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NEW SPECIES OF SHAD (*ALOSA OHIENSIS*),  
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NOTES ON OTHER FOOD-FISHES OF THE OHIO RIVER.

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By BARTON WARREN EVERMANN,  
*Ichthyologist of the United States Fish Commission.*

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From time to time there have come to the U. S. Fish Commission reports of the capture of shad in the Mississippi basin. When attempts were made to verify these reports, either no reliable data could be secured or the fish thought to be a shad proved to be some other species. For example, the "shad" from the Atchafalaya River, in Louisiana, was shown by the present writer in 1897 to be an undescribed species and genus of the hickory shad family (*Dorosomidae*) which was named *Signalosa atchafalaya*. This is a small fish, not exceeding a few inches in length, which is used as bait by the cat-fish fishermen of that river.

As long ago as 1872 Professor Baird called attention to the occurrence of shad in the Ouachita River, in Arkansas, and Dr. Goldsmith, of Vermont, stated that he had several years previously taken shad at the Falls of the Ohio.

The "shad" now and then reported from the Ouachita, White, and St. Francis rivers and other waters in Arkansas proved, in some cases at least, to be the hickory shad, *Dorosoma cepedianum*. Not many of the reports from this region, however, have been investigated. A few years ago the toothed herring or mooneye (*Hiodon alosoides*) became unusually common in the Wabash, and, coming as it did, soon after a plant of Potomac shad had been made in the Wabash by the U. S. Fish Commission upon the recommendation of the late Col. Richard W. Thompson, local fishermen were in the habit of referring to it as the "Dick Thompson shad."

A newspaper item from Montgomery, W. Va., dated May 20, 1896, says:

The fishermen hereabouts are having great sport. Large schools of shad, put in Elk River by the Government six years ago, are stranded at Lock No. 2 and are being scooped out by the hundreds with dip-nets. One man took 300 pounds in two hours.

Upon seeing this item the Commission addressed a letter of inquiry to the postmaster at Montgomery, to which Mr. W. M. Dent replied June 5:

I have sent several of our local fishermen to catch some specimens [of the shad], but I am sorry to say that they are unable to catch them at the present time. A few

weeks ago, when the river was flush, quite a number of fish were seen below the dam near this place, and some of them were caught by what we call grab-hooking, which is to tie a number of hooks to a line and drag it through the water, but since the river has fallen I am informed that most of the fish have disappeared.

I had a talk to-day with the man in charge of the Government lock, and he promised to try to catch some of the fish when there is a rise in the river again. In case he succeeds I will take pleasure in sending them to you.

Mr. Dent was not able to secure any specimens, and nothing further was heard regarding the occurrence of shad in the Kanawha that year. On May 22, 1897, a letter was received by the Fish Commission from Mr. James Sowders, wholesale dealer in fresh fish and oysters, Louisville, Ky., in which he says:

I forward you four small shad. I get them as large as 4 or 5 pounds each. They are not hickory shad, but are the same fish taken in the rivers along the Atlantic coast. I have been getting these fish for the past twenty years or more, but only a few, as we have never fished for them in the right way. I put in the long seines this season and took lots of them. I expect to do much better next season, as I expect to make a success of gill-netting them. We have never fished gill nets of any kind in these waters. I know that there are just millions of these fish in this river, for I see them out in the rapids going up the river to spawn. I have fishermen all along the Ohio, and have several crews fishing below Memphis on the Mississippi River in the early spring, and they get a catch of shad there a month before we do here, and my men at Troy (about 130 miles below Louisville) get them before we do here. I am positive that they are the same fish caught in the Atlantic coast rivers. These shad come from the Gulf of Mexico and spawn in the Monongahela River.

An examination of the four shad sent to the Commission by Mr. Sowders showed that they differed from the common shad, as well as from the Alabama shad, in some important particulars, and it was determined to take the first opportunity to visit Louisville and make an investigation as to the character and extent of the fishery. Accordingly, on May 11 of the following year, when Mr. Sowders sent on six additional specimens, and wrote that the shad were then running in considerable numbers, it was arranged that I should visit Louisville at once.

On the way out from Washington I stopped one day at Montgomery, W. Va., to make inquiries regarding the occurrence of shad in the Kanawha.

Arriving at Louisville on May 15, I spent the next four days making investigations there. The shad were then running in some numbers, and many specimens were examined.

It at once became evident that the Ohio shad was an undescribed species. Its publication, however, has been delayed in the hope that an opportunity might soon offer to trace the migration of the fish up the river from the Gulf. Other duties have not permitted such an investigation to be undertaken, and it now seems undesirable to delay longer the report upon the inquiries already made.

*Alosa ohioensis*, new species. (Figs. 1 and 2.)

Type, No. 50469, U. S. N. M., a female example 18 inches long and weighing 3 pounds, taken by Mr. James Sowders, May 9, 1898, at the Falls of the Ohio.

*Description of the type.*—Head 4.5; depth 3.6; eye 5.5; snout 4; maxillary 2.1; mandible 1.87; D. 18; A. 18; gillrakers  $49 + 26 = 75$  on right side,  $47 + 27 = 74$  on left.

Body very long, slender, and much compressed; dorsal and ventral outlines very gently and evenly arched; head rather long, conic; caudal peduncle very long, the distance from base of caudal to dorsal fin equaling distance from that point to preopercle; mouth large; maxillary broad, reaching posterior border of eye, lower jaw slightly projecting and fitting into a small notch in tip of upper jaw; cheek and opercles strongly striate; scales large and deciduous; fins moderate; gillrakers moderate in number, the longest about equal to snout in length.

