and usually have a finer beak sculpture than those found in rivers. But there are all kinds of intergrades. . . ."

***Anodonta imbecillis* Say**

This interesting species was recorded by Sterki (1907: 395) as, "Over the state, common, in all kinds of waters." Clark and Wilson (1912: 47) found one specimen in the St. Marys River at Ft. Wayne and 38 in the canal at Maumee, Ohio. Ortmann (1919: 164) reports specimens taken by Goodrich in the Miami-Erie Canal in Lucas County, Ohio. This mussel was taken at stations 23, 24, and 19. Its abundance in the dredged channels of Lake St. Marys is indicated by the numerous specimens taken while deepening the channel. The habitats from which my specimens were taken seem to indicate that it prefers soft sand or silt bottom conditions in quiet water areas.

***Lasmigona compressa* (Lea)**

Sterki (1907: 393) attributes to it a state wide distribution, but Clark and Wilson (1912: 46) found only one specimen in their Maumee River work. During this study, one specimen was taken in the Auglaize River at station 11 and five specimens in Wolf Creek at station 20.

***Lasmigona costata* (Rafinesque)**

A state wide distribution for this species is given by Sterki (1907: 393). It was found to be a common species in both the Maumee and Auglaize Rivers by Clark and Wilson (1912: 45-46).

Goodrich also collected it in the Maumee River in Defiance County and in the St. Marys in Mercer County (Ortmann 1919: 128). It was found in Auglaize County at stations 8, 10, 12, 13, 14 and 18 in the Auglaize River proper.

Ortmann (1919: 30) states: "It is found in large rivers as well as in small creeks, although it is distinctly more abundant in the latter. There is hardly any small stream from which it is entirely absent. . . ." As suggested by van der Schalie (1938: 54), I found this statement only partly true. This naiad is distributed throughout the lower Auglaize River in this County, but it does not occur in the upper part or in the larger tributaries. I found the majority of my specimens in shallow, sand and gravel riffles with noticeable current as did Price (1940: 13) in Franklin County, Ohio.

#### **Anodontoides ferussacianus (Lea)**

A widespread distribution over the state is claimed for this species by Sterki (1907: 394). However, Clark and Wilson (1912: 46) found no specimens in the Maumee drainage of Ohio. I find this naiad to be widespread over the county in practically all water areas, stations 4, 5, 6, 7, 8, 11, 12, 13, 14, 15, 18, 19, 20, 22, and 23. It is especially common at stations 7 and 20, both in small headwater streams. It ranks next to *Anodonta grandis* as the most abundant naiad in Auglaize County. This mussel was most abundant in the more quiet stretches of shallow water living partly buried in the sandy silt.

Two top minnows (*Fundulus notatus*) and one green sunfish (*Lepomis cyanellus*) collected at station 6 in Muddy Creek carried glochidia between the rays of the caudal, dorsal and anal fins. *Anodontoides ferussacianus* was the only species of naiad taken in this creek, and I therefore supposed that the glochidia were of this species.

#### **Strophitus rugosus (Swainson)**

This mussel is recorded as widespread over the state, as common and variable by Sterki (1907: 394). But, Clark and Wilson (1912: 47) state that it: ". . . is not common in the Maumee Basin . . . none were seen in the Auglaize River." Goodrich collected it in the St. Marys River in Mercer County (see Ortmann, 1919: 203). It was not found to be common at any location in this county but was taken at stations 7, 11, 12, 13, 17, and 18. This naiad is found most commonly in creeks and small streams with sand, silt, or fine gravel bottoms.

#### **Alasmidonta calceolus (Lea)**

*A. calceolus* is common throughout the state according to Sterki (1907: 393). Clark and Wilson (1912) do not mention this species in their report on "The Mussel Fauna of the Maumee River." During this study, it was found in the Great Miami and Auglaize River systems at stations 15, 16, 17, 19, 21, and 22. It was abundant in Pusheta Creek at station 15, and common at stations 19 in Blackhoof and 22 in Muchinippi Creeks. This species was found only in the smaller creeks where it was usually buried in the sand and gravel on the bars and riffles.

