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DEPARTMENT OF COMMERCE AND LABOR
BUREAU OF FISHERIES
GEORGE M. HOPKINS, Commissioner

THE MUSSELS OF THE BIG BUFFALO
FORK OF WHITE RIVER,
ARKANSAS

Bureau of Fisheries Document No. 759



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PHYSICAL AND BIOLOGICAL CONDITIONS.

The Big Buffalo River drains a considerable portion of the northern slope of the Boston Mountains. It is a winding stream bordered on its outer curves by bluffs, most of which rise perpendicularly from the water to a height of 20 to 400 feet or more. In many places back from these bluffs the highest mountains rise quite abruptly to a height of about 1,500 feet above the river. The immediate banks were estimated to be from 10 to 30 feet high. In many places where a root-hold can be had on the face of these bluffs stunted cedars are growing, and these become more numerous and taller along its upper margin. The slopes and tops of the mountains support a considerable forest of oak and pine. The river valley is narrow, which is also true of all its tributaries. In dry weather the river is little more than a creek and such it is usually called by the residents; but in wet weather it often becomes a raging mountain torrent. In its lower course it has been known to rise 30 feet or more in one day.

Prof. W. N. Gladson, of the University of Arkansas, to whom the party was indebted for many courtesies, examined the river for mussels between Boxley and a point about 10 miles above the ford on the road from Harrison to Jasper. No shells were found in this portion of the river except a few in the last mile or two.

The bed of the portion of the stream visited varied in width from about 30 feet to 200 feet. Over many shoals the water was not deep enough to float the boats, which drew only about 5 inches of water, and in the long deep holes it seldom exceeded a depth of 6 feet. Along the course of the river are many sand and gravel bars, which seem to shift more or less with each freshet, leaving, perhaps, less than half the river in anything like a permanent bed.

Mussel beds, as compared with those on the White River, were neither large nor plentiful, and these occupied only the favorable

pieces in the bed of the stream which appeared to be permanent. No beds were found on sand bars, and when found on gravel bars the sand and gravel were mixed with larger fragments of rocks. It would be quite impossible to collect shells in this stream with hogs or dogs such as are successfully used on the Illinois River in Illinois. Nowhere were shells found in abundance, and if all shells taken out by the pearl hunters could be used in the manufacture of buttons there could certainly not be much profit in collecting and transporting them.

Note.—Regarding the statements of some pearl hunters that a bed can be worked thoroughly one season and as many shells found there the following one, the general impression is that the mussels are not so abundant as formerly. During the low water the hogs eat all that they are able to obtain, and are, no doubt, partially responsible for the depletion of many beds in the upper course of the stream. Inquiries were made as to shells in the smaller tributaries, and the answer was either "none" or "very few." Along the portion of the river examined the beds have all been very thoroughly worked annually for the past few years by pearl hunters, and work of this nature was being carried on energetically in 1910.

It seems that a stream which varies so greatly in volume as this one does, so much of its bed changed by freshets, with scarcely any permanent sand bars, would not furnish conditions for an abundant growth of mussels. Between Boxley and a point about 10 miles above the ford on the Harrison-Jasper road only one small bed was observed.

The distance between our first and last camps was 95.8 miles, and the difference in elevation was 402 feet, or about 4.2 feet per mile. The fall for the first 15 miles was about 4.3 feet per mile, and in the last 15 miles 3.2 feet per mile. Between our camps of July 28 and July 30 the fall was 4.9 feet per mile for a distance of about 15 miles. During the trip the river was gauged at three places with the following results: The flow of Buffalo River above the forks of Little

Dudale, sec. 8, T. 16 N., R. 20 W., on July 22 was 43.6 cubic feet per second, the gauge height at Gilbert on this day being 3.6 feet; the width of water was 51 feet. On July 26, in sec. 35, T. 16 N., R. 20 W., below the forks the flow was 53.19 cubic feet per second, with a gauge height at Gilbert of 3.8; width 64 feet. On August 1 at Gilbert the flow was 107.1 cubic feet per second, gauge 3.2, width 68. The following is a list of camps, giving the elevation of each and the distance from each to the next as furnished by Prof. Gladson. The measurements are within distances in feet between each station on the following route. The elevations are above mean sea level, Gulf of Mexico, from United States Geological Survey bench marks, Fayetteville, Ark.

CAMPS ON BUFFALO FORK OF WHITE RIVER, ARK.

Camp designation.	Location.	Elevation.	Stadia distance from preceding station.
	NEPTOS CO. EXTRY, ARK.		
A	South line of sec. 34, T. 14 N., R. 21 W. of 61st principal meridian.	828
B	N. E. corner of sec. 12, T. 16 N., R. 20 W.	793	22,766
C	N. E. corner of sec. 10, T. 16 N., R. 20 W.	765	22,980
D	N. E. corner of sec. 10, T. 16 N., R. 20 W.	728	5,874
E	N. E. corner of sec. 35, T. 16 N., R. 20 W.	724	32,556
F	E. 1 sec. 35, T. 16 N., R. 19 W.	688	35,526
	SEAFOR CO. EXTRY, ARK.		
G	Center of sec. 31, T. 16 N., R. 18 W.	694	36,992
H	N. E. corner of sec. 11, T. 15 N., R. 17 W.	631	41,052
I	N. E. corner of sec. 25, T. 15 N., R. 17 W.	595	20,720
J	South of S. E. corner of sec. 31, T. 16 N., R. 16 W.	536	20,316
K	Center of S. E. 1 sec. 25, T. 16 N., R. 16 W.	540	23,130
L	N. E. corner of sec. 10, T. 16 N., R. 15 W.	517	36,978
M	E. 1 sec. 10, T. 16 N., R. 15 W.	490	42,084
	MARION CO. EXTRY, ARK.		
N	Near center of sec. 26, T. 15 N., R. 15 W.	471	35,488
O	N. E. corner of sec. 26, T. 15 N., R. 15 W.	492	44,156
P	N. E. corner of sec. 26, T. 15 N., R. 14 W.	421	26,814

