d Curlew.
as seen in the possession of Mr. Fletcher
t summer. He told me it was taken by
, Dubois County, Ind., April 2, 1896. The
g measurements: Length, 21 in.; bill, 5;
in.

ron.

m Bicknell, Knox County, April 18, 1896.
t vicinity in summer, though he does not
ey were before they began to drain the

Hawk.

House at Indianapolis is a Duck Hawk
896. (Beasley).

e capture of the fourth specimen of the
ish Lake in the spring of 1896. This is
he interior of the United States. It was
ake Shooting and Fishing Club by Mr.
23d last, and is now in Mr. Earle's pos-
96, p. 255).

). Savanna Sparrow.

en of this sparrow, a female, which was
96. The specimen is now in the collec-

man's Sparrow.

ien of this species three miles north of
ce, and tried a part of the time to keep
and unsuspicious. Often would squat
s and remain there motionless for some
t quite frequently, and saw it very dis-
along the fence. This is its first record
for southeastern Indiana.

Some Interesting Bones. By M. B. Thomas.

[abstract.]

In October, 1896, there came to Crawfordsville a man by the name of Henry Patterson with a large wagon load of bones. These were extravagently described in handbills and attracted many visitors.

They were studied by the author and Prof. D. Bodine. Afterwards by Dr. E. E. Cope, with the aid of photographs. The bones were from some recent finback whale, but they made a profitable exhibition for their owner.

The Hydrographic Basins of Indiana and Their Molluscan Fauna. By R. Ellsworth Call.

For the purposes of this paper the State of Indiana is regarded as being divided into ten major hyrographic basins, as shown in the accompanying map. Of these the largest is the basin of the Wabash; the smallest the basin of the Patoka. Some of the waters of the State debouche into the Atlantic through the great lakes; others find their way to the gulf by way of the Illinois and Mississippi, still others reaching the same destination by way of the Ohio and Mississippi. Of these two major systems of drainage the latter is by far the most important.

Waters of the Atlantic Drainage.—In the northeastern part of the State is a considerable area of country, drained by the Maumee, itself a stream formed by the St. Mary's and St. Joseph rivers, and emptying into Lake Erie. Of the surface features of this small basin more will be said in the section devoted to the physiographic features of the various regions.

The second and third sub-drainage areas of northern Indiana contribute their waters to Lake Michigan; one, the largest, through the St. Joseph's River, the second of that name within the State; the other, the smaller, has no large streams and is directly drained into Lake Michigan. Between the two last named lies the upper portion of the Kankakee River, a considerable stream, which flows into the Illinois.

Waters of the Gulf Drainage.—More than nine-tenths of the State's area is directly contributary to the Ohio through the remaining six basins which we have found it convenient to establish. Nearly all of this vast territory is drained by the Wabash and its two principal tributaries, the east and west forks of the White River. Next in order of size come the Ohio, the Whitewater and the Patoka, the latter, however, tributary to the Wabash directly.

Surface features.—The northern region of Indiana is entirely within the region of ancient glaciation; its surface is characteristic of the drift areas. It is characterized by streams which are almost entirely in glacial debris, sand, gravel, boulders and clay variously contributing to the bottom features of the several streams; in the low-lying and imperfectly drained prairie regions are many lakes of varying areas, as the seasons are wet or dry, and of very great differences in their comparative sizes. These lakes are, for the most part, shallow, with more or less sandy, or gravelly, or bouldery, bottoms and shores. An abundant marshy vegetation surrounds them, and sluggishly flowing streams serve to drain most of them. The whole region being so heavily covered with glacial deposits there are few elevations and they are mostly portions of the several terminal moraines; the country rock rarely, if ever, appears in either natural or artificial sections. The beds of all the streams are full of glacial boulders and sands or gravels.

The Kankakee basin differs in no essential respects from those just described. It is worthy of note, however, that the course of this river, as indeed that of all within the drift area, has been largely determined by the moraines which cross the State in a series of irregular lines, most of which are north of the Wabash. The same general truth is apparent of the Maumee River, the course of which has certainly been determined by the glacial detritus over which it flows. But the general drainage level is so slight that there are sections, as those between Huntington and Fort Wayne, where, at seasons of the year when the streams are all at full flood, the waters indifferently flow to either the Atlantic or the Ohio drainage. This important fact will be again noted in the matter of distribution of the mollusks of the two regions.