#### **Alasmidonta marginata (Say)**

According to Sterki (1907: 393), it is found over the state in both the Ohio and Lake Erie drainages. Ortmann (1919: 185) lists it from the Maumee River in Defiance County, but it was not mentioned by Clark and Wilson (1912). During four years of collecting in Auglaize County, I have taken one specimen. This was collected at station 13 in the Auglaize River. The ecology of this species is given by van der Schalie (1938: 61) as follows: "In the small-river areas of the upper part of this drainage [Huron River] it occurs on a sand and gravel bottom in current."

#### **Ptychobranthus fasciolare (Rafinesque)**

This species occurs in both drainages in Ohio according to Sterki (1907: 390), but was not abundant anywhere in the Maumee Basin according to Clark and Wilson (1912: 48). Goodrich also collected it in the Maumee River in Defiance County (Ortmann, 1919: 211). I have only two specimens from Auglaize County, both from the Auglaize River and taken approximately one mile apart. Henry van der Schalie (1938: 61) states it, ". . . is usually found buried deep in an unshifting sand and gravel bottom in rapids and seems to show definite aversion toward ponded or backwater conditions."

**Micromya iris** (Lea)

Sterki (1907: 389) lists this species as occurring in both drainages and Clark and Wilson (1912: 51) claim it does not appear to be common in the Maumee Basin but is probably more common than collections would indicate. Only five specimens were taken in the county, one at station 12 and four at station 18, all in the Auglaize River proper. In every instance specimens were taken in sand deposits on the downstream side of large patches of water willow in shallow water.

**Carunculina parva** (Barnes)

According to Sterki (1907: 389) this mollusk is found, ". . . over the state (both drainages, Lake Erie); rivers, creeks, and canals." My records show this species as common at station 4 in Hussey's Creek, but rare at stations 3, 7, 15 and 18. This mussel has been collected frequently in Lake St. Marys in Mercer County, but as yet I have found none in the Auglaize County end of the lake. All collections were taken from fine sand silt and clay in shallow waters.

**Lampsilis fasciola** Rafinesque

Sterki (1907: 388) gave as its distribution, "both drainages, over the state." Clark and Wilson (1912: 54) state: "This very attractive little mussel was not common in the Maumee Basin. . . ." Goodrich collected it in the Maumee River in Defiance County (Ortmann, 1919: 311). My one specimen from this county was found at station 13 in the Auglaize River. Ortmann (1919: 311) describes its habitat as follows: "In Pennsylvania it distinctly prefers riffles with lively currents and gravelly bottoms, but it is not found in very strong currents and among large rocks."

**Lampsilis siliquoidea** (Barnes)

The distribution as given by Sterki (1907: 388) is "Over the state, common and variable; common in Lake Erie and decidedly variable. . . ." Clark and Wilson (1912: 52-53) indicate its widespread distribution in the Maumee Basin, and Goodrich (Ortmann, 1919: 286) collected it in the St. Marys River in Mercer County. It was taken at stations 7, 8, 10, 12, 13, 14, 15, 18, 20, and 21 in the Great Miami, Auglaize and St. Marys river drainages. It is locally very abundant and would probably rate as third in abundance in the county.

Like Ortmann (1919: 288), I found it prefers rather quiet water and sandy-mud bottom conditions. Much variation in specimens is noted. Ortmann (1919: 291), concerning the subspecies *rosacea*, remarks: "I have the impression that *rosacea* is not so much a geographical, as an ecological race, produced by the environment of great lakes, and that it turns up wherever the proper conditions are offered." Variation in this species is shown in relation to exposure by Brown, Clark and Gleissner (1938, Fig. 3). The same authors state (1938: 699), "The differences found between individuals of the same species from streams and lakes does not seem so singular when series from a large number of habitats within lakes and streams are compared. Such a series certainly shows complete intergradation for the shell characters of size and shape. A suitable stream habitat favors the large sizes and the exposed large lake habitat, the extreme cases of stunting."

