Neves

Heard 1970

MALACOLOGIA, 1970, 10(1): 23-31

AMERICAN MALACOLOGICAL UNION SYMPOSIUM
RARE AND ENDANGERED MOLLUSKS

3. EASTERN FRESHWATER MOLLUSKS (II) THE SOUTH ATLANTIC AND GULF DRAINAGES

by William H. Heard

Florida State University,
Tallahassee, Florida 32306, *U.S.A.*

INTRODUCTION

The eastern United States contains over 50 major drainage systems, as well as many smaller ones, between the St. Croix River on the Maine - New Brunswick, Canada, border and the Rio Grande River on the Texas - Mexico border. In addition, the interior drainages contribute to the very extensive Mississippi River and Great Lakes - St. Lawrence River watersheds.

The coastal drainages have been designated by Simpson (1900) and H. & A. van der Schalie (1950) as comprising the Atlantic and Apalachicolan, as well as part of the Interior Basin (= Mississippian), faunal regions for unionid mussels. The Atlantic region has been divided into a northern and a southern element, with the Potomac River drainage employed as the demarcation between the 2 parts. This report will cover the freshwater gastropods and bivalves of the South Atlantic Region from the Potomac River in Maryland to the St. Marys River on the Georgia - Florida border, peninsular Florida, the Apalachicolan Region, and the southern-most portion of the Interior Basin (i.e., the Alabama River system west to the Rio Grande drainage in Texas).

Unfortunately, there are significant gaps in our knowledge of the taxonomy, phylogenetic relationships, and geographical and ecological distribution of the mollusks of many of the drainages. Efforts have been made in recent years to correct our ignorance, and it is hoped that the effect of this symposium will be to stimulate both further and more intensive research in these areas.

THE NATURE OF THE FAUNA

In general, the streams flowing into the Atlantic Ocean and Gulf of Mexico contain rather endemic mollusk elements. Each region or subregion is characterized by the presence and/or absence of various genera and species, and even within a single region striking differences in the fauna may occur from one stream to another.

For example, one-half of the entire mollusk fauna of the Apalachicolan Region is endemic (e.g., *Notogillia* Pilsbry and *Quincuncina* Ortmann), about one-quarter also extends to the north and west, and the remaining nearly one-quarter extends southward into central Florida (Clench & Turner, 1956). Examining the mussel fauna (Unionidae) separately, one finds that one-fourth of the species are endemic, another quarter are related to eastern (South Atlantic) species, and half of the species have western (Interior Basin) affinities (van der Schalie, 1940).

Within this same Apalachicolan Region, different drainages often have different assemblages of mollusks, i.e., vary in the numbers and kinds of species present. In comparing the elements of the whole region, Clench & Turner (1956) clearly point out that the Apalachicola River (with its major tributaries, the Flint, Chattahooche and Chipola rivers) contains the greatest total number of species, the largest number of

species endemic to the region, and the largest number of species endemic to any single one of the drainage systems. In contrast, the Suwannee River drainage has fewer total species, has a proportionately smaller fauna which is endemic to the region, and altogether lacks species endemic to that drainage.

These relationships of endemism (both between and within regions) appear to occur throughout the coastal drainages in the eastern United States, while widespread species typify (in part) the much larger Interior Basin. If one compares freshwater mollusks regionally, however, it becomes immediately clear that the South Atlantic and Apalachicolan faunas are depauperate in relation to those of the southern part of the Interior Basin (particularly as concerns the large Alabama River system).

THE NATURE OF THE AREA

The drainage systems of the South Atlantic Region, peninsular Florida, the Apalachicolan Region and the southern part of the Interior Basin traverse one or more of the following physiographic provinces (as listed and described by Fenneman, 1938): Appalachian Mountains/Highlands, Valley and Ridge, Blue Ridge, Piedmont Plateau and Coastal Plain (both the Atlantic and Gulf portions). Short streams are usually confined to the Coastal Plain, while larger drainage systems may have tributaries flowing through several provinces. For example, the Coosa River tributary of the Alabama River system originates in the Blue Ridge and flows through the Valley and Ridge Province and the Piedmont Plateau before entering the Alabama River proper in the northern Gulf Coastal Plain. Another tributary, the Tombigbee River, flows largely through the Gulf Coastal Plain (a tributary of its own, the Black Warrior River, originates in the Appalachian Highlands) where it joins the Alabama River proper only about 25 miles from the Gulf of Mexico.