The 10 cotypes, which consist of 2 males and 8 females, exhibit no important differences, and the 38 examples examined at Louisville May 16 to 19 showed no variations of value. Indeed, the characters of this species seem unusually stable, as may be seen from an examination of the accompanying table.

The number of gillrakers varies from 66 to 75, only a single example, however, running below 68 and only 5 above 74. The average of 49 examples was  $45 + 26 = 71$  for the right side, and  $46 + 26 = 72$  for the left side. The average for the 4 known adult examples of the Alabama shad is 67, and even the minimum for the common shad is more than 90. In so far as the number of gillrakers is concerned, it thus appears that the Ohio shad is between the other 2 known species, approaching most nearly the Alabama shad (figs. 3 and 4). Indeed, if this species resembled the Alabama shad in other respects as closely as it does in number of gillrakers I would hesitate to regard them as being distinct.

The Alabama shad is a short, chunky species, having the depth one-third the length, and with the maxillary very slender; while the Ohio shad is a much longer, more slender fish, whose depth is scarcely more than a fourth of the length even in the females, while the males are still more slender. And the maxillary in the Ohio shad is broader, more closely resembling that of the common shad (Figs. 5 and 6).

Besides the 4 examples received from Mr. Sowders May 22, 1897, and the 6 received from him May 11, 1898, many others were examined by me at Louisville May 16 to 19, 1898, where I was able to do so through the kindness of Mr. Sowders, who permitted me to examine, weigh, and measure those taken by his fishermen.

In all, 49 fish were examined critically, including 27 females and 22 males.

In looking through the records in the Department of Fishes, U. S. National Museum, I found that a single specimen of shad was received from Louisville in May, 1878, through the kindness of a Mr. Griffith. In the Museum register it is recorded as "*Alosa sapidissima*," and bears tag No. 21346.

The following table gives lengths, weights, gillrakers, and comparative measurements of all the specimens of Ohio shad which have been critically examined.

Tag No.	Sex.	Length.	Weight.	Head.	Depth.	Eye.	Snout.	Maxillary.	Mandible.	Dorsal.	Anal.	Gillrakers.		
												No. on first arch on right side.	No. on first arch on left side.	
*1089	Female	16	<i>Ins.</i> 2	4.5	3.8	5.5	4.3	2.25	1.7	14	20	47+26=73	46-26=72	
1091	do	16	2	4.5	4	5.5	4.3	2.25	1.75	15	19	46-25=71	45-26=71	
1090	do	16	2.25	4.5	3.6	5.5	4.25	2.25	1.7	15	19	45+27=72	47+27=74	
1092	do	16	2	4.5	3.87	5.5	4.3	2.25	1.75	15	19	46+26=72	46-28=74	
1619	Male	15	1.5	4.25	4.4	5.33	4.33	2.13	1.87	17	20	44+27=71	46-28=74	
1622	do	16	2	4	3.9	5.5	4	2	1.8	18	19	47+26=73	46+28=74	
1620	Female	16.5	2.5	4.4	3.5	5.2	4.2	2.1	1.8	18	20	46+25=71	39+25=74	
1621	do	18	3	4.5	3.6	5.5	4	2.1	1.87	18	18	49+26=75	47+27=74	
1623	do	15.5	2	4.4	3.6	5	4.5	2	1.83	19	19	43+25=68	44+26=70	
1624	do	17.25	3	4.5	3.5	5	4.3	2	1.83	19	20	46+26=72	46+27=73	
These 38 specimens, examined at Louisville, were not preserved.	Male	17	2	4.5	3.8	5.75	3.7	1.87	2			45+26=71	46+25=71	
	do	16.75	1.75	4.5	3.8	5	3.8	1.87	2			43+26=69	44+27=71	
	do	16	2	4.4	4	5.25	3.8	2.1	1.9			45+25=70	45-25=70	
	Female	17.5	2.25	4.5	4	5	4	2.1	1.9			46+27=73	44+26=70	
	do	17	2.25	4.5	3.75	5.5	4	1.9	1.87			47+25=72	46+26=72	
	do	17	2.5	4.2	3.8	5.3	3.8	1.87	2			47+27=74	46+25=71	
	do	16.5	2.25	4.4	3.9	5.5	3.8	2	1.87			46+27=73	46+27=73	
	do	16	2	4.5	3.9	5.5	3.5	2	1.87			44+26=70	43+25=68	
	Male	15.5	2	4.4	4	5	3.5	2	1.75			45+25=70	45+25=70	
	Female	16.5	2.25	4.4	3.8	5.25	3.8	2	1.75			45+26=71	45+28=73	
	do	15	2	4.25	3.8	5.25	3.8	2	1.75			45+28=73	47+28=75	
	Male	16	2	4.25	3.8	5.25	3.8	2	1.8			45+27=72	46+28=74	
	do	16	2	4.4	3.83	5.25	3.8	2	1.8			45+27=72	45+27=72	
	do	17	2.25	4.5	3.83	5.25	3.8	2	1.8			45+27=72	46+27=73	
	do	16	2	4.25	4	5	3.8	2.1	1.8			46+29=75	46+27=73	
	do	17	2	4.2	3.9	5.25	3.8	2.1	1.8			45+26=71	45+26=71	
	do	16.5	2	4.25	3.8	5.25	4	2	1.8			44+26=70	46+26=72	
	Female	17	2.5	4.5	3.9	5	3.67	2	1.8			45+25=70	45+26=71	
	do	17.5	2.25	4.5	3.9	5	3.8	2.1	1.75			44+26=70	45+25=70	
	do	17	2.25										47+28=75	47+27=74
	Male	17	2.25										45+26=71	47+24=71
	do	17	2.25										44+27=71	43+26=69
	do	17.5	2.5										43+27=70	45+25=70
	do	16	2										44+26=70	46+25=71
	do	16	2										44+26=70	46+25=71
	do	17	2.5										47+28=75	47+27=74
	do	17.5	2.25										45+25=70	46+25=71
	do	17	2.75										45+26=71	44+27=71
	do	17	2.25										45+25=70	44+24=68
	do	16.5	2.25										45+25=70	44+25=69
do	15	1.75										43+25=68	43+23=66	
do	16	1.75										43+25=68	48+23=71	
Female	18	3										44+25=69	47+27=74	
do	17	2.75										46+24=70	45+26=71	
do	17	2.5										45+25=70	45+25=70	
do	15.5	1.75										45+25=70	44+25=69	
do	16	1.75										48+26=74	48+27=75	
do	16.5	1.5										45+26=71	45+26=71	
do	16	2										46+26=72	46+25=71	
do	16	2.25										46+26=72	48+24=72	
21346†	do	18		4.4	3.5	5	4.5	2.1	1.8	15	20	46+26=72	48+24=72	