**Lampsilis ovata ventricosa** (Barnes)

Sterki (1907: 388) states that *L. ventricosa* occurs over the state, is very variable, and is also common in Lake Erie. He states further that *L. ovata* occurs in the Ohio and Greater Miami Rivers. Clark and Wilson (1912: 54) state that *L. ventricosa*, in some localities, runs into a species which in its form is known as *L. ovatus* but, "in the Maumee Basin it is well marked and fairly uniform." Ortmann (1919: 304-305) lists northwestern Ohio specimens as *L. ovata ventricosa* and gives the following specific records: the Maumee River in Lucas and Defiance Counties; Beaver Creek in Williams County; and the Scioto River in Hardin County. He (1919: 303) states that both *L. ventricosa* and *L. ovata ventricosa* are, "forms of the same species connected by numerous intergrades, but locally may be pure." The Specimens of Auglaize County can well be placed as intergrades from a transition zone. The difficulties in the systematics of these forms are discussed by Ortmann (1919: 298) and they will not be discussed here. Only five specimens were collected in the county at stations 12, 13, 15 and 18. These were taken in pool-like

areas on the downstream side of beds of water willow in deposits of soft sand and silt. These data agree with Ortmann's observations (1919: 306).

**Unio merus tetralasmus** Ortmann

The variety *U. tetralasmus camptodon* (Say) is recorded from the Great Miami River by Sterki (1907: 392) and was taken in Lake St. Marys in Mercer County. It is locally very abundant in the Miami-Erie Canal. Many shells are cast upon the beaches of Lake St. Marys by the wave action but no living specimens have been taken from the lake during my collecting. From the shells on the beaches, we may assume it to be fairly common in the lake.

	St. Marys River	Hussey's Creek	Barrington's Creek	Clear Creek	Carter Creek	Muddy Creek	Auglaize River	Two Mile Creek	Pusheta Creek	Owl Creek	Quaker Run	Dry Run	Blackhoof Creek	Virginia Creek	Wrestle Creek	Muchimippi Creek	Willow Creek	Wolf Creek	Miami-Erie Canal	Lake St. Marys	Behm's Creek	Lake Lorain	
<i>Quadrula quadrula</i> .....							x																
<i>Amblema costata</i> .....							x																
<i>Elliptio dilatatus</i> .....							x																
<i>Fusconaia flava</i> .....							x																
<i>Pleurobema cordatum coccineum</i> .....							x																
<i>Anodonta grandis</i> .....	x		x				x		x														
<i>Anodonta imbecillus</i> .....							x						x										
<i>Lasmigona compressa</i> .....							x																
<i>Lasmigona costata</i> .....							x																
<i>Anodontoides ferussacianus</i> .....	x		x			x	x		x				x										
<i>Strophitus rugosus</i> .....				x			x		x														
<i>Alasmidonta calceolus</i> .....							x		x				x										
<i>Alasmidonta marginata</i> .....							x																
<i>Ptychobranchnus fasciolaris</i> .....							x																
<i>Micromya iris</i> .....							x																
<i>Carunculina parva</i> .....	x		x				x		x														
<i>Lampsilis fasciolaris</i> .....							x																
<i>Lampsilis siliquoidea</i> .....				x			x										x	x					
<i>Lampsilis ovata ventricosa</i> .....							x		x														
<i>Unio merus tetralasmus</i> .....																			x	x			

FIG. 2. Distribution of species in the water areas of Auglaize County.

**FUTURE OF AUGLAIZE COUNTY NAIADES**

Numerous factors combine to limit the abundance of mussels in any body of water. The influences of civilization are proving detrimental to the fauna of this county. The most serious limiting factor is that of erosion silt. Ellis (1931: 5) states, "The outstanding factor producing changes in river conditions at present throughout the Mississippi River system was found to be erosion silt." Dredging in the headwaters of the Auglaize River in 1940 (Clark 1942: 10), "... resulted in placing such quantities of silt in suspension as to form the chief sources of pollution in the river. This silt was deposited approximately 4 miles downstream, covering the gravel and rubble bottom to a maximum depth of 4 inches." The filling in of backwater areas and the increasing turbidity of Lake St. Marys are of concern to all who are interested in this lake. Ellis (1931: 6-7) indicates that the heavy silt loads of streams create unstable bottom conditions, cover mussel beds and juvenile mussels and, "... affects the mussel survival of both young and adults through the oxygen supply." The suitability of the soil of Auglaize County



for tillage, the removal of existing timber, and increasing demands on agriculture will without doubt result in more dredging, ditching and tiling, thus increasing the silt load of our streams.