No special effort was made to collect fishes, and the few taken in Rush Creek and in a small stream near Mount Hensy were damaged by the swamping of a boat and were not brought out. A number of game fishes, including rock bass, green sunfish, long-eared sunfish, and small-mouth black bass were caught by casting. A yellow cat (*Leptops oivaris*) was taken on a set line, and some residents had taken with a spear some other catfishes, which were identified as *Ameiurus anquilla*. Suckers (the common white sucker and the red horse) were apparently common. Small fishes were nowhere abundant, the more common species being *Notropis zonalis*. No large-mouth black bass were seen until near Red Cloud mine, where one specimen was taken, and a second one jumped into our boat at the last station, but below Red Cloud mine fly fishing was very poor as compared with that in the river farther up.

MUSSEL BEDS LOCATED.

The exact location of the various mussel beds was rather difficult of determination. So few people were living along the stream that it was impossible to learn the local names of the fords, bluffs, and many of the shoals. It was possible, however, to locate the camps quite accurately and to approximate the distance between them, which enabled us to locate the beds fairly well, since they are usually found on the outer or bluff side of the river. Following is a list of the approximate localities where the collections of shells were made:

Station 1.—July 21, camp A. Immediately above the second ford above Welch's, where the Harrison-Jasper stage crosses the river, a few shells were found on gravelly bottom. Farmers living near

It is said that several years ago shells were quite numerous and that one man could then perhaps have gathered 400 pounds in one day. This bed had been worked for pearls and so devastated by hogs that mussels are now very scarce. The river in places was not more than 30 feet wide, and, especially on and near shoals, the bed was gravel and sand; between these shallow places the river widens to from 50 to 100 feet, and flows with a sluggish current 4 to 6 feet deep over a rocky and muddy bottom.

A short distance below camp A is a small bed from which about 20 shells belonging to three species were taken during an hour's search. Many of these were dead, and only five were retained for the collection.

Shells taken at station 1: Rock mussel, washboard, *Quadrula undulata*, very abundant; *Unio gibbosus*, scarce; sand mussel, *Symphyla costata*, only one seen; *Strophitus edentulus*.

Station 2.—July 22, camp C. The character of the river was about the same as above. A few dead shells were observed, but no live ones were found.

Shells taken at station 2: White niggerhead, *Quadrula coccinea*, a few dead; rock mussel, washboard, *Quadrula undulata*, scarce; *Strophitus edentulus*, scarce; *Tamopsis planicostatus*, 1 specimen; butterfly, *L. ventriosus*, 1 live specimen, dead common.

Station 3.—July 23. From about 1 mile above to 1 mile below camp D.

Shells taken at station 3: Red niggerhead, *Quadrula tuberculata*, scarce; white niggerhead, *Quadrula coccinea*, scarce; *Unio gibbosus*, common; *Musculoida celsata*, 1 specimen; sand mussel, *Symphyla costata*, *Strophitus edentulus*, common; *Tamopsis venustus*, common; butterfly *L. ventriosus*, abundant; *L. breviculus britsi*.

After purchase of a wooden boat a trip was made down the Little Buffalo to the forks and back to camp. Inquiries were made along the river concerning shells in the Little Buffalo, all answers being to the effect that they were scarce and were always scarcer than in the Big Buffalo above the junction of these two streams. A local rain had swollen the stream and more water was flowing than in the Big Buffalo above the forks. It appeared to be the swifter of the two streams and its bed more rocky. From this camp to the mouth of the Little Buffalo the river flows mostly over gravel. A few dead shells were seen and fewer live ones were found. Just below the mouth of the streams they were more numerous, but far from abundant.

From about a mile below the forks to the next camp no beds were observed and but few shells or fragments of shell were seen on the rocks. Up to this time no shells were found which had been recently opened by pearl hunters.

July 26, camp E. Here there was a small mussel bed,

Shells taken at station 4: White niggerhead, *Quadrula coccinea*, scarce; *Unio gibbosus*, abundant; niggerhead, *Musculoida tenuis*, scarce; sand mussel, *Symphyla costata*, common; *Strophitus edentulus*, scarce; green mugget, red mugget, grass mucket, *Tamopsis ligamentinus*, *L. breviculus britsi*, scarce.

Station 5.—July 26. About 2 miles below camp E a much larger bed was found. The pearl hunters had recently been here and about 100 freshly-opened shells were observed and a few live ones were found.

Shells found at station 5: Red niggerhead, *Quadrula tuberculata*, common; white niggerhead, *Q. coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, 1 dead; sand mussel, *Symphyla costata*, abundant; green mugget, red mugget, grass mucket, *Tamopsis ligamentinus*, common; butterfly, *L. ventriosus*, scarce.

Station 6.—July 26. About 1 mile above camp F a small bed was observed, from which about 50 shells were taken during a search of an hour or more.

Shells found at station 6: Red niggerhead, *Quadrula tuberculata*, scarce; white niggerhead, *Q. coccinea*, common; *Unio gibbosus*, scarce; sand mussel, *Symphyla costata*, common; young fantail, *Cyprogenia aberti*, scarce; spectacle case, *Tamopsis rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, scarce; butterfly, *L. ventriosus*, scarce; *L. breviculus britsi*, scarce.