\*These 10 specimens have been assigned to certain museums as follows:  
 No. 1089, cotype, to the Field Columbian Museum, on whose records it is No. 3489.  
 No. 1090, cotype, to the American Museum of Natural History, on whose records it is No. 2163.  
 No. 1091, cotype, to the Museum of the University of Indiana, where it is No. 9550.  
 No. 1092, cotype, to the Museum of Comparative Zoology, where it is No. 28810.  
 No. 1619, cotype, to the U. S. National Museum, where it is No. 50470.  
 Nos. 1620 and 1623, cotypes, to the Museum of Leland Stanford Junior University, where they are Nos. 12672 and 12673.  
 No. 1621, the type, to the U. S. National Museum, where it is No. 50469.  
 Nos. 1622 and 1624, cotypes, are in the U. S. Fish Commission reserve series.  
 †No. 21346, cotype, has been in the U. S. National Museum since May, 1878.

During my stay of 4 days at Louisville (May 16 to 19, 1898) the number of shad caught was very few. The catch of May 16 was 19 fish, that of May 17 was 16, while only 3 were gotten on May 18. At this time the roes were quite small, and I think the shad would not have spawned before the 1st to the 15th of June. The examples received

from Mr. Sowders in 1897 and 1898 indicated that their spawning time would have been in the first half of June.

These shad were caught by means of seines light-leaded so that they would fish the upper few feet of water rather than the bottom. This method of fishing was adopted in order to get the spoonbill cat, which, when running, swims close to the surface; and while fishing

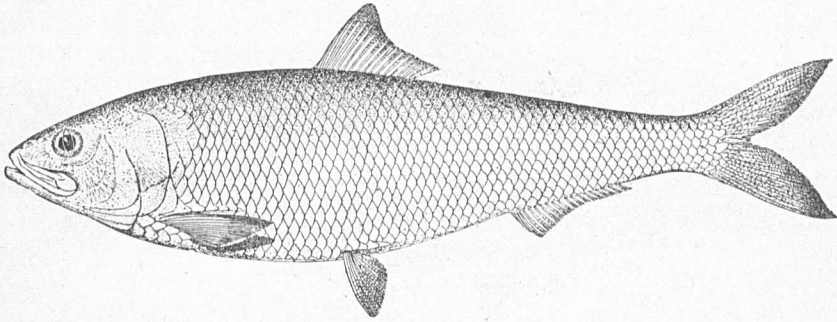


FIG. 1.—Ohio Shad, *Alosa ohioensis* Evermann; female. Drawing from the type.

for the spoonbill, the shad were caught at the same time. The two species appear to “run” at the same time when both swim near the surface.

The principal seining-ground near Louisville in 1898 was below the Falls of the Ohio, and between Rock Island and the Indiana shore. The seines in use were about 70 yards long, 1.5-inch bar, and 90 meshes deep.

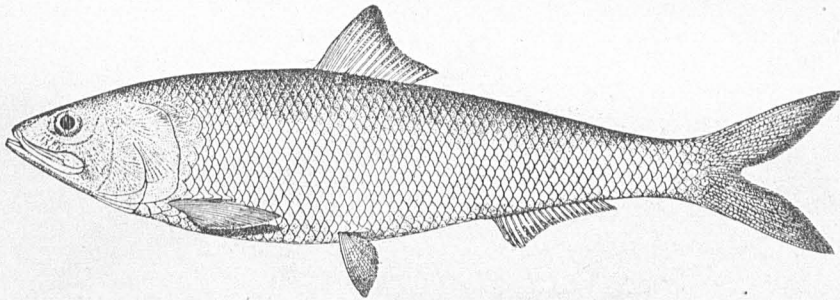


FIG. 2.—Ohio Shad, *Alosa ohioensis* Evermann; male. Drawing from one of the cotypes.