Striking differences in the freshwater mollusk fauna(s) occur between and occasionally within, different physiographic provinces. The Piedmont Plateau has a very sparse fauna, and most of the species of the rich fauna of the Coosa River occur in the Valley and Ridge Province. And frequently, the Coastal Plain assemblage is quite distinct from the composition found upstream in another province.

These phenomena are mentioned here to point out that within a single faunal region distinct elements of the biota may be found in different "zones" of the same drainage. These faunal elements may reflect a variety of circumstances, such as (1) a group which is adapted to living in small stream conditions versus a large river habitat, (2) an area which is comparatively "more favorable" for such factors as type and/or quantity of food or substrate conditions, or (3) preclusion of a part or all of the fauna because of industrial pollution.

Such generalities are frequently made to explain the presence or absence of species in/from an area without more specific information. It is particularly common to blame pollution for the absence of some or all biota, and while this conclusion may often be valid it is nearly always based on superficial observation. More detailed information concerning ecological requirements and hazards are in effect lacking, and such data are desirable for all species, and in particular for those which are localized in distribution and can be considered rare and/or endangered.

CHANGES IN THE FAUNA

It should be clear to all that the freshwater mollusk fauna(s) of the eastern United States has been altered and is continuing to change at an amazing rate, often in a disadvantageous direction.

The following categories of circumstances and the accompanying specific examples

reflect largely personal observations; a few conditions were taken from the literature. Further information is currently being assembled on the freshwater mollusks of peninsular Florida and the drainages of the South Atlantic Region, principally by the workers at Harvard's Museum of Comparative Zoology. More complete data will be provided when their studies are published.

Species of Decreased Abundance/Distribution

The natural ranges of many species of plants and animals are diminishing, largely due to human alteration of the environment(s). This circumstance is demonstrated, in part, by the reduced abundance of organisms in an area. Unless at least a few breeding individuals can be maintained, the population will become extinct. And if this course is followed by numerous populations, the species may be summarily reduced in its geographic distribution and perhaps eventually experience total extinction.

Pomacea paludosa Say (Gastropoda: Pilidae) occurs in southern Georgia and Alabama and throughout Florida. Because of the activities of the U.S. Army Corps of Engineers, large tracts of the Everglades in southernmost peninsular Florida have been drained. One result of this action has been the destruction of this snail's habitat, and consequently their numbers have decreased in this region. Similarly, the Florida kite, a bird which preys upon *P. paludosa* in the Everglades, is diminishing in numbers.

Another example concerns two unionid clams. In 1963 *Anodonta imbecilis* Say and *A. peggyae* Johnson occurred in approximately equal numbers in Lake Talquin (the type locality of *A. peggyae*!), a reservoir of the Ochlookonee River, Leon-Gadsdon County, Florida. Since that time, however, *A. imbecilis* has become all but extinct and *A. peggyae* has become drastically reduced in numbers in the impoundment. This situation has evidently been wrought principally by the Florida Fresh Water Fish and Game Commission which has administered rotenone to the reservoir to remove a pest fish, the grizzard shad (= *Dorosoma cepedianum*). After such treatment, the shore is littered with numerous decaying bivalves of several species.

Clench & Turner (1956) state that *Goniobasis albanyensis* Lea (Gastropoda: Pleuroceridae) probably formerly occupied the entire Apalachicola River system but that it now is confined to the Flint and Chattahoochee tributaries. Farming and consequent silting is listed as the cause of the decline not only of *G. albanyensis* but also of *G. boykiniana* (Lea) which is considered nearly extinct.

Notogillia wetherbyi Dall (Gastropoda: Hydrobiidae) is recorded by Clench & Turner (1956) as inhabiting the St. Johns, Suwannee and Apalachincola drainage systems. It has also been discovered as fossil along the McBride's Slough tributary of the Wakulla River in Wakulla County, Florida. For unknown reasons, it is extinct in that drainage now.

Extinct Species

Although several fossil species of freshwater mollusks have been described from the South Atlantic and Gulf Coastal drainages, very few have become extinct in comparatively recent times.

Ordinarily, a list of such species would include those of the genus *Tulotoma* Haldeman (Gastropoda: Viviparidae). However, in the past few years intensive collecting by Mr. Herbert Athearn of Cleveland, Tennessee, has located 1 living population each of 2 species, *T. angulata* (Lea) and *T. magnifica* (Conrad), in the Coosa River tributary of the Alabama River. The Coosa River is crossed by a number of dams, and the attendant impoundments as well as silting and pollution have served to drastically alter the original aquatic fauna(s). Consequently, the 2 populations of *Tulotoma* may represent the last remnants of this genus.