Station 7.—July 27. There were no beds of mussels observed for 3 or 4 miles below camp F, and very few dead or fragments of shells were found. About 1 mile above Mount Hersey a few shells were taken on a bed which extended through a longer course of the river. The shells, which were scarce, were found mostly among the larger rocks.

Shells found at station 7: Sand mussel, *Symphyla costata*, scarce; green mugget, red mugget, grass mucket, *Tamopsis ligamentinus*, scarce; *L. breviculus britsi*, scarce.

None was found on an extensive sand and gravel bar at this point. The bed of the river is very rocky with quite extensive shoals both above and below Mount Hersey. A small bed was observed near the mouth of Cave Creek, its presence being made known by old shells and fragments on the gravel bars. No live mussels were seen, but a few were observed by one of the rangers.

Station 8.—July 28. Above Wolm. A small mussel bed was observed about 1 mile below camp G. A much larger bed is located just above Wolm. Many mussels were seen here in the deeper water, and many had been recently opened by pearl hunters. This bed was at least three-quarters of a mile long, being much larger than any previously observed.

Shells found at station 8: White niggerhead, *Quadrula coccinea*, scarce; *Unio gibbosus*, scarce; sand mussel, *Symphyla costata*,

one; *Strophites edentulus*, scarce; fantail, *Trigonia tuberculata*, scarce; spectacle case, black sand-shell, *Lampsilis bicostus*, 7 taken; *L. venustus*, scarce; green mugget, red mugget, grass mucket, *L. tiganensis*, most abundant species; butterfly, *L. venustus*.

The river widens just below this bed and runs over a gravel bar, much of the water evidently flowing through the gravel. It was so shallow that the boats, which drew about 5 inches of water, passed with difficulty.

Station 7.—July 29. About 2 miles from camp H I lay a mussel bed about one-half mile long on a shoal. Many shells had been opened, but none recently. Live mussels were plentiful, many of them lying in sand between rocks. On this, as well as other beds observed, the shells were in such rocky places that tongs or other appliances could not be used, and all shells taken by pearl hunters were taken by hand. In an hour's collecting about 150 live shells were secured.

Shells found at station 9: Red niggerhead, *Quadrula tuberculata*, very abundant; white niggerhead, *Q. coccinea*, scarce; *Unio gibbosus*, common; niggertoe, *Alsmithonta truncata*; *A. educeola*, 1 found; sand shell, *Symphynota costata*, abundant; *Lampsilis ozarkensis*, abundant; *L. venustus*, scarce; green mugget, red mugget, grass mucket, *L. tiganensis*, most abundant species; butterfly, *L. venustus*, scarce; *L. breviculus britsi*, scarce.

Station 10.—July 29. About 5½ miles below camp H a small bed was found, and two other small beds were observed, one about ¾, the other about 5 miles from camp.

Shells found at station 10: Red niggerhead, *Quadrula tuberculata*, scarce; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, scarce; fantail, *Trigonia tuberculata*, scarce; spectacle case, *Lampsilis venustus*, scarce; green mugget, red mugget, grass mucket, *L. tiganensis*, most abundant species.

Station 11.—July 30. About 2 miles below camp I there was a mussel bed less than one-half mile in length. Pearl hunters had opened many shells, but not recently.

Shells found at station 11: *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, scarce; spectacle case, *Lampsilis rectus*; *L. venustus*, scarce; green mugget, red mugget, grass mucket, *L. tiganensis*, abundant; butterfly, *L. venustus*; *L. breviculus britsi*, scarce. *Station 12.*—July 30. About ¾ miles below camp I a small bed was found.

Shells found at station 12: White niggerhead, *Quadrula coccinea*, scarce; *Unio gibbosus*, sand mussel, *Symphynota costata*; *Strophites edentulus*, spectacle case, *Lampsilis rectus*; green mugget, red mugget, grass mucket, *L. tiganensis*, abundant; *L. breviculus britsi*, scarce.

Station 13.—July 30. About one-half mile below this last bed was a much larger one. A boy and a man were here hunting pearls, but they would give no information on the subject. There were on the shore at this place about 4 or 5 bushels of recently opened shells, by far the greatest number so far observed in one place.

Shells taken at station 13: Red niggerhead, *Quadrula tuberculata*, abundant; white niggerhead, *Q. coccinea*, scarce; *Unio gibbosus*; sand mussel, *Symphynota costata*; *Lampsilis ozarkensis*, scarce; red mugget, green mugget, grass mucket, *L. tiganensis*.

Station 14.—August 1. A short distance above camp J, which was near the railroad station at Gilbert, was a small mussel bed; no specimens taken. About one-half mile below Gilbert is a fairly large bed lying on coarse gravel with larger fragments of rock and some sand. The depth of the water was about 2 feet. Three men, hunting pearls, were sitting on the bottom and digging the shells up with their hands. Each shell was opened at once, and if no pearl was found it was dropped and another one taken, every portion of the bed being examined. These men insisted they could take all they could find, and the next year as many more could as easily be found. The nature of the bottom was such that tongs or other devices could not be used profitably, for there were too many fragments of rock much larger than the shells and many about the size of the shells. Many of the shells were embedded beside the larger fragments and in some cases partly under them. Where the water was deeper the shells were collected in a bag and taken to the shore and opened. At this bed there was less than a bushel of shells on shore, while three or four times that amount were strewn over the bottom where the men were working.