According to Mr. Sowders the first shad obtained at Louisville were caught about 1876, when a good many were secured by seining just below the Falls. Mr. Sowders's father, who was then in the fish business, compared them with shad billed to him from Baltimore as “Potomac shad.” Being unable to detect any important difference, he called those from the Ohio “Potomac shad,” which name they have ever since retained among the Louisville fish-dealers. They found a ready sale then, perhaps at a better price than they now receive. Since

that time a few have been taken each year, but no large catches until 1897. The catch that year was relatively very large. The first fish were gotten May 5, and from then until May 20 the daily catch at Mr. Sowders's fishery at the Ohio Falls ran from 125 to 740 fish.

Mr. Sowders thinks the great increase in the catch in 1897 was due to a change in the method of fishing. Until then the seines had been

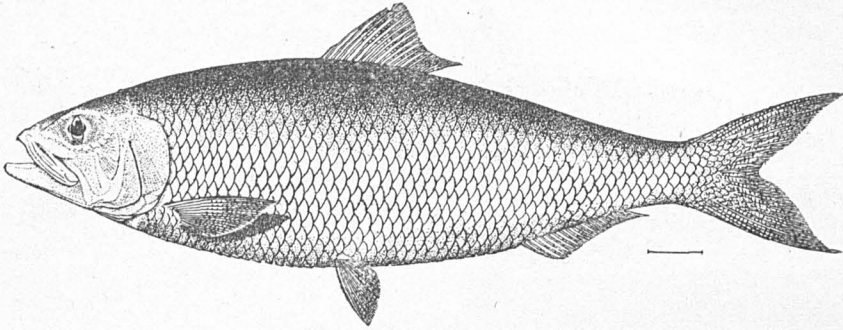


FIG. 3.—Alabama Shad, *Alosa alabamae* Jordan & Evermann; male. Drawing from the type.

heavily leaded, hence hugged the bottom closely and caught only bottom fish, the seines not being deep enough to fish the entire depth of water. The catch was made up chiefly of such bottom fish as catfish, buffalo, and fresh-water drum. The surface-swimming fish, such as the spoonbill cat, shovelnose sturgeon, and shad, would pass over the net. Desiring to catch the spoonbill cat, Mr. Sowders instructed his fishermen to put lighter leads upon the seines, so that they would

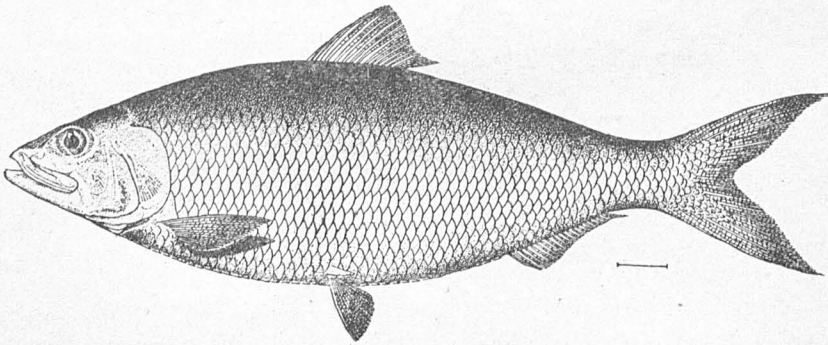


FIG. 4.—Alabama Shad, *Alosa alabamae* Jordan & Evermann; female. Drawing from the type.

fish the upper portion of the water. As a result, not only were the spoonbill cat and shovelnose sturgeon taken, but the shad also. All three of these species appear to run at about the same time.

The first shad caught in 1898 were gotten April 28. The catch in that year was said to have been much lighter than in 1897; but the catch of all species in 1898 was light.

Very little is known regarding the distribution of the Ohio shad. All the specimens I have seen were taken at the Falls of the Ohio. About March 15, 1898, Mr. Sowders was at Coahoma, Miss., where he saw 25 or 30 shad caught. This was in the Mississippi about 10 miles below Friars Point, Coahoma County, or about 75 miles below Memphis. The fishermen said they caught a good many of them, but

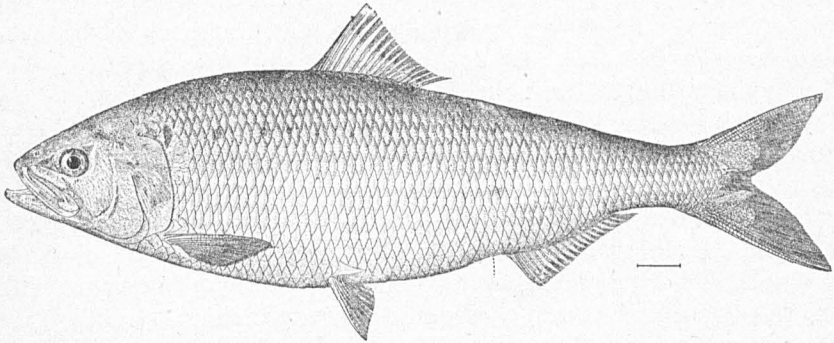


FIG. 5.—Common Shad, *Alosa sapidissima* (Wilson); male.

were uncertain what they were. Some called them "skipjack," but believed them different from the common skipjack (*Pomolobus chrysochloris*). These fishermen said they had been getting this fish for years, but never valued them very highly. They used them chiefly for cat-fish bait. The roes of those which Mr. Sowders saw were very small.