Among the pleurocerid snails, Clench & Turner (1956) list *Goniobasis catenoides*

(Lea), known only from the Chattahoochee River at Columbus, Georgia, as extinct, "apparently ... exterminated by river silt."

Extinct Communities

On occasion, one may find that a habitat previously visited has been destroyed and that the assemblage of mollusks at that site has been eliminated.

We are fortunate indeed to have such faunal lists as that prepared by Hinkley (1906) for the Yalobusha River (and other drainages) and that by Frierson (1911) for the Pearl River (in part), both in Mississippi. The Yalobusha and Pearl drainages presently receive substantial industrial effluents, and the former faunas at Grenada and Jackson (respectively) have been obliterated. Further downstream, beyond the recovery zone, one may again find elements of the fauna that formerly resided upstream. In the Pearl River at Columbia, Mississippi, approximately 100 miles downstream from Jackson, one can collect over 20 species of unionid mussels. But only upstream from the bridge (U.S. Hwy. 98), because immediately under the bridge the stream again receives an odorous contribution, the Columbia sewage. A striking zonation can be observed, and no mussels occur below the source of the effluent.

More horrifying still are examples of the extinction of the fauna of nearly entire drainages. A paper mill at Foley, Florida, voids its wastes into the Fenholloway River about 15 miles from the Gulf of Mexico. The entire fauna and flora of the main channel has been totally destroyed, and only remnants remain in the unaffected small tributaries. A similar situation, involving phosphate mining pollution, has effected the decimation of the fauna in the main channel of the Peace River in peninsular Florida.

DISCUSSION (THE ENDANGERED FAUNA)

The overall changes in the freshwater mollusk fauna(s) of the eastern United States brought about by human activities have been immense, although only a few examples have been cited here.

Examination of a drainage map of the United States reveals a paucity of natural lakes in the Atlantic and Gulf coastal states as compared to those of the northern areas which felt the impact of glaciation, one effect of which was to scour out depressions which became lake basins. Evidently the evolution of freshwater gastropods has followed accordingly. The majority of aquatic pulmonates are in the north, and most prosobranchs occur in the south. Nearly the entire fauna of the south is composed of gilled species, and as such it is more susceptible to disruption of the aquatic environment than the lunged basommatophorans of the northern lakes.

Most gilled aquatic mollusks are stream-dwellers, and they are affected if the stream is altered in some way such as by (1) dam construction and impoundment of stream water to provide recreational facilities, better navigation, and/or a source of electric power, (2) industrial pollution which affects the chemical content of the water (by robbing the stream of dissolved oxygen, adding toxic materials, and/or adding normally non-toxic materials in toxic quantities), and/or by (3) extensive farming which through erosion will increase the silt content of streams, a process tending to progressively destroy the aquatic fauna.

Although Birmingham, Alabama, lies several hundred miles upstream from the Gulf of Mexico and numerous dams occur along the Alabama-Coosa River waterway, attempts have been made to promote this city as a seaport. The aquatic mollusks of the drainage have already been extensively damaged by impoundment-production (as well as by silting and pollution), yet further efforts are underway to construct additional dams (with locks), threatening the remaining species.

Industrial plants are continually arising alongside or near streams, and while attempts to encourage conservation are everywhere these days there are too few and/or too weak laws to punish or correct violations. Plans for the construction of a paper mill on the Apalachicola River between Bristol and Blountstown, Florida, are now under consideration. Unless measures are taken for adequate treatment of the effluents, we will most certainly lose the mollusks of the main channel, particularly *Glebula rotundata* (Lamarck) (Pelecypoda: Unionidae), a large stream species which finds its eastward limit in this drainage.

The southern states are comparatively agricultural (e.g., cotton, peanuts, tobacco), and soil conservation must be practiced not only for human benefit of continued crops but also for the perpetuation of the aquatic fauna. Silting is often said to affect mollusks by interfering with their respiration and/or feeding, and by altering the substrate disadvantageously. Specific evidence, particularly of an experimental nature, is largely lacking, however.

One can and must conclude that all of our freshwater mollusks, not only those of the eastern United States, are endangered. The factors which have partially or totally destroyed such faunal elements continue to plague us. Particular concern should be afforded not only rare and/or diminishing species (e.g., the unionids *Pleurobema collina* (Conrad) of the James River, Virginia, and the Tar River, North Carolina; and *Elliptio spinosa* (Lea) of the Altamaha River drainage in Georgia (Boss & Clench, 1967)), but also those which are greatly restricted in range even though they may be abundant in it (e.g., the unionids *Elliptio mcmichaeli* Clench & Turner and *Quincuncina burkei* Walker of the Choctawhatchee River system in southern Alabama and the Florida panhandle (Clench & Turner, 1956)). If such streams are sufficiently changed in some way, these endemic forms will vanish.