The region drained by the Wabash and the White rivers is, in many respects, widely different from the region previously described. For many miles of its course the upper Wabash flows through canons cut into the country rock within its own life history; at Wabash and Peru the real nature of this corrasive work is well exhibited. But higher up the canon is deeper and the stream less wide; suddenly it rises high on the surface and flows along over glacial detritus, like the rivers farther to the north. That it flows, for some part of its course, in preglacial channels is true, but it is also true that it has abandoned those channels in other portions of its course. It results from this that its character changes at various points along its course; a fact of importance that should be borne in mind in discussing the distribution of the fresh-water mollusks found in its waters.

Both the basins of the White rivers present two features in common: they flow, at their beginning, over a surface covered with glacial matter and then suddenly pass beyond its limit of distribution and flow in channels through regions

the physiographic features of which were determined in preglacial times. In the upper portion of their courses, therefore, they present similar features to those of the upper Wabash, but in their lower valleys they are quite different though alike in most respects when compared with each other. The highest and roughest region of the State is drained by the White River and the small Wabash contributary basin, the Patoka. This region is the least well known conchologically.

The Whitewater basin is very like the upper Wabash and for the most part is entirely within the limit of glaciation, which reaches the Ohio in the vicinity of Lawrenceburg, in Dearborn County. The lower portion of the Whitewater is peculiarly sandy and does not seem to be suited to very great development of molluscan life.

The long and narrow basin of the Ohio is very rough and the country rock, chiefly limestone, everywhere appears in the bluffs and along the small tributary streams. In certain of the smaller streams of this basin Strepomatid shell life appears in great abundance, but the Unionid fauna is mainly confined to the Ohio itself and no species appear which are not to be found in that stream.

From these facts it is evident that a wide diversity of environmental conditions is exhibited in the several basins as herein outlined. These differences find corresponding variables in the waters of the streams; in some they are quite soft, while in others the waters are very hard. Most of the small lakes in the northern portion of the State present waters that are very hard; in them the waters are often so highly charged with calcium carbonate that it is deposited thickly on the portions of the shells that project above the bottoms in which they are partly buried. In many of the streams the same facts are to be observed; this is especially noticeable in the upper Wabash, the shells from which are all more or less heavily coated with this substance. Collections from lower down, notably from Terre Haute to the mouth, are almost entirely devoid of this accretion.

It is important to note the molluscan facies of the various drainage areas and by a comparison of their faunas seek to correlate, if possible, the facts of distribution with the physiographic and geologic features. The physiographic features have already been noted; to facilitate comparisons of this nature lists of the mollusks have been collated, in every case based upon specimens actually collected at one or more localities in the several basins. While these lists are incomplete in that they do not represent the full richness of the several faunas they have proven instructive and may be useful in the general biologic study now undertaken by the Academy. These lists now follow.

SUMMARY OF GEOGRAPHIC DISTRIBUTION.