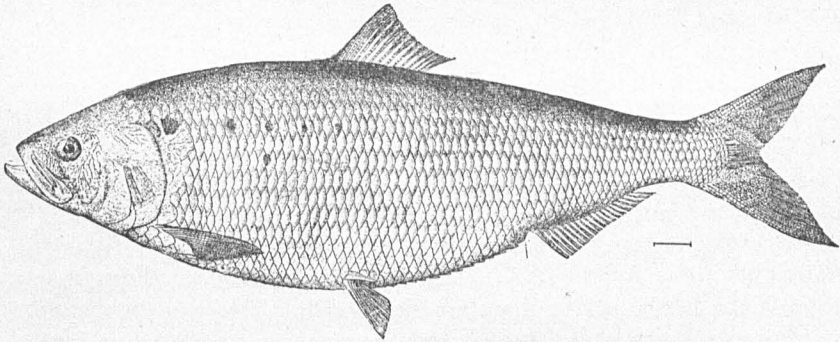


FIG. 6.—Common Shad, *Alosa sapidissima* (Wilson); female.

The next place from which this shad has been reported is Flint Island, in the Ohio River, a mile below Concordia, Ky., or about 90 miles below Louisville. Mr. Sowders reports that he got shad there in small numbers about April 20, 1897. They were seen at Brandenburg, Ky., about 40 miles below Louisville, about the same time.

Mr. Sowders says he heard of the shad at Vicksburg about 1883, and in 1884 in the Ohio at Hickman; also at Aurora, Ind., in 1886 and subsequently.



As already stated, the Fish Commission heard of the occurrence of shad in the Kanawha River at Montgomery, W. Va., in May, 1896. On May 13, 1898, I visited Montgomery, hoping that I might be able to secure specimens, or at least obtain further data regarding the occurrence of shad at that place. Very little additional information, however, could be secured. It was learned that shad had never been seen there, according to the persons interviewed, until in May, 1896. Only a few people knew anything about them, and not many were caught. The fish were seen at Lock No. 2, which is at the town of Montgomery, and at Lock No. 3, which is 5 or 6 miles below.

According to Mr. Pink Brown, shad were abundant during the "light moon in May, 1896," in the Kanawha at Cabin Creek, just below Coalburg, or 8 miles below Montgomery. The river was full of them and he caught a great many with a seine. He sold none because everybody was catching them. He took some to Capt. James Calvert, of the *Kanawha Belle*, who said they were common all along the river. Mr. Brown says those he caught were fine, large fish, excellent eating, and full of roe when caught, but he did not notice any eggs running from them, though others reported that they did. Mr. Brown did not catch any shad after the "light moon in May," but other parties continued for some days to catch them at the locks with drag hooks.

Several years ago, it was stated, copperas water from the Cannelton mines entered the river and killed many fish, among them a "white-fish" which many now believe was the shad. The fishermen and others in this region who are familiar with the toothed herring and the skipjack say that the fish they call the shad is a very different species.

Lock No. 2, at Montgomery, is on the north side of the river and is faced by a high stone wall, on the outside of which, in the swift water, is where the shad were caught. For some time I watched a man with drag hooks trying for shad, but he met with no success.

Inquiry among the fish-dealers at Evansville, Ind., in May, 1898, developed the fact that the shad is scarcely known at that place. One dealer stated that he had seen shad caught in the Ohio near Evansville about 1868 and a few in 1897. He also stated that he had taken them in the Wabash, about 10 miles above its mouth. He gave the weight of the shad as about 2 pounds, and says they die very soon when caught.

Only one of 3 dealers interviewed at Vincennes, Ind., had ever heard of shad in the Mississippi basin. He claimed to have received some shad a few years ago from St. Louis, but says they were too expensive for his market, as he had to sell them at 75 cents each. He did not know but that these fish may have been shipped from the East.

All the known facts regarding the distribution and habits of the Ohio shad indicate that it has regular runs, like the common shad.

It appears in the Mississippi on the borders of Coahoma County, Miss., about the middle of March; in the lower Ohio about a month

later (April 20); at Louisville still a little later (April 28 to May 20), and in the Kanawha River at Montgomery, W. Va., in the latter part of May.

The Ouachita River, Arkansas, from which shad have been reported, has its mouth in the Red River near the confluence of the latter with the Mississippi, more than 200 miles below Coahoma, where they were seen by Mr. Sowders, and only about 200 miles from the Gulf of Mexico. Although it has not been proved that these shad come up from the Gulf of Mexico, it may be regarded as certain that they do and that they are as truly anadromous as is the Atlantic shad.

Whether important fisheries for the Ohio shad can be established remains to be determined. In the first place, it is not yet known whether the fish is commercially abundant. It is not at all improbable that its apparent scarcity may be due merely to the fact that the methods of fishing in vogue in the Mississippi basin have not been such as would prove effective in the capture of shad. Gill nets and trap nets are scarcely known, and where seines are used they are usually leaded so as to fish the bottom, and are hauled mostly during the daytime. Shad might very well be present in abundance and remain forever unknown so long as the present fishing methods are continued.