Shells found at station 14: Red niggerhead, *Quadrula tuberculata*, abundant; eob shell, rabbit's foot, *Q. cylindrica*, common; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, abundant; *Strophites edentulus*; fantail, *Trigonia tuberculata*, common; red shell, *Lampsilis purpuratus*, scarce; spectacle case, *L. rectus*, common; green mugget, red mugget, grass mucket, *L. tiganensis*, abundant.

Station 15.—August 1. Below Gilbert, for about 2 miles, the current was quite rapid and the bottom very rocky. About ¾ miles below Gilbert was a considerable stretch of deeper water, bordered near the shallow water with sand and gravel bars. Mr. Cookson, a professional pearl hunter, had been working here for nearly a week. He had worked over the shallow places, and when we met him he was collecting in water about 5 feet deep. So many shells, he said, were between and under the edges of the larger rocks that tongs could not be used. His method was to have his sack for shells weighted down; by holding it with one hand he could draw them off under water and search for shells as long as he could. I tried this method, after

which he would come to the surface, take a breath, and disappear again under water. During the week he had taken out of this bed about 10 bushels of shells, but did not believe many were left. From this bed a series was selected by Mr. Cookson and common names known to him were given them. Pearls, he says, are found mostly in the red and green mussels (muckets) and the washboards, and these shells are usually the most abundant. All shells taken, however, are opened for pearls. Mr. Cookson had hunted pearls for several years. He reported finding on an average pearls to the value of about \$300 each year. The most valuable one found by him sold for \$50.

Shells found at station 15: Red niggerhead, *Quadrula tuberculata*, common; white niggerhead, *Q. coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, common; *Unio gibbosus*, niggertoe, *Lasaidonta truncata*; sand mussel, *Symphynota costata*; young fantail, *Cyprogenia aberti*; fantail, *Tritogonia tuberculata*; red shell, *Lampsilis purpuratus*; *L. ozarkensis*; spectacle case, *L. rectus*; red mugget, green mugget, grass mucket, *L. ligamentinus*; *L. brucellus britsi*.

Station 16.—August 2. About 3 miles below camp K (Cookson's camp) a collection was made from a bed about the size of the one mentioned above.

Shells found at station 16: White niggerhead, *Quadrula coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, more abundant than all other species; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, common; fantail, *Tritogonia tuberculata*, scarce; young fantail, *Cyprogenia aberti*, scarce; red shell, *Lampsilis purpuratus*, scarce; *L. glans*, 1 specimen; *L. ozarkensis*, common; spectacle case, *L. rectus*; *L. venustus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, abundant; butterfly, *L. centricosus*.

Station 17.—August 2. About 5 or 6 miles below Cookson's camp a small bed was found and from it a collection was made. In the next mile two other very small beds were observed at the head of shoals in very rocky places. No collections were made from these beds.

Shells found at station 17: Red niggerhead, *Quadrula tuberculata*, abundant; white niggerhead, *Q. coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, abundant; rock mussel, washboard, *Q. undulata*, abundant; all other species combined; *Unio gibbosus*, scarce; niggertoe, *Lasaidonta truncata*, sand mussel, *Symphynota costata*, scarce; *Strophitus edentatus*, common; fantail, *Tritogonia tuberculata*, scarce; *Lampsilis ozarkensis*, common; spectacle case, *L. rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, abundant.

Station 18.—August 3. About 1 mile from camp L a mussel bed was found, composed of fossils by two furrows, the shells being col-

lected in sacks and opened on the bank. About 5 bushels of shells had been taken.

Shells found at station 18: Red niggerhead, *Quadrula tuberculata*, abundant; white niggerhead, *Q. coccinea*, scarce; cob shell, rabbit foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, very abundant; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, abundant; fantail, *Tritogonia tuberculata*, scarce; red shell, *Lampsilis purpuratus*, scarce; spectacle case, *L. rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, abundant.

Station 19.—August 3. Below station 18 for a mile or two were few small beds which had recently been worked by pearl hunter. In all of these there was probably not more than a bushel of open shells.

Shells found at station 19: Red niggerhead, *Quadrula tuberculata*, very abundant; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, abundant; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, scarce; young fantail, *Cyprogenia aberti*, scarce; fantail, *Tritogonia tuberculata*, scarce; *Lampsilis ozarkensis*; green mugget, red mugget, grass mucket, *L. ligamentinus*.

Station 20.—August 3. About 6 miles below camp I and near the Jack Pot mine a small bed of shells was observed. About 1 bushel had been recently opened by pearl hunters. From these and a few live ones found a collection was made.

Shells found at station 20: Red niggerhead, *Quadrula tuberculata*, scarce; rock mussel, washboard, *Q. undulata*, common; fantail, *Tritogonia tuberculata*, scarce; red shell, *Lampsilis purpuratus*, scarce; *L. ozarkensis*, scarce; spectacle case, *L. rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, common.

Station 21.—August 4. About 1 mile below camp M were two bed of mussels. These had within a day or two been worked by pearl hunters, the shells being opened on the bank. Not more than 2 or 3 bushels had been taken from both of these beds, which were on the outer curve of the river and among more rocks than usual.

Shells found at station 21: Red niggerhead, *Quadrula tuberculata*, abundant; white niggerhead, *Q. coccinea*, scarce; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, abundant; *Unio gibbosus*, scarce; sand mussel, *Symphynota costata*, scarce; *Strophitus edentatus*, fantail, *Tritogonia tuberculata*, scarce; spectacle case, *Lampsilis rectus*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, common; butterfly, *L. centricosus*, scarce.

Station 22.—August 4. About 5 miles below camp M a bed similar to the above was found and from it a collection was made.