LITERATURE CITED

BOSS, K. J. & CLENCH, W. J. 1967. Notes on *Pleurobema collina* (Conrad) from the James River, Virginia. *Occ. Pap. Moll.*, Harvard Univ. Mus. Comp. Zool., 3: 45-52.

CLENCH, W. J. & TURNER, R. D. 1956. Freshwater mollusks of Alabama, Georgia, and Florida from the Escambia to the Suwannee River. *Bull. Florida State* Mus., 1: 97-239.

FENNEMAN, N. M. 1938. *Physiography of the Eastern United States*. McGraw-Hill Book Co., Inc., New York, 714 p.

FRIERSON, L. S. 1911. A comparison of the Unionidae of the Pearl and Sabine rivers. *Nautilus*, 24: 134-136.

HINKLEY, A. A. 1906. Some shells of Mississippi and Alabama. *Nautilus*, 20: 34-36, 40-44, 52-55.

SIMPSON, C. T. 1900. Synopsis of the naiades, or pearly freshwater mussels. *Proc. U.S. Nat. Mus.*, 22: 501-1044.

van der SCHALIE, H. 1940. The naiad fauna of the Chipola River, in northwestern Florida. *Lloydia*, 3: 191-208.

van der SCHALIE, H. & van der SCHALIE, A. 1950. Mussels of the Mississippi River. *Amer. Midl. Nat.*, 44: 448-466.

Discussion of Dr. Heard's Paper

by Herbert D. Athearn

Cleveland, Tennessee 37311, *U.S.A.*

My field work on the freshwater mollusks of the Gulf of Mexico drainage region began in 1941 and has been carried on intensively since 1954. During that period collections were made at about 500 stations. Many species were found to be abundant, others are common, and some are rare or very rare and have been found on only one or a few occasions. Other species previously reported from the region have never been collected by me.

Some species have apparently become very rare or perhaps even extinct during the past few years because of water pollution, dam construction or other habitat disruption. Dam construction on the Coosa River has eliminated almost all riffle habitats and has been particularly destructive to the rich, endemic fauna which previously flourished there.

Several of these now rare and endangered, or possibly extinct, species have already been mentioned by Dr. Heard. Unfortunately an additional large number should also be inserted into the preliminary list. These are as follows:

SOUTHERN AND CENTRAL TEXAS DRAINAGES

UNIONIDAE
- *Fusconaia friersoni* B. H. Wright 1896
- *Fusconaia lananensis* Frierson 1901
- *Fusconaia ridelli* Lea 1861
- *Quadrula aurea* Lea 1859
- *Lampsilis bracteata* Gould 1866

LOWER MISSISSIPPI AND ATCHAFALAYA RIVER TRIBUTARIES

PLEUROCERIDAE
- *Lithasia hubrichti* Clench 1965
- *Anculosa arkansensis* Hinkley 1915

UNIONIDAE
- *Margaritifera hembeli* Conrad 1838
- *Fusconaia missouriense* Marsh 1901
- *Arkansia wheeleri* Walker & Ortmann 1912
- *Ptychobranchus occidentalis* Conrad 1836
- *Lampsilis streckeri* Frierson 1927
- *Dysnomia florentina curtisi* Utterback 1915
- *Dysnomia lefevrei* Utterback 1915