Many plants of Atlantic shad have been made by the United States Fish Commission in the waters of the Mississippi basin—the first in 1874 and the last in 1893—and although none of the planted shad has since been received by the Fish Commission for identification, and the capture of none has been fully authenticated, it does not follow by any means that none has survived. It is by no means improbable that the Atlantic shad may now be abundant in the Gulf and its tributary streams, and that a thorough investigation may establish the fact. At any rate the vast economic and scientific importance of the matter justifies a very careful and exhaustive investigation of the whole matter.

The spawning time of the shad in the Ohio River is probably not earlier than the 10th of June. The numerous examples seen at Louisville May 16 to 19 were far from ripe and it is doubtful if any of them would have spawned much before the middle of June.

As an article of food the Ohio shad does not yet seem to have appealed to the citizens of the Mississippi Valley. At Louisville they sold at a low price, the price received by the fishermen being but 2 cents a pound, the same that was paid for carp, buffalo, and toothed herring. Those who are familiar with the delicious Atlantic shad and who know how to prepare it find the Ohio species not at all inferior.

If the shad should be found to be present in the Mississippi and its tributaries in sufficient numbers to justify the establishment of permanent fisheries each spring, there is little doubt but that it would soon become quite as highly prized as its near relative in the Atlantic coastal streams.

## NOTES ON OTHER FOOD-FISHES OBSERVED AT THE FALLS OF THE OHIO.

During the visit to Louisville for the purpose of studying the Ohio shad several other food-fishes were observed and many important notes were made upon them, the more valuable and interesting of which are here recorded.

In the fishery at Louisville the species caught are classed as "good fish," "small fish," and "shovelnose sturgeon." Spoonbill cat and fresh-water drum are classed as "good fish," and all other species as "small fish," except the shovelnose sturgeon, which is classed by itself.

**Polyodon spathula** (Walbaum). "*Spoonbill Cat*"; *Paddle-fish*.

This is one of the most interesting fishes of the Ohio basin. It is said to occur in the Kanawha at least as far up as Montgomery. At Louisville it is the most valued of all the fishes found there. It is only within the last few years that the spoonbill cat has possessed much commercial value, but now it is more sought after than any other species in the Mississippi basin. Although its principal value is on account of its roe, from which caviar is made, the flesh has now come into considerable favor and finds a ready sale.

The paddle-fish is found in the Ohio, at Louisville, in the spring in large numbers. The fishing season is chiefly during the month of May, at which time the fish are running upstream. The principal fishery is just below the Falls, where the fish are taken in the same seines which are used in the shad and shovelnose sturgeon fisheries.

During my stay at Louisville (May 16 to 19) I saw a good many of these fish caught and examined many examples in Mr. Sowders's market. When the spoonbills are caught the fisherman cuts off the heads (including the collar bones), the tail, and all the fins, and then receives 4 cents a pound for what is left. The majority of those seen were small, probably running from one-half to 15 pounds dressed. Some were not over a foot in length. Nearly all the large ones were females full of nearly ripe roe. The eggs did not run from any that I saw, but the fishermen say they had a few recently which were entirely ripe.

Just where these fish spawn no one knows certainly. Mr. Sowders and the fishermen think they go to the bayous and quiet places in the river above Louisville. Judging from the roe I saw in May, I would say that many of the fish examined would have spawned early in June—perhaps between June 5 and 20—and it would seem that it should not be difficult to discover their spawning-beds.

There is, however, no other fresh-water fish in our waters about whose spawning time, place, and habits, and whose development so little is really known, although their eggs and young have been long desired by all zoologists interested in the origin and development of fishes. No one seems ever to have seen this fish spawning, and the young under 8 or 10 inches in length are absolutely unknown. Anyone obtaining specimens under 8 inches in length would confer a great favor upon science by forwarding them, preserved in formalin, to the U. S. Fish Commission at Washington.

The utilization of the roe of the spoonbill cat began only a few years ago, and it is now by far the most valuable part of the fish. The eggs are a greenish-black in color, about three times the size of shad eggs, and are very numerous. In converting them into caviar they are run through a wire screen to separate them from all the fat and connective tissue; then they are salted by mixing with them the proper amount of Lüneburg salt. This is the most delicate part of the whole process and the best results can be obtained only by practice. After adding the salt the eggs at

first become dry, but in a few minutes a brine has been formed. The salted eggs are then placed on fine-meshed sieves, where they are allowed to drain, after which they are packed in casks or cans as caviar. The method does not differ from that followed with the eggs of sturgeon.

Mr. Sowders says that 1897 was his best year. In 1898 he got considerable quantities at various places down the Mississippi in March.

**Acipenser rubicundus** Le Sueur. *Lake Sturgeon; Ohio Sturgeon.*

The sturgeon ascends the Kanawha at least to Montgomery, but it does not appear to be common anywhere in the Ohio basin. This species was formerly much more abundant in the Ohio, and I have seen a very large example with ripe roe at Louisville in March.

**Sphyrhynchus platorhynchus** (Rafinesque). *Shorenose Sturgeon.*

This is a rather abundant fish at Louisville. They are taken in seines with the spoonbill cat and the Ohio shad, as they run at the same time with those species and also swim well toward the surface of the water when running. The fisherman ties them in bunches (2 to 4 in a bunch, which weighs about 4 pounds), for which he receives 10 cents each. The accompanying table gives the weight and length of 41 males and 21 females examined.