SPECIES.	Ohio Basin.	Whitewater Basin.	Patoka Basin.	East White Basin.	West White Basin.	Wabash Basin.	Maumee Basin.	St. Joseph Basin.	Kankakee Basin.	Lake Michigan Basin.
UNIVALVES.										
Amnicola cincinnatiensis Anth.	x	.....	.....	.....	x	x	x	x	x	x
Amnicola limosa Say	x	x	x	x	x	x	x	x	x	x
Amnicola porata Say	x	x	x	x	x	x	x	x	x	x
Ancylus tardus Say	x	x	x	x	x	x	.....	x	.....	x
Bulinus hypnorum Linnæus	.....	.....	.....	.....	x	.....	.....	x	x	x
Helisoma bicarinata Say	.....	x	.....	.....	x	.....	x	x	x	x
Helisoma campanulata Say	.....	.....	.....	.....	.....	x	x	x	x	x
Helisoma trivolvis Say	x	x	x	x	x	x	x	x	x	x
Limnophysa caperata Mull	.....	.....	.....	.....	x	x	.....	.....	x	x
Limnophysa desidiosa Say	x	x	x	x	x	x	x	x	x	x
Limnophysa humilis Say	x	x	x	x	x	x	x	x	x	x
Limnophysa palustris Mull	x	x	x	x	x	x	x	x	x	x
Limnophysa reflexa Say	x	x	x	x	x	x	x	x	x	x
Menetus exacutus Say	.....	.....	.....	x	x	x	.....	.....	x	.....
Physa ancillaria	.....	.....	.....	.....	.....	x	.....	.....	.....	.....
Physa gyrina Say	x	x	x	x	x	x	x	x	x	x
Physa heterostropha Say	x	x	x	x	x	x	x	x	x	x
Valvata tricarinata Say	.....	.....	.....	.....	.....	.....	.....	x	.....	.....
Somatogyrus subglobosus Say	x	x	.....	.....	.....	x	.....	.....	.....	.....
Pomatiopsis lapidaria Say	x	.....	.....	.....	x	x	.....	.....	.....	x
Campeloma decisum Say	.....	.....	.....	.....	.....	x	x	x	.....	.....
Campeloma integrum DeKay	.....	.....	.....	.....	x	.....	x	x	.....	.....
Campeloma ponderosum Say	x	.....	.....	.....	.....	x	.....	.....	.....	.....
Campeloma rufum Hald	.....	.....	.....	x	x	x	x	x	.....	.....
Campeloma subsolidum Anth	.....	.....	.....	.....	x	x	.....	x	x	.....
Lioplax subcarinata Say	x	.....	.....	.....	.....	x	.....	x	x	.....
Viviparа contectoides Binney	.....	.....	.....	.....	.....	x	.....	x	.....	.....
Viviparа intertexta Say	.....	.....	.....	.....	.....	x	.....	x	.....	.....
Viviparа subpurpurea Say	.....	.....	.....	.....	.....	x	.....	.....	.....	.....
Anculosa praerosa Say	x	.....	.....	.....	.....	.....	.....	.....	.....	.....
Anculosa trilineata Say	x	.....	.....	.....	.....	.....	.....	.....	.....	.....
Anculosa carinata Brug	x	.....	.....	.....	.....	.....	.....	.....	.....	.....
Angitrema armigera Say	.....	.....	.....	.....	.....	x	.....	.....	.....	.....
Angitrema verrucosa Say	x	.....	.....	.....	.....	x	.....	.....	.....	.....
Goniobasis bicolorata Anth	x	.....	.....	.....	.....	.....	.....	.....	.....	.....
Goniobasis cubicoides Anth	.....	.....	.....	.....	.....	x	.....	.....	.....	.....
Goniobasis depygis Say	x	.....	.....	.....	.....	.....	.....	.....	.....	.....
Goniobasis infantula Lea	x	.....	.....	.....	.....	.....	.....	.....	.....	.....
Goniobasis informis Lea	x	.....	.....	.....	.....	.....	.....	.....	.....	.....
Goniobasis interlineata Anth	.....	x	.....	.....	.....	.....	.....	.....	.....	.....
Goniobasis intersita Hald	x	.....	.....	.....	.....	x	x	x	.....	x
Goniobasis livescens Menke	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Goniobasis louisvillensis Lea	x	.....	.....	.....	.....	.....	.....	.....	.....	.....
Goniobasis semicarinata Say	.....	x	.....	.....	.....	x	.....	.....	.....	.....
Goniobasis spartenburgensis Lea	.....	.....	.....	.....	.....	x	x	x	x	x
Goniobasis pulchella Anth	x	x	x	x	x	x	x	x	x	x
Lithasia obovata Say	x	.....	.....	.....	.....	x	.....	.....	.....	.....
Mereschia grovesnorii Lea	.....	.....	.....	.....	.....	x	.....	.....	.....	.....
Pleurocera canaliculatum Say	x	.....	.....	.....	x	x	.....	.....	.....	.....
Pleurocera elevatum Say	x	.....	.....	.....	.....	x	.....	.....	.....	.....
Pleurocera moniliferum Lea	x	.....	.....	.....	.....	x	.....	.....	.....	.....
Pleurocera simplex Lea	x	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pleurocera subulare Lea	x	.....	.....	.....	.....	x	x	x	.....	x
Pleurocera troostii Lea	.....	.....	.....	.....	.....	x	.....	.....	.....	.....
Pleurocera undulatum Say	x	.....	.....	.....	.....	x	.....	.....	.....	.....