Shells found at station 22: Red niggerhead, *Quadrula tuberculata*, common; cob shell, rabbit's foot, *Q. cylindrica*, scarce; sand mussel, *Symphynota costata*, scarce; fantail, *Tritogonia tuberculata*, scarce; *Lampsilis ozarkensis*, scarce; green mugget, red mugget, grass mucket, *L. ligamentinus*, common; butterfly, *L. centricosus*, scarce.

rotata, scarce; red shell, *Lamprolites purpuratus*, common; green murex, red murex, grass murex, *L. ligamentinus*, abundant.

Along the river on its outer banks a few very small beds were observed. Owing to the small number of shells, deeper water, and the large rocks, these beds were not worked by pearlmen.

Station 22.—August 5. About 2 miles below camp N was found the largest bed observed. It was being worked by two men and two women who live near by and hunt pearls a portion of the time in July and August when their crops do not need their attention. They reported that pearls collected by them during the summer months brought them about \$200. Mr. Samuel W. Jones, Rush, Ark., one of the men, stated that if all the shells found in one season were taken from the bed just as many would be found the next year. From this bed they estimated they would take about 25 bushels of shells. They had just begun work for the season. The most abundant species found here is *Lamprolites ligamentinus*, which, according to Mr. Jones, contains the most pearls. At this place this species was more abundant than all others combined.

Shells found at station 23: Rock mussel, washboard, *Quadrula tuberculata*, scarce; *Unio gibbosus*, scarce; fanfall, *Tritogonia tuberculata*, common; green murex, red murex, grass murex, *Lamprolites ligamentinus*, abundant.

Station 24.—August 5. About 1 mile above the Red Cloud mine we passed a bed of shells where pearl hunters had been, but it was very small compared to the above.

On all outward bends of the river were small beds, but these were passed by by pearl hunters, no doubt because shells were scarce, and on account of the rocks and deeper water they were difficult to get in any numbers. A short distance above and below the mouth of Rush Creek were small beds, the latter being worked by pearl hunters. No collection was made from these beds.

Shells found at station 24: Red niggerhead, *Quadrula tuberculata*, scarce; cobshell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, common; *Unio gibbosus*, common; sand mussel, *Symphyla costata*, scarce; fanfall, *Tritogonia tuberculata*, scarce; red shell, *Lamprolites purpuratus*; *L. ozarkensis*, abundant; *L. planicostatus*. 1 specimen; spectacle case, *L. rectus*, scarce; *L. angustus*, scarce; green murex, red murex, grass murex, *L. ligamentinus*, abundant; butterfly, *L. ventricosus*, scarce; *L. brevicostus*, scarce.

Station 25.—August 6. About 2½ miles below Red Cloud mine a large bed was found which had been recently visited by pearl hunters. On the shore were about 10 bushels of recently opened shells, from which a collection was made. On recently worked beds pearls were not very plentiful, for the pearlmen aim to get every-

Shells found at station 25: Red niggerhead, *Quadrula tuberculata*, common; white niggerhead, *Q. coccinea*, common; cob shell, rabbit's foot, *Q. cylindrica*, common; rock mussel, washboard, *Q. undulata*, abundant; *Unio gibbosus*, scarce; sand mussel, *Symphyla costata*, common; *Strophitus edentatus*, scarce; young fanfall, *Cypripogonia aberti*, scarce; fanfall, *Tritogonia tuberculata*, common; red shell, *Lamprolites purpuratus*; *L. ozarkensis*, scarce; spectacle case, *L. rectus*, common; green murex, red murex, grass murex, *L. ligamentinus*, most abundant species; *L. butcheri*, two examples taken; butterfly, *L. ventricosus*.

Station 26.—August 6. In the next 2 or 3 miles a few small beds were found and then a second large one, where about 5 bushels of recently opened shells were seen.

Shells found at station 26: Red niggerhead, *Quadrula tuberculata*, common; cob shell, rabbit's foot, *Q. cylindrica*, scarce; sand mussel, *Symphyla costata*, scarce; spectacle case, *Lamprolites rectus*, scarce; green murex, red murex, grass murex, *L. ligamentinus*.

From this place to our next camp (camp P) very few shells were noticed.

Soon after camp P was established a succession of heavy thunder storms raised the river about 5 feet and the usually clear water became muddy. Under the most favorable circumstances it would be a week or more before any further observations regarding shells could be made, and so the work was discontinued here. Residents near here state that mussel beds occur from this point to the mouth of the river much the same as to number and abundance of shells as in a corresponding distance up stream from this place.

LIST OF MUSSEL SPECIES COLLECTED.

Local name ¹	Common or trade name	Scientific name
Red niggerhead.	Pink warty-shank.	<i>Quadrula tuberculata</i> .
White niggerhead.	Bluish-pink.	<i>Q. coccinea</i> .
Cob shell, rabbit's foot.	Spike.	<i>Q. undulata</i> .
Rock mussel, washboard.	Milk-toe.	<i>Q. cylindrica</i> .
Niggerhead.	Printed shell.	<i>Unio gibbosus</i> .
Sand mussel.	Spear-head.	<i>Symphyla costata</i> .
Young fanfall.	Bachiana.	<i>Cypripogonia aberti</i> .
Fanfall.		<i>Tritogonia tuberculata</i> .
Red shell.		<i>Lamprolites purpuratus</i> .
Spectacle case.	Black sand shell.	<i>L. ozarkensis</i> .
Spectacle case.		<i>L. rectus</i> .
Green murex, red murex, grass murex.	For number.	<i>L. ligamentinus</i> .
Butterfly.		<i>L. ventricosus</i> .