*Table showing sex, length in inches, and weight in pounds of 62 shovelnose sturgeon examined at Louisville, Ky., May 16 to 19, 1898.*

Sex.	Length.	Weight.	Sex.	Length.	Weight.
	<i>Inches.</i>	<i>Pounds.</i>		<i>Inches.</i>	<i>Pounds.</i>
Male	21	2	Male	21	1.5
Do	25	2.25	Do	19	1.25
Do	25.6	2.5	Do	21	1.5
Do	24	2.5	Do	21	1.5
Do	27	3	Do	21.5	1.75
Do	21	1.5	Do	19	1.25
Do	23	2	Do	18.5	1.25
Do	21	2	Do	19	1.25
Do	21	2	Do	16.5	1
Do	25	2.75	Do	18	1.25
Do	24	2.5	Female	26	3.75
Do	20	1.5	Do	22	2
Do	22	2	Do	25	3.25
Do	26	3	Do	27	4
Do	22	2	Do	26	3.5
Do	20	1.5	Do	25	3
Do	24	2.75	Do	24.5	2.75
Do	24	2.25	Do	26	3
Do	22	1.5	Do	26	3.5
Do	21	1.75	Do	23	2.75
Do	24	2.5	Do	26	3
Do	22	1.75	Do	28	4.25
Do	20	1.5	Do	23	2.5
Do	21	1.75	Do	27	4
Do	24.5	3	Do	26	3.25
Do	21	1.5	Do	29.5	4.75
Do	20	1.25	Do	26	4
Do	21	2	Do	25	3
Do	20	1.5	Do	26	3
Do	20	1.5	Do	24	2.75
Do	24	2.25	Do	22	2

The total number of examples of this species examined critically was 62, of which 41 were males and 21 females. The smallest male was 16.5 inches long and weighed 1 pound; the largest male was 27 inches long and weighed 3 pounds; the average length of the males was 21.7 inches, and the weight 1.89 pounds. The smallest female was 22 inches long and weighed 2 pounds; the largest female was 29.5 inches long and weighed 4.75 pounds; the average length of the females was 25.4 inches, and the average weight 3.24 pounds.

In addition to these 62 fish examined, I measured, but did not determine the weight or sex of, 78 others. Of these the smallest was 18 inches long, the largest 28

inches, and the average length was 22.57 inches. These fish were all much smaller than the books usually indicate this species to be. The largest I have ever seen was under 4 feet long.

Rafinesque, in writing of this fish in 1820, in his *Ichthyologia Ohiensis*, says:

"A singular species, very common in the Ohio, Wabash, and Cumberland in the spring and summer, but seldom reaching as high as Pittsburg. It appears in shoals in March and disappears in August. It is very good to eat and bears many names, such as spade-fish, shovel-head, flat-head, flat-nose, etc., having reference to the shape of its head, which is flattened somewhat like a spade. It is also found in the Mississippi and Missouri, where the French call it *La pelle*, or *Poisson pelle*, which has the same meaning. Size, from 2 to 3 feet; greatest weight, 20 pounds."

The eggs of the shovelnose sturgeon are used at Louisville in the making of caviar, and are mixed with those of the spoonbill cat. They are a little smaller and somewhat darker than those of the latter species. The majority of the fish examined were not nearly ripe, and their spawning time is probably not earlier than July or late in June.

***Ictalurus furcatus*** (Le Sueur). *Blue Cat.*

Several examples seen at Louisville, where it is a valued food-fish. Rafinesque, in his *Ichthyologia Ohiensis*, mentions this cat-fish under the name *Siturus cerulescens*. He calls it "a fine species, reaching sometimes a very large size. I have been told that one was taken weighing 185 pounds, and another 250 pounds. Vulgar names, blue cat, brown cat, and cat-fish."

***Ictalurus anguilla*** Evermann & Kendall. *Eel Cat; Willow Cat.*

One example of this recently discovered and interesting species was seen at Louisville, May 18. Length 9 inches to base of caudal; weight 1.5 pounds. Head 3.83; depth 5.75; eye 6.67; snout 2.8; width of mouth 2.3 in head; maxillary barbel reaching gill-opening; distance from snout to origin of dorsal fin one-third length of body.

***Ictalurus punctatus*** (Rafinesque). *Channel Cat.*

More common than the preceding, but not reaching so large a size.

***Ameiurus nebulosus*** (Le Sueur). *Common Bullhead.*

A few examples seen at Louisville.

***Leptops olivaris*** (Rafinesque). *Goujon.*

A large and important food-fish not uncommon in the Ohio; several examples seen at Louisville.

***Ictiobus bubalus*** (Rafinesque). *Small-mouthed Buffalo.*

Seen only at Louisville, where it was taken in seines along with the paddle-fish and shad.

***Carpiodes carpio*** (Rafinesque). *Carp Sucker.*

This species was originally described by Rafinesque from the Falls of the Ohio, where it is commonly called carp. Several examples seen by me.

***Cycleptus elongatus*** (Le Sueur). "*Black Sucker*"; "*Mississippi Sucker*"; "*Gourd-seed Sucker*."

This interesting sucker is found sparingly at Montgomery. It runs early in the spring, ahead of the shad, reaching Montgomery early in May. A fisherman at this place says they reach a weight of 15 pounds. They will not take the hook and are usually caught at the lock by "grab-hooking." A few examples of this sucker were seen at Louisville, where it is said to be most abundant in the fall. It reaches a considerable size, examples of 18 pounds having been reported. It is a sweet, delicious fish, and finds ready sale.