SPECIES.	Ohio Basin.	Whitewater Basin.
BIVALVES.		
Pisidium abditum Hald	x	.....
Pisidium rotundatum Prime	.....	.....
Pisidium virginicum Bourg	x	.....
Sphærium fabale Prime	.....	.....
Sphærium rhomboideum Prime	.....	.....
Sphærium solidulum Prime	x	x
Sphærium sphæricum Anth	.....	.....
Sphærium stamineum Conrad	x	.....
Sphærium striatinum Lam	x	x
Sphærium sulcatum Lam	x	.....
Sphærium transversum Say	x	x
Anodonta decora Lea	x	x
Anodonta edentula Say	x	x
Anodonta ferruginea Lea	.....	.....
Anodonta ferussaciana Lea	x	x
Anodonta footiana Lea	.....	.....
Anodonta grandis Say	x	x
Anodonta imbecillis Say	x	x
Anodonta paonia Lea	.....	.....
Anodonta plana Lea	x	x
Anodonta salmonia Lea	x	.....
Anodonta shæfferiana Lea	.....	.....
Anodonta subcylindracea Lea	.....	.....
Anodonta wardiana Lea	x	.....
Anodonta suborbiculata Say	.....	.....
Anodonta undulata Say	.....	.....
Margaritana calceola Lea	x	x
Margaritana complanata Bar	x	x
Margaritana confragosa Say	.....	.....
Margaritana dehiscens Say	x	.....
Margaritana hildrethiana Lea	x	.....
Margaritana marginata Say	x	x
Margaritana monodonta Say	x	.....
Margaritana rugosa Barnes	x	x
Unio abruptus Say	x	.....
Unio esopus Green	x	.....
Unio alatus Say	x	.....
Unio anodontoides Lea	x	.....
Unio arctior Lea	x	.....
Unio asperrimus Lea	x	.....
Unio camptodon Say	x	x
Unio capax Green	x	.....
Unio cicatricosus Say	x	.....
Unio cincinnatiensis Lea	x	.....
Unio circulus Lea	x	.....
Unio clavus Lam	x	x
Unio coccineus Lea	x	.....
Unio cooperianus Lea	x	.....
Unio cornutus Barnes	x	.....
Unio crassidens Lam	x	.....
Unio cylindricus Say	x	.....
Unio distans Anth	.....	.....
Unio donaciformis Lea	x	.....
Unio dorfeuillianus Lea	x	.....
Unio ebenus Lea	x	.....
Unio elegans Lea	x	.....
Unio ellipsis Lea	x	x
Unio fabalis Lea	x	.....
Unio foliatus Hild	x	.....

IC DISTRIBUTION.

East White Basin.	West White Basin.	Wabash Basin.	Maumee Basin.	St. Joseph Basin.	Kankakee Basin.	Lake Michigan Basin.
x	x	x	x	x	x	x
x	x	x	x	x	x	x
x	x	x	x	x	x	x
	x	x		x		x
	x		x	x	x	x
			x	x		x
x	x	x	x	x	x	x
	x	x		x		x
x	x	x	x	x	x	x
x	x	x		x		x
x	x	x	x	x	x	x
x	x	x	x	x	x	x
		x				
x	x	x	x	x	x	x
x	x	x	x	x	x	x
				x		
	x	x				
				x		
	x	x	x	x		
		x		x	x	
		x		x	x	
		x		x		
		x				
		x				
		x				
		x				
		x	x	x		x
		x				
x	x	x	x	x	x	x
	x	x				
		x				
		x				
		x				
		x	x	x		x
		x				
		x				

SUMMARY OF GEOGRAPHIC DISTRIBUTION—Continued.

SPECIES.	Ohio Basin.	Whitewater Basin.	Patoka Basin.	East White Basin.	West White Basin.	Wabash Basin.	Maumee Basin.	St. Joseph Basin.	Kankakee Basin.	Lake Michigan Basin.
BIVALVES.										
Pisidium abditum Hald	x				x	x	x	x	x	
Pisidium rotundatum Prime								x		
Pisidium virginicum Bourg	x							x		
Sphærium fabale Prime						x				
Sphærium rhomboideum Prime								x		
Sphærium solidulum Prime	x	x	x	x	x	x	x	x	x	x
Sphærium sphæricum Anth						x				
Sphærium stamineum Conrad	x									
Sphærium striatinum Lam	x	x	x	x	x	x	x	x	x	x
Sphærium sulcatum Lam	x					x		x		
Sphærium transversum Say	x	x	x	x	x	x	x	x	x	?
Anodonta decora Lea	x	x						x		
Anodonta edentula Say	x	x	x	x	x	x	x	x	x	x
Anodonta ferruginea Lea					x					
Anodonta ferussaciana Lea	x	x	x	x	x	x	x	x	x	x
Anodonta footiana Lea						x		x		
Anodonta grandis Say	x	x	x	x	x	x	x	x	x	?
Anodonta imbecillis Say	x	x			x	x				
Anodonta pavonia Lea				x		x				
Anodonta plana Lea	x	x	x	x						
Anodonta salmonia Lea	x				x	x		x		
Anodonta shefferiana Lea					x					
Anodonta subcylindracea Lea						x	x	x	x	
Anodonta wardiana Lea	x			x	x					
Anodonta suborbiculata Say						x				
Anodonta undulata Say										
Margaritana calceola Lea	x	x	x	x	x	x	x	x	x	?
Margaritana complanata Bar	x	x			x	x				
Margaritana confragosa Say						x				
Margaritana dehiscens Say	x					x				
Margaritana hildrethiana Lea	x			x	x	x				
Margaritana marginata Say	x	x	x	x	x	x	x	x	x	?
Margaritana monodonta Say	x					x				
Margaritana rugosa Barnes	x	x	x	x	x	x	x	x	x	x
Unio abruptus Say	x					x				
Unio æsopus Green	x					x				
Unio alatus Say	x			x	x	x			x	
Unio anodontoides Lea	x					x				
Unio arctior Lea	x				x	x				
Unio asperrimus Lea	x									
Unio camptodon Say	x			x	x	x			x	
Unio capax Green	x	x?				x				
Unio cicatricosus Say	x					x				
Unio cincinnatiensis Lea	x									
Unio circulus Lea	x			x	x	x	x	x	x	
Unio clarus Lam	x	x	x	x	x	x	x	x	x	?
Unio coccineus Lea	x			x	x	x			x	
Unio cooperianus Lea	x					x				
Unio cornutus Barnes	x			x	x	x			x	
Unio crassidens Lam	x					x				
Unio cylindricus Say	x			x	x	x			x	
Unio distans Anth								x		
Unio donaciformis Lea	x			x	x	x				
Unio dorfeuillianus Lea	x									
Unio ebenus Lea	x									
Unio elegans Lea	x			x	x	x			x	
Unio ellipsis Lea	x	x	x	x	x	x	x	x	x	x
Unio fabalis Lea	x					x		x		
Unio foliatus Hild	x									