¹ The local names given here are those first used by pearlmen, and are not necessarily the true names of the shells. The names of the shells are given in the list of shells, and the influence of the water on the shells is given in the list of shells. The names of the shells are given in the list of shells, and the influence of the water on the shells is given in the list of shells. The names of the shells are given in the list of shells, and the influence of the water on the shells is given in the list of shells.

DISTRIBUTION OF MUSSEL SPECIES.

Tringoides, *Quadrula tuberculata* (*Pogonogone*).—Rather common throughout the whole extent of the river traversed. The species is represented by 75 examples of various sizes, none very large and none very small. The shells do not exhibit much variation; they belong to a small, somewhat inflated type, much like those found in the streams of Kentucky and Tennessee. The specimens taken at station 6 were rather inflated compared with the others, and those obtained at station 26 were relatively small and thin. None were sufficiently inflated, however, to be regarded as *Q. gronifera*, which differs from this species chiefly in degree of inflation, and none was so flat as the fine specimens of *Q. tuberculata* found in the Murren, Tippecanoe, and Wabash Rivers, where the species appears to reach its finest development. All lacked the fine wavy sculpture of the umbones which is characteristic of the young of *Q. tuberculata* in its most perfect condition. The name "red nigger-head" was applied to this shell at the pearler's camp below Gilbert. On account of its colored and lusterless naere this shell has little commercial value.

It was found at the following stations: 3, scarce; 5, common; 6, scarce; 9, very abundant; 10, scarce; 12, abundant; 14, abundant; 15, common; 17, abundant; 18, abundant; 19, very abundant; 20, scarce; 21, abundant; 22, common; 24, scarce; 25, common; 26, common.

Mela niggerhead, *Quadrula cocinea* (*Conrad*).—Although fairly well distributed, having been collected through nearly all the stretch of river traversed, and at 14 different stations, *Quadrula cocinea* does not appear to be common in the river. In all, 42 shells were obtained. The greatest number taken at one place was 9, collected at station 6. The shells are all rather small and moderately inflated. The greater number have white naere, though a few are pink. At the pearler's camp it was called "white niggerhead." This species probably really belongs to *Planorbena*, as Ortmann has found the earer gills only functioning as narsopia. It is, however, quite variable and may include several species. I have never found the common flat form gravid. An inflated form, identified as this, but representing somewhat the shape of *Q. solida*, was found gravid in the New York River and contained glochidia in only the outer gills. Where this species attains a good development the white-naere shells furnish very fine naere material, but the rather dwarf shells of the Big Horn River are of no commercial value.

It was found at the following stations: 2, a few dead shells; 3, scarce; 4, scarce; 5, scarce; 6, common; 8, scarce; 9, scarce; 12, scarce; 13, scarce; 14, scarce; 16, scarce; 17, scarce; 18, scarce; 21, scarce; 26, common.

Cob shell, *robbitt's foot*, *Quadrula cylindrica* (*Say*).—The first one, a dead shell, was taken at station 5. From here on it was, on the whole, rather common. The greatest number taken at any one place was 13, at station 25. In all, 59 examples were secured. At the pearler's camp it was called "cob shell." Along the Wabash it is known as "rabbit's foot." The naere of all found is white, though many are more or less stained. Several were beautifully marked by green triangular marks and some were semitranslucent. None was young and most were of medium size. The species has no commercial value.

It was found at the following stations: 5, one dead; 14, common; 15, common; 16, common; 17, abundant; 18, common; 19, common; 21, common; 24, common; 25, common; 26, scarce.

Rock mussel, *washboard*, *Quadrula undulata* (*Barnes*).—Common to abundant throughout the part of the river examined and represented in the collection by 61 shells. The shells are of the same general type, medium in size and rather inflated. None is so compressed as the fine examples to be found in northern Indiana and Ohio and none so markedly inflated as to suggest *plicata*. Within the limits suggested there is some variation in the degree of inflation. Those obtained at station 16 are somewhat flat, and one is almost smooth. One obtained at the Jack Pot mine is markedly elongate as compared with the others, but not conspicuously so when compared with large series from elsewhere. The shells collected at station 26 are considerably eroded. The greater number of these shells exhibit well-marked costae on the posterior-dorsal slope, with deep furrows between them. High ribs extending ventrad from the posterior slope and separated by deep furrows are also common. In these features the shells resemble a common type of the west and south and approach the style represented by Say's figure of *Umbro costatus*. At the pearler's camp they were called "rock mussel," or "washboard."

Where this species attains good development it is a good commercial species, but the Big Buffalo shells are small and of poor quality. It was found at the following stations: 1, most abundant; 2, scarce; 10, abundant; 17, abundant; 18, most abundant; 19, abundant; 20, common; 21, abundant; 23, scarce; 24, common; 25, abundant; 26, abundant.

Umbro gibbosus (*Barnes*).—Common: represented in the collection by 77 specimens. As a usual thing only a few shells were obtained at a station. The greatest number obtained at one place was 10, collected at station 24. The most common form is the familiar medium-sized shell with violet naere. Those obtained at station 3 and those collected at station 12 are large shells with white porcellaneous naere. The five examples taken at station 9 are dwarfed specimens with

orange naere, closely resembling a form common in Green River, KY. This species is of no commercial importance.

It was found at the following stations: 1, scarce; 3, common; 4, abundant; 6, scarce; 8, scarce; 9, common; 10, scarce; 11, scarce; 14, scarce; 16, scarce; 17, scarce; 18, scarce; 19, scarce; 21, scarce; 22, scarce; 23, scarce; 24, common; 25, scarce.