**Carpiodes velifer** (Rafinesque). *Quillback*; "Carp."

Not rare at Louisville, where it is called "carp."

**Catostomus commersonii** (Lacépède). *Common Sucker*.

At Montgomery this sucker was seen salted in brine in kegs of about 100 pounds each. They had been received from Charleston, W. Va., where they presumably had been put up. They had been billed to the dealer at Montgomery as "white-fish," and were sold by him under that name at 2 for 5 cents. In the same keg were seen a few common redhorse (*Moxostoma aureolum*) and one-toothed herring (*Hiodon alosoides*). They are said to sell fairly well and there is no good reason why these coarser fish might not be utilized extensively in this way.

This sucker is common throughout the Ohio basin, but was not seen by me at Louisville.

**Moxostoma aureolum** (Le Sueur). *Common Redhorse*.

A few examples of this fish were seen at Montgomery in a keg of pickled common sucker (*Catostomus commersonii*). It is not uncommon at Louisville, where a number of specimens were seen.

**Cyprinus carpio** Linnaeus. *German Carp*.

The German carp has become well established in the Ohio River and considerable numbers are caught each year. Though a much maligned fish, the carp has come to be one of the most important fresh-water food-fishes of the Mississippi Valley. In the Illinois River it is of greater value to the fishermen than all other species combined; and instead of destroying the black bass, as many anglers and others would have us believe, the black bass have actually increased along with the carp in that river.

**Anguilla chrysypa** Rafinesque. "Eel"; *Common Eel*.

The eel is not uncommon, at least as far up as Montgomery, where I saw one taken on a hook at the lock. It occurs at Louisville, but no specimens were seen during my visit.

**Hiodon alosoides** (Rafinesque). *Toothed Herring*.

One example was seen in a keg of pickled suckers in a grocery at Montgomery, where they were all sold as "white-fish," at two for 5 cents.

This species was seen at Louisville, where it was not common. It is classed among the "small fish" for which the fishermen receive 2 cents a pound.

**Dorosoma cepedianum** (Le Sueur). *Hickory Shad*; *Gizzard Shad*.

An abundant fish in the Ohio Valley, of little or no value as food. Several seen at Louisville.

**Stizostedion vitreum** (Mitchill). "Salmon"; "White Salmon"; *Wall-eyed Pike*.

This valuable species seems to be rather uncommon in the Ohio and its larger tributaries. At Montgomery it is said to be their best game fish, and is caught by trolling with an artificial minnow. It is said to reach a weight of 18 pounds in the Kanawha. No examples were seen either there or at Louisville.

**Aplodinotus grunniens** Rafinesque. "White Perch"; "Yellow Perch"; *Fresh-water Drum*.

This large, coarse fish seems to be quite common in all the larger streams of the Ohio basin. I saw it caught on a hook at Lock No. 2 just below Montgomery. A good many are caught in seines at the Falls of the Ohio, where it brings the fishermen 4 cents a pound. About a dozen were examined May 16, the largest of which weighed about 5 pounds. The next day one of 13 pounds was caught. This fish is highly prized and meets with a ready sale.

At Louisville I did not hear the names drum, sheepshead, or gaspergou, by which this interesting species is usually known. It is there generally called the white perch or yellow perch. Among the common names which Rafinesque heard applied to this fish along the Ohio he mentions white perch, white perch, buffalo perch, grunting perch, bubbling perch, bubbler, and mussel-eater. He further says that—

“It is one of the largest and best found in the Ohio, reaching sometimes to a length of 3 feet and a weight of 30 pounds, and affording a delicate food. It is also one of the most common, being found all over the Ohio and even in the Monongahela and Allegheny, as also in the Mississippi, Tennessee, Cumberland, Kentucky, Wabash, Miami, etc., and all the large tributary streams, where it is permanent, since it is found at all seasons except in winter. In Pittsburg it appears again in February. It feeds on many species of fishes—suckers, cat-fishes, sun-fishes, etc., but principally on the mussels, or various species of the bivalve genus *Unio*, so common in the Ohio, whose thick shells it is enabled to crush by means of its large throat teeth.

“The structure of those teeth is very singular and peculiar; they are placed like paving stones on the flat bone of the lower throat, in great numbers and of different sizes; the largest, which are as big as a man’s nails, are always in the center; they are inverted in faint alveoles, but not at all connected with the bone. Their shape is circular and flattened, the inside always hollow, with a round hole beneath. In the young fishes they are rather convex above and evidently radiated and mammillar, while in the old fishes they become smooth, truncate, and shining white.

“A remarkable peculiarity of this fish consists in the strange grunting noise which it produces, and from which I derived its specific name. It is intermediate between the dumb grunt of a hog and the single croaking noise of the bullfrog. The grunt is only repeated at intervals and not in quick succession. Every navigator of the Ohio is well acquainted with it, as they often come under the boats to enjoy their shade in summer, and frequently make their noise.

“Another peculiarity of this fish is the habit which it has of producing large bubbles in quick succession while digging through the mud or sand of the river in search of mussels or unios. \* \* \* This fish is either taken in the seine or with the hook and line; it bites easily, and affords fine sport to the fishermen. It spawns in the spring, and lays a great quantity of eggs.”

The otoliths or ear stones of this fish are unusually well developed, and are familiar to the boys along the Ohio as “lucky stones.”