SUMMARY OF GEOGRAPHIC DISTRIBUTION—Continued.

Species.	Ohio Basin.	Whitewater Basin.	Patoka Basin.	East White Basin.	West White Basin.	Wabash Basin.	Maumee Basin.	St. Joseph Basin.	Kankakee Basin.	Lake Michigan Basin.
Unio fragosus Conrad	x				x	x				
Unio gibbosus Barnes	x	x	x	x	x	x	x	x	x	x
Unio glans Lea	x			x	x	x	x			
Unio gracilis Barnes	x					x				
Unio graniferus Lea	x					x				
Unio iris Lea	x	x	x	x	x	x	x	x	x	?
Unio irroratus Lea	x			x	x	x				
Unio lachrymosus Lea	x	x		x	x	x			x	
Unio laevissimus Lea	x					x				
Unio lens Lea	x					x				
Unio ligamentinus Lea	x	x	x	x	x	x	x	x	x	x
Unio luteolus Lam	x	x	x	x	x	x	x	x	x	x
Unio metanevrus Raf	x			x	x	x			x	
Unio multiradiatus Lea	x	x	x	x	x	x	x	x	x	x
Unio multiplicatus Lea	x	x		x	x	x	x			
Unio mytiloides Raf	x					x				
Unio nasutus Say								x		
Unio obliquus Lam	x									
Unio occidens Lea	x	x	x	x	x	x	x	x	x	x
Unio orbiculatus Hild	x					x				
Unio ovatus Say	x					x				
Unio parvus Barnes	x	x	x	x	x	x	x		x	
Unio perplexus Lea	x			x	x	x				
Unio personatus Say						x				
Unio phaseolus Barnes	x			x	x	x	x		x	
Unio plenus Lea	x					x				
Unio plicatus LeSueur	x	x	x	x	x	x			x	
Unio pressus Lea	x	x	x	x	x	x	x	x	x	x
Unio pustulatus Lea	x				x	x				
Unio pustulosus Lea	x				x	x	x			
Unio pyramidatus Lea	x					x				
Unio rangianus Lea	x					x				
Unio rectus Lam	x	x	x	x	x	x	x	x	x	x
Unio retusus Lam	x		x	x	x	x	x	x	x	x
Unio rubiginosus Lea	x	x	x	x	x	x	x	x	x	x
Unio sampsonii Lea						x				
Unio securis Lea	x				x	x				
Unio solidus Lea	x					x				
Unio spatulatus Lea	x			x	x	x			x	
Unio subovatus Lea	x				x	x			x	
Unio subrostratus Say	x				x	x	x			
Unio sulcatus Lea	x				x					
Unio tenuissimus Lea	x					x				
Unio triangularis Barnes	x			x	x	x				
Unio trigonus Lea	x					x				
Unio tuberculatus Barnes	x	x	x	x	x	x			x	
Unio undulatus Barnes	x	x	x	x	x	x			x	
Unio varicosus Lea	x									
Unio ventricosus Barnes							x	x	x	x
Unio verrucosus Barnes	x				x	x				
Unio zigzag Lea	x			x	x	x				
Totals	127	46	37	61	81	130	49	59	57	33

From this table it will be observed that the species of the following list are quite generally distributed throughout the State, representatives having been seen from nearly every basin. It will be noted at once that most of these forms are of

)ISTRIBUTION—Continued.