Vigorites, *Manicobia tumida* (B. H. Wright).—Rare; only seven shells obtained, one at station 4, one at station 9, another at station 12, and three at station 15, where it was called "nigger-toe." Where it reaches its best development this is a beautiful shell. It is however, of no commercial importance.

Manicobia calceola (Lea).—Only two shells were collected, one at station 3 and one at station 9. This does not necessarily mean that it is rare, as on account of its small size and habit of burying itself in the bottom it is easily overlooked.

Sand mussel, *Symphyla costata* (Rafinesque).—A fairly common shell, found throughout the entire length of the river examined, and represented in the collection by 90 specimens. Most of the shells are of medium size, a few are smaller, but none very small, the smallest being about 3 inches long. There is no very marked variation among them; one specimen obtained at station 6 is compressed and somewhat deformed, and one from station 19, probably a female, is inflated, with deep costae. At station 15 they were called "sand mussels." On account of the yellowish, lusterless naere and usual thinness of shell, mussels of this species have no commercial value.

It was found at the following stations: 4, common; 5, abundant; 6, common; 7, scarce; 8, scarce; 9, abundant; 10, scarce; 11, scarce; 14, abundant; 16, common; 17, scarce; 18, abundant; 19, scarce; 21, scarce; 22, scarce; 24, scarce; 25, common; 26, scarce.

Strophitus alenches (Say).—Although this shell is found throughout all the portion of the river examined, it is rather scarce nearly everywhere and nowhere abundant. One shell found at station 2 was short and truncate. The others were much alike and quite thin. *Strophitus alenches* is an exceedingly variable shell, especially as regards thickness, and the naere varies from bluish to yellowish. Even the best shells are of no commercial value.

It was found at the following stations: 2, scarce; 3, common; 4, scarce; 12, scarce; 17, common; 25, scarce.

Young fontinalis, *Uppmannia aberti* (Conrad).—Not common; only 19 examples secured, the first one at station 6, and the last three at station 25. Most of the specimens are rather old and somewhat worn, a few are of medium size with the epidermis entire. Call suggests a resemblance between a young *T. aberti* and *Planorbis elegans*. The latter is more inflated and the coloration has rather the contour of *Quadricula* than of *Fontinalis*, but as with *T. aberti*, only very low elongated

raised places, hardly pronounced enough to be called papules, extending ventrad. The species is not nearly so pulchrose as *T. bronchi* (Lea). The fine tessellated markings, green on a yellowish ground, sometimes disposed in broad rays, are similar to the color markings of the last-named species, and assist in identifying the species.

It was found at the following stations: 6, scarce; 16, scarce; 19, scarce; 25, scarce.

Fantail, *Trygonia tuberculata* (Barnes).—From the place where first encountered, station 8, to station 25 this is a fairly common shell, though rather scarce at some stations. In all, 48 shells were taken. At station 15 it was known as "fantail." The shells are all relatively small and thin, and most of them exhibit the peculiarity of having a purplish naere, only very few being white, but none so deep a purple as frequently occurs in specimens from Texas. In the Iowa and upper Mississippi Rivers, where this species attains large size and always or most always has a white iridescent naere, it is valuable for buttons, knife handles, etc., but the thin purplish Arkansas shells are of no commercial value.

It is significant that though the greater number of these shells have colored naere, *Lampisilis ligamentaria*, which is frequently rose tinted in the upper Mississippi, and *Quadrula coccinea*, which often has rose-tinted naere everywhere, show little disposition here to develop colored naere, this in the greater number of cases being white. This shows clearly that the causes producing tinted naere are not the same for all species, and may be an individual peculiarity.

It was found at the following stations: 8, scarce; 10, scarce; 14, common; 16, scarce; 17, scarce; 18, scarce; 19, scarce; 20, scarce; 21, scarce; 22, scarce; 23, common; 24, scarce; 25, common.

Red shell, *Lampisilis purpurulus* (Lamarck).—Fairly common from station 14 to station 25, 25 shells having been secured in this portion of the river. They exhibit no variation except in size. Some of the examples are rather small, but the greater number are of good size.

The young shells are thin and fragile, but later become thick and heavy. The species closely resembles *L. alatus* in the color of naere, which is rich purple, and that of the epidermis, which is black. It differs from that species in being considerably more inflated and with very little wing. The species is rather closely related to *L. alatus* and is said to have a wedge-shaped glomidium, which would agree with that of *alatus*. At station 15 it is known as the "red shell."

It was found at the following stations: 14, scarce; 16, scarce; 18, scarce; 20, scarce; 22, common.

Lampisilis glans (Lea).—Only one specimen of this small species was found. It was obtained at station 16. It is brownish-green, both in color and size and is liable to be overlooked even where fairly common.

Lampsilis whiteensis (Curt) var.—These specimens, unlike anything I could find a figure or description of, more closely resemble a very elongated *Quadrula coccinea* than anything else, agreeing with that species both in texture of epidermis and color of nacre, which is usually a rich rose, though occasionally white. Examples were submitted to Mr. Bryant Walker, of Detroit, Mich., who has made a special study of fresh-water mussels and identified them as above. Mr. Walker remarks:

Not typical. I have author's examples. But these agree with a shell I have so named from Hardy. Taken by themselves, I should say that these shells were *Microdonax* rather than a species of *Lampsilis*. They are not, however, Simpson's *elliptica*. Alcoholic specimens, which would enable the writer to be established, would be desirable.

These shells also agree fairly well with specimens labeled *osarkensis* in the Davenport Academy of Sciences, with which they have been compared.

This form was fairly common between stations 9 and 25, 20 examples having been secured.