The small size of most of Auglaize County streams implies an irregularity of flow which possibly ranks with erosion silt as one of the most limiting factors of a large naiad population. The Auglaize and St. Marys Rivers, Blackhoof, Pusheta, Muddy, Clear, Muchinippi and Wolf Creeks are permanent streams, (note naiad distribution in Fig. 2) but the remaining ones become intermittent during the dry seasons. All streams of this county were once spring fed and the increasing irregularity in stream flow indicates the disappearance of these springs. As early as 1907, Sterki (1907: 368) mentioned this factor as one of those responsible for the disappearance of mollusca.

The problem of pollution is one of importance in the St. Marys River below the city of St. Marys and in the Auglaize River below Wapakoneta. Deposits of sludge are common in both causing the elimination of the naiades.

The changes in the ecological factors of the streams through irregularity of stream flow, pollution, and increasing silt loads have resulted in increased turbidity, decreased amounts of vegetation, changes in the substratum and a corresponding change in fish life or hosts for the parasitic stages of naiades. A comparison of reports by Clark (1942: 1-171) and Kirsch (1894: 334-337) show that Kirsch obtained 14 species of fish not found at present in the upper portion of the St. Marys River. This means a loss of 14 potential hosts of the parasitic naiad stages.

The impounding of streams and the subsequent silting over of mussel beds (Ellis 1931: 8) has not become a serious problem in this county. One dam in the Auglaize River at Wapakoneta impounds possibly a mile of the stream. This dam may impede the upstream migration of fish and thereby reduce the number of hosts for the parasitic mussel glochidia.

Sterki (1907: 368) states, "The canals, which were great routes for mollusca, are more and more neglected, and partly abandoned." The Miami-Erie Canal with its chain of small ponds is intact throughout Auglaize County, but abandoned in Shelby County to the south and Allen County to the north. Portions of the canal are held at their original levels by a series of dams and locks, but the deep soft mud banks and the limited number of species of fish do not provide attractive conditions for a heterogeneous mollusca population.

The collecting of mussels for pearls or for the button industry has not affected the population of this county. I have never seen or heard of a pearl or button shell collector in this county and doubt if one will work these streams because the naiad population is too small to induce such activities.

We have a fair muskrat population in this county but as yet I have not found one of the "kitchen middens." In the adjacent county, Logan, I have counted as many as 195 pairs of shells of *Anodonta grandis*, *Quadrula quadrula*, and *Carunculina parva* at one of these feeding sites at Indian Lake. H. van der Schalie (1938: 75), states that, ". . . the muskrat and mink are most destructive to them [naiades] in the river and lakes above Ann Arbor.

#### SUMMARY AND CONCLUSIONS

1. The naiad fauna of Auglaize has been found to consist of 19 species.
2. A new host is reported for the glochidia of *Anodontoides ferussacianus*.
3. The naiad fauna of Auglaize County is a composite of several potential routes. Perhaps the most significant is the "Greater Maumee River" as postulated by Ortmann and the Ohio Canal system. Other possible sources are in the form of an exchange of species through later connections of the St. Marys and Wabash River by means of ditches and floodwaters. Furthermore there is a possibility of stream piracy among all headwater streams bringing about an open route to the Ohio River through its tributaries.

4. The distribution and abundance of naiades in Auglaize County is determined in part by ecological and habitat conditions.

5. Drastic changes in the ecology of the aquatic conditions in this county have without doubt resulted in the reduction or extermination of some species, an increase of others, and perhaps an addition of new inhabitants.

6. Erosion silt and the increasing irregularity of stream flow are the most detrimental factors to our mussel fauna.

7. Those species which are tolerant of the most widely diversified conditions are the most abundant in Auglaize County.

8. The mud-inhabiting species or those most tolerant of highly turbid waters are the ones which will probably continue to increase under existing conditions.

9. The mussels of Auglaize County have little economic importance and no mussel fishery can be anticipated.

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