TOMBIGBEE - ALABAMA - COOSA RIVER SYSTEM

NERITIDAE
- *Lepyrium showalteri* Lea 1861

VIVIPARIDAE
- *Lioplax cyclostomatiformis* Lea 1844

AMNICOLIDAE
Clappia cahabensis Clench 1965
Clappia clappi Walker 1909
PLEUROCERIDAE
Pleurocera foremani Lea 1842
Pleurocera showalteri Lea 1862
Goniobasis alabamensis Lea 1861
Goniobasis bellula Lea 1861
Goniobasis brevis Lea 1842
Goniobasis bullula Lea 1861
Goniobasis caelatura stearnsiana Call 1886
Goniobasis cahawbensis fraterna Lea 1864
Goniobasis capillaris Lea 1861
Goniobasis clausa Lea 1861
Goniobasis crenatella Lea 1860
Goniobasis fusiformis Lea 1861
Goniobasis gibbera H. H. Smith, Goodrich 1936
Goniobasis hartmaniana Lea 1861
Goniobasis haysiana Lea 1842
Goniobasis impressa Lea 1841
Goniobasis jonesi Goodrich 1936
Goniobasis lachryma Anthony, Reeve 1861
Goniobasis laeta Jay 1839
Goniobasis macglameriana Goodrich 1936
Goniobasis olivula Conrad 1834
Goniobasis pilsbryi Goodrich 1927
Goniobasis pupaeformis Lea 1864
Goniobasis pupoidea Anthony 1854
Goniobasis pygmaea H. H. Smith, Goodrich 1936
Goniobasis vanuxemiana Lea 1842
Gyrotoma alabamensis Lea 1860
Gyrotoma amplum Anthony 1860
Gyrotoma cariniferum Anthony 1860
Gyrotoma excisum Lea 1843
Gyrotoma hendersoni H. H. Smith, Goodrich 1924
Gyrotoma incisum Lea 1843
Gyrotoma laciniatum Lea 1845
Gyrotoma lewisi Lea 1869
Gyrotoma pagoda Lea 1845
Gyrotoma pumilum Lea 1860
Gyrotoma pyramidatum Shuttleworth 1845
Gyrotoma spillmani Lea 1861
Gyrotoma walkeri H. H. Smith, Goodrich 1924
Anculosa choccoloccoensis H. H. Smith, Goodrich 1922
Anculosa clipeata H. H. Smith, Goodrich 1922
Anculosa coosaensis Lea 1861
Anculosa foremani Lea 1842
Anculosa formosa Lea 1860
Anculosa griffithiana Lea 1841
Anculosa ligata Anthony 1860
Anculosa melanoides Conrad 1834
Anculosa modesta H. H. Smith, Goodrich 1922

Anculosa picta Lea 1860
Anculosa showalteri Lea 1860
Anculosa taeniata Conrad 1834
Anculosa torrefacta H. H. Smith, Goodrich 1922
Anculosa vittata Lea 1860

ANCYLIDAE

Rhodacmea cahawbensis Walker 1904
Rhodacmea filosa Conrad 1834
Rhodacmea gwatkiniana Walker 1917
Rhodacmea rhodacme Walker 1917
Neoplanorbis carinatus Walker 1908
Neoplanorbis smithi Walker 1908
Neoplanorbis tantillus Pilsbry 1904
Neoplanorbis umbilicatus Walker 1908
Amphigyra alabamensis Pilsbry 1906

UNIONIDAE

Fusconaia rubidula Frierson 1905
Quadrula archeri Frierson 1905
Quadrula stapes Lea 1831
Pleurobema aldrichianum Lea 1858
Pleurobema altum Conrad 1854
Pleurobema avellana Simpson 1900
Pleurobema concolor Lea 1861
Pleurobema decisum Lea 1831
Pleurobema favosum Lea 1856
Pleurobema fibuloides Lea 1859
Pleurobema furvum Conrad 1834
Pleurobema hagleri Frierson 1900
Pleurobema hanleyanum Lea 1852
Pleurobema hartmanianum Lea 1860
Pleurobema instructum Lea 1861
Pleurobema interventum Lea 1861
Pleurobema irrasum Lea 1861
Pleurobema johannis Lea 1859
Pleurobema lewisi Lea 1861
Pleurobema meredithi Lea 1858
Pleurobema murrayense Lea 1868
Pleurobema perovatum Conrad 1834
Pleurobema rubellum Conrad 1834
Pleurobema simulans Lea 1874
Pleurobema showalteri Lea 1860
Alasmidonta mccordi Athearn 1964
Strophitus alabamensis Lea 1861
Ptychobranchus foremanianum Lea 1842
Ptychobranchus greeni Conrad 1834
Obovaria curta Lea 1859
Plagiola lineolata Rafinesque 1820 (secure elsewhere)
Lampsilis altilis Conrad 1834
Lampsilis perovalis Conrad 1834
Lampsilis perpasta Lea 1861
Villosa propria Lea 1865
Dysnomia metastriata Conrad 1840

Dysnomia othcaloogensis Lea 1857
Dysnomia penita Conrad 1834

EASTERN GULF DRAINAGES: ESCAMBIA TO SUWANNEE RIVER

UNIONIDAE
Margaritifera hembeli Conrad 1838
Quincuncina burkei Walker 1922
Megalonaias boykiniana Lea 1840
Pleurobema pyriforme Lea 1857
Elliptio sloatianus Lea 1840
Alasmidonta triangulata Lea 1858
Medionidus penicillatus Lea 1857
Lampsilis australis Simpson 1900
Lampsilis binominata Simpson 1900
Lampsilis haddletoni Athearn 1964
Lampsilis jonesi van der Schalie 1934