East White Basin.	West White Basin.	Wabash Basin.	Maumee Basin.	St. Joseph Basin.	Kankakee Basin.	Lake Michigan Basin.
.....	x	x	.....	.....	.....	.....
x	x	x	x	x	x	x
x	x	x	x	.....	.....	.....
.....	.....	x	.....	.....	.....	.....
.....	.....	x	.....	.....	.....	.....
x	x	x	x	x	x	?
x	x	x	.....	.....	.....	.....
x	x	x	.....	.....	x	.....
.....	.....	x	.....	.....	.....	.....
x	x	x	.....	.....	.....	.....
x	x	x	x	x	x	x
x	x	x	x	x	x	x
x	x	x	.....	.....	x	.....
x	x	x	x	x	x	x
x	x	x	x	.....	.....	.....
.....	.....	x	.....	.....	.....	.....
.....	.....	.....	.....	x	.....	.....
.....	.....	x	.....	.....	.....	.....
x	x	x	x	x	x	x
.....	.....	x	.....	.....	.....	.....
.....	.....	x	.....	.....	.....	.....
x	x	x	x	.....	x	.....
x	x	x	.....	.....	.....	.....
.....	.....	x	.....	.....	.....	.....
x	x	x	x	.....	x	.....
.....	.....	x	.....	.....	.....	.....
x	x	x	.....	.....	.....	.....
x	x	x	x	x	x	x
x	x	x	x	.....	.....	.....
x	x	x	x	x	x	x
.....	.....	x	.....	.....	.....	.....
.....	x	x	.....	.....	.....	.....
.....	.....	x	.....	.....	.....	.....
x	x	x	.....	.....	x	.....
.....	x	x	.....	.....	x	.....
.....	x	x	x	.....	.....	.....
.....	x	.....	.....	.....	.....	.....
.....	.....	x	.....	.....	.....	.....
x	x	x	.....	.....	.....	.....
.....	.....	x	.....	.....	.....	.....
x	x	x	.....	.....	x	.....
x	x	x	.....	.....	x	.....
.....	.....	.....	x	x	x	x
.....	x	x	.....	.....	.....	.....
x	x	x	.....	.....	.....	.....
61	81	130	49	59	57	33

t the species of the following list are
State, representatives having been seen
at once that most of these forms are of

wide geographic distribution over the northern United States, a fact which goes a long way, first, in establishing their high antiquity as species, and second, the fact that they have successfully adapted themselves to conditions which are widely variant. Many of them occur far to the southward, beyond the limits of glaciation, extending even to the middle portions of Alabama, some of them under other names than those which we are accustomed to apply to them here. Differences of a trivial character, the result of environment, appear to have been seized upon by the species makers and the older naturalists whose ambitions alike seemed to have been to write "*nobis*" after a specific name.

REGISTER OF GENERALLY DISTRIBUTED SPECIES.

Unio clavus.
**Unio iris.*
Unio luteolus.
Unio ligamentinus.
Unio multiradiatus.
Unio rubiginosus.
**Margaritana marginata.*
Anodonta ferussaciana.
**Anodonta grandis.*
Sphaerium striatinum.
Amnicola porata.
Limnophysa palustris.
Limnophysa desidiosa.
Physa heterostropha.
Goniobasis pulchella.
Unio ellipsis.
Unia pres-us.
Unio gibbosus.
Unio rectus.
Unio occidens.
Margaritana calceola.
Margaritana rugosa.
Anodonta edentula.
Sphaerium solidulum.
**Sphaerium transversum.*
Amnicola limosa.
Limnophysa reflexa.
Helisoma trivolvis.
Physa gyrina.

Summarizing this group of names, there are nine genera and twenty-nine species; of these four genera and twenty species are bivalves; the rest are univalves. There have been found up to this time, and thus certainly known to belong to the Indiana fauna, a total of one hundred and sixty-five species of fresh water shells. Nearly one-sixth, therefore, of our species are to be found all over the State; this proportion will certainly be increased on thorough exploration. Geographic series, which have been studied, of these widely distributed forms show some interesting facts in the line of variation, facts which are, most certainly, to be correlated with peculiarities of environment. This is especially true of those forms which are indifferently found in lakes, ponds or flowing streams, such as

*These forms have been found in all but one basin in Indiana, with every probability that each occurs therein and will be found on full exploration.