It was found at the following stations: 9, abundant; 13, scarce; 15, common; 17, common; 20, scarce; 24, abundant; 25, scarce.

Lampsilis planicostatus (Lea).—Only two examples, both females, from station 2 and one from station 24. These were submitted to Mr. Bryant Walker, who remarks, "A very interesting find. The first record west of the Mississippi, I believe. Male examples would be very desirable." The shells are elongate, somewhat resembling long flattened *via*, but without the brilliant radiation of that species. *Species* cast; *Lampsilis Thomas* (Conrad).—Seven examples of this small species were found, all at station 8, and above Wolem. It had the more deep purple, and one of the small females bore a remarkable resemblance to a large *Lampsilis glans*. A specimen was identified to Mr. Bryant Walker, who identified it as above. It is fairly common shell in southern streams.

Spelta case, *Black sand shell*, *Lampsilis rectus* (Lamarck).—Further notes. The first shells of this species were taken at station 6. All 40 shells were secured. One dead shell had a colony of *Phormidium* growing on the inside of one valve. Most of the shells of this species were of medium size and rather poor quality. Little marked shells are the rule rather than the exception, which is a reverse of the situation in parts of the upper Mississippi, where most of the shells are pearly. Where this shell attains large size of this white nacre it is an excellent commercial species. At the above station 15, it was called "speckle case." In the lower part it is known as the "black sand shell" while the former one is called "black sand shell."

It was found at the following stations: 6, scarce; 10, scarce; 14, common; 17, scarce; 18, scarce; 20, scarce; 21, scarce; 24, scarce; 25, common; 26, scarce.

Lampsilis venustus (Lea).—Not common, but well distributed, the first 11 being taken at station 3 and the last one at station 24. In all, 19 specimens were secured. Mr. Bryant Walker, to whom the specimens were referred and who identified them, in remarks concerning some of the specimens says, "On the whole they seem to be between *venusta* and *pleasii*. More material from different localities would be very desirable."

This is a small species attaining the length of about 50 millimeters. Most of the females have a peculiar sulcus extending from the post ventral margin dorsad, and the epidermis with exceedingly fine capillary rays posteriorly. Mr. Walker calls attention to their close relationship and similarity to *L. elliptiformis* (Conrad). Call it of the opinion that *venustus* and *pleasii* are the same.

It was found at the following stations: 3, common; 8, scarce; 9, scarce; 11, scarce; 16, scarce; 24, scarce.

Green mugget, *red mugget*, *grass mugget*, *Lampsilis tyamentinus* (Lamarck).—This is much the most abundant species found in the river, and is represented by 216 shells obtained at numerous stations from station 5 down to station 26. There are four without data. Only a few of the shells have rosy nacre. There is great variation in size, form, and general appearance. Most of the various forms found in widely different localities are found in this one river, not in widely separated parts of the river, however, but in the same mussel bed. Two examples from station 5 are very thick and heavy. One other from the same place is flattish, with broad rays, and another one is small, flattened, and rayless. This latter decauperate form, resembling a style common in Green River, Ky., is a common type in the river. One specimen, collected at station 9, and one from station 23, are remarkably inflated and elongate. One shell collected at station 19 is inflated and arcuate, having the general shape of *Symphynota costata*. At station 15 a specimen with broad green bands and a greenish epidermis, the kind known by clambers along the Mississippi as the "grass mugget" was called "green mugget" and one with a rusty epidermis and no rays was called "red mugget."

Although the mugget, *Lampsilis tyamentinus*, is one of the staple shells used in button manufacture, those of the Big Buffalo River are of little commercial value on account of their general small size and lack of uniformity.

It was found at the following stations: 5, common; 6, scarce; 7, scarce; 8, very abundant; 9, very abundant; 10, very abundant; 11,

abundant; 12, abundant; 14, abundant; 16, abundant; 17, abundant; 18, abundant; 20, common; 21, common; 22, abundant; 23, abundant; 24, abundant; 25, abundant.

Lampyris turturina (*Lamorch*).—Rare; only two examples obtained, both at station 26. They were rather small for river shells, but heavier than the form usually found in lakes.

Butcherfly, Lampyris ventricosa (*Barnes*).—Not very abundant, but found distributed throughout most of the length of the stream examined. In all, 22 specimens were found. Most of the shells were well layered. They exhibited the usual variation in form. One shell collected at station 6 is a short inflated female, bearing a general resemblance to *L. cognata*, but thick. One shell, obtained at station 8, was small, well layered, and more closely approaching the shape of *L. gonata*, and had a yellowish epidermis well layered with green.

It is only at its best that *L. ventricosa* is a good button shell, and those of Big Buffalo River are only moderately good shells.

It was found at the following stations: 2, one live shell; 3, abundant; 5, scarce; 6, scarce; 9, scarce; 21, scarce; 24, scarce.

Lampyris brevitarsis brevis (*Simpson*).—This shell is new to the collection of the bureau, and was identified by Mr. Bryant Walker. It agrees fairly well with examples of *brevitarsis* Call, in the Department Academy of Sciences, with which specimens were compared, but is broader and flatter posteriorly. It is a flattened shell bearing some resemblance to a small, thin, considerably produced *Lampyris latifolius*, but not markedly inflated postero-ventrally. The numerous green rays are much interrupted and broken up by the lines of growth. Two examples from station 4 have rather rosy nacre. There are 28 shells in the collection. The first five were obtained at station 3 and the last one at station 24.

It was found at the following stations: 4, scarce; 6, scarce; 7, scarce; 9, scarce; 11, scarce; 12, scarce; 24, scarce.

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