Margaritana rugosa and *Unio luteolus*. No two series, from the different areas, present exactly the same facies. So marked is this, in some cases, that the lake forms can always be separated from those which were obtained in streams. This general study is reserved for more abundant data and final discussion on another occasion.

A further study of the geographic tables will demonstrate that the richest shell faunas occur in the Wabash and the Ohio drainages, these two areas furnishing nearly the same species in common, though many of each are not generally distributed over the State. Of the shells which are both common and yet limited in distribution *Unio ebenus*, *Unio irroratus* and *Unio æsopus* among the bivalves, and *Campeloma ponderosum* and *Pleurocera canaliculatum* among the univalves will serve as types. The differences between the two basins may be noted from the following lists:

OHIO BASIN.	WABASH BASIN.
Unio camelus.	*Unio personatus.*
Unio varicosus.	UNIO SAMPSONII.
UNIO CINCINNATIENSIS.	*Anodonta suborbiculata.*
Unio foliatus.	*Margaritana confragosa.*
Unio dorfeuillianus.	*Sphaerium sphaericum.*
Sphaerium stamineum.	**Spharium fabale.*
Anculosa prærosa.	*Goniobasis spartenburghensis.*
Anculosa trilineata.	*Goniobasis livescens.*
Anculosa carinata.	*Goniobasis cubicoides.*
Goniobasis bicolorata.	*Angitrema armigera.*
Goniobasis depygis.	MESESCHIZA GROVESNORII.
GONIOBASIS INFANTULA.	*Pleurocera troostii.*
Goniobasis informis.	*Vivipara subpurpurea.*
Goniobasis intersita.	*Viripara contectoides.*
GONIOBASIS LOUISVILLENSIS.	*Viripara interlexta.*
Pleurocera simplex.	*Menetus exacutus.*
Amnicola cincinnatiensis.	*Campeloma decisum.*
	Campeloma rufum.
	Campeloma subsolidum.
	Limnophysa caperata.
	Planorbella campanulata.

*Not seen; admitted to the list on the authority of Temple Prime, vide "Catalogue of the Species of Corbiculadæ," p. 10, 1863.

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bles will demonstrate that the richest Ohio drainages, these two areas furnish- ough many of each are not generally which are both common and yet limited and *Unio æsopus* among the bivalves, *canaliculatum* among the univalves will e two basins may be noted from the fol-

WABASH BASIN.

Unio personatus.
UNIO SAMPSONII.
Anodonta suborbiculata.
Margaritana confragosa.
Sphaericum sphaericum.
**Sphærium fabale.*
Goniobasis spartenburghensis.
Goniobasis livescens.
Goniobasis cubicoides.
Angitrema armigera.
MESESCHIZA GROVESNORII.
Pleurocera troostii.
Vivipara subpurpurea.
Viripara contectoides.
Viripara intertexta.
Menetus exacutus.
Campeloma decisum.
Campeloma rufum.
Campeloma subsolidum.
Limnophysa caperata.
Planorbella campanulata.

ority of Temple Prime, vide "Catalogue of

Here are totals of eleven species found in the Ohio basin against fifteen which are found in the Wabash basin. The proportion would be substantially the same if the synonymous forms included, printed in small capitals, were excluded from the list. None of the members of the genus *Vivipara* appear in the Ohio basin, while but two *Uniones* are found in the Wabash basin that are not found in that of the Ohio. No limnæids appear to be characteristic of the Ohio basin, while three such are found in the Wabash. Yet it is to be constantly borne in mind that further collections may invalidate this comparison by the discovery of other common forms, or that some of these forms may yet be ascertained to be common to the two faunas.

Turning again to the northern portion of the State, the most interesting fact presented is the existence of a number of Ohio drainage forms in the Maumee River, a stream of the Atlantic drainage. Opportunity was afforded the past spring to make a small collection in the Maumee and the St. Mary's Rivers at Fort Wayne, well within the Maumee Basin. While the collection was by no means exhaustive, it developed some very interesting facts which possess more than a passing significance.

Among the Ohio River forms found were the following:

Unio rubiginosus,
Unio glans,
Unio luteolus,
Unio retusus,
Margaritana complanata,
Anodonta edentula,
Unio clavus,
Unio gibbosus,
Unio parvus,
Margaritana calceola,
Goniobasis pulchella,
Unio pressus.

These species are accredited to the Western fauna, and most of them are not hitherto recorded as belonging to the Atlantic fauna. Two of these were so recorded by the writer as long ago as 1877, in the Erie Canal, in the Mohawk drainage, at Mohawk, N. Y., and record made of the fact in the "American Naturalist," Vol. XII, pp. 472, 473. Other records have since appeared. *Unio luteolus* is often quoted in faunal lists used for exchange purposes by Eastern collectors, but in every case where specimens have been secured, thus far, they have proven to be the male forms of the totally distinct *Unio cariosus*, a form not yet found in Western waters. *Anodonta edentula* may be, and probably is, a geographic variety of the Eastern *Anodonta undulata*, but the Maumee forms are Western in facies. It is therefore proper to regard it here as a Western shell in the drainage of an Atlantic stream. So far as the specimens go which are in my possession, they do not present very marked differences from the same shells found a few miles to the west in waters tributary to the Wabash. The environmental factors are precisely

the same in both areas, and there should be no marked differences. There are none. But mingling with the Western fauna of the Upper Wabash were found large numbers of the Eastern strepomatid shell, *Goniobasis livescens*, a form which is abundant from New York throughout Northern Ohio and along the Great Lakes. Near Huntington, on the Wabash, this shell was the most abundant strepomatid found. The same facts were true of the St. Mary's and the Maumee, though the greatest numbers were found in the former stream, clinging to the rocks along the banks, in the heart of the city of Fort Wayne. Associated with them were large numbers of *Pleurocera subulare*, a form abundant in the East, but also of wide Western distribution, and an undetermined pleuroceroid mollusk of Western affinities. It closely resembles *Pleurocera lewisii*, but of this determination I am yet uncertain.

It is important to note, in this connection, that the headwaters of the Aboite River, or its east fork, approach to within three miles of the St. Mary's at Fort Wayne, and that the divide at that locality is hardly perceptible. Moreover, the Wabash & Erie Canal has long established water communication between the two basins—probably long enough to establish interchange of faunas, especially in the case of the univalves, which are far more migratory in their habits than the Unionidæ. This is the case in the Erie Canal in New York, by means of which the advent of the Western fauna into Eastern waters may be almost chronologically traced. To offset this possible explanation is the fact that the species seem to be well established, and occur, many of them, in great numbers in the Maumee Basin. But, whatever the explanation, the species appear in the two basins, and in them both there is a commingling of the two faunas, with but few Western representatives of the Eastern fauna. The Eastern representatives in the Western fauna greatly outnumber, both in species and individuals, the Eastern fauna in the Western Basin.

The suggestion of the relation of this distribution to glaciation and its physiographic results has before occurred to the writer, though in another connection. As long ago as 1886, in discussing certain anomalies in the distribution of Ohio River forms of *Unionidæ* in the State of Kansas, attention was directed to this problem in the following language: "Considerable data have accumulated in the hands of the writer which seem to imply the necessity of correlating this peculiar distribution with certain facts in glacial geology, but those data will not warrant the statement that such correlation exists. Attention is directed to this problem in the hope that other observers may use their opportunities and supply all the in-

formation possible."* A recent writer proposes** the same explanation for the distribution of the two faunas in this region and, from the facts we have herein adduced, the locality offers most excellent opportunities for a careful study of the problem. Yet, the fact of the artificial connection of these two areas must constantly be borne in mind. A second region where the heads of the drainage areas are practically coincident occurs in Kosciusko County, where the several small lakes and general low-lying region are all drained by streams which flow either into the Tippecanoe or the Turkey rivers, the first of which is tributary to the Wabash, the second to the St. Joseph's, of Michigan. A low moraine separates the two basins. This is the location of the Biological Station of the State University which will, presumably, interest itself in this question.

An investigation of the fauna of the Upper Wabash that would be complete might disclose others of the eastern species in its waters. Strong corroborative evidence might be secured through the ichthyic fauna of the two rivers, the Wabash and the Maumee, for, if the suggestions of this paper are tenable, some degree of correspondence should be disclosed by a study of the fishes. This correspondence, if it exists, will aid in understanding the method of distribution of the *Unionidæ* which is so largely effected through the medium of fishes.

Vide, Call, "Fifth Contribution to a Knowledge of the Fresh-Water Mollusca of Kansas," Bull. Washburn College Laboratory of Natural History, vol. i, No. 6, pp. 178, 179, 1886.

**Simpson, "On the Mississippi Valley Unionidæ Found in the St. Lawrence and Atlantic Drainage Areas," American Naturalist, vol xxx, pp. 379-384, 1896.