A CENTURY OF ACADEMY OF SCIENCE PUBLICATIONS WITH RELEVANCE TO SOUTH DAKOTA'S WILD VERTEBRATE FAUNA AND FOSSILS

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ABSTRACT

We examined the titles, abstracts, and texts of all past volumes of the Proceedings of the South Dakota Academy of Science to determine how many articles contained information on wild vertebrate fauna species or on fossil evidence of prehistoric vertebrate fauna that have resided within the state at one time period or another. Frequency data are presented on the occurrence of species or fossil evidence of South Dakota's vertebrate fauna reported in various articles published in the Proceedings of the South Dakota Academy of Science. However, quantification to the species or genus levels of taxonomy for some wild fauna groups and prehistoric fauna fossils was limited or absent, in part, due to sample sizes or limited expertise in specimen collection, preservation, and identification methodologies. Despite these limitations, several thousand wild fauna and fossil specimens that contain taxonomic labeling plus some collection location and habitat information currently exist in various repositories within South Dakota or elsewhere and are available for further research or study.

Keywords

Paleontology, vertebrate fauna, fossil vertebrates, South Dakota

THE PALEONTOLOGICAL TAXA RECORDED FROM SOUTH DAKOTA

Although all fossil organisms antedated the establishment of political boundaries, it is useful to estimate the number of fossil taxa from South Dakota, if only to reveal the vast importance of paleontology to its citizens. Beyond being im-

portant as both an earth science and a life science, paleontology has traditionally inspired young people to pursue careers in science generally. A fine example was Glenn Lowell Jepsen, born in Lead and a youthful resident of Rapid City, who ultimately became a distinguished professor at Princeton University, but began his scientific interest by collecting White River fossils.

There are fundamental principles that governed the fossil record as we see it, and these are much different from performing a census of the living fauna. For practical purposes, the only animals represented in the fossil record will be those with durable body parts, such as calcareous shells, chitinous exoskeletons, and bones. Major phyla that lack durable anatomy are virtually unknown as fossils. Taphonomy, the science that views the passage of organisms from the biological record to the geological record, works against soft-bodied organisms. In terms of prehistory, the stratigraphic systems with a fossil record begin with the Cambrian Period, which is the earliest age for organisms with calcareous shells, approximately 600,000,000 years ago. This period and all subsequent periods are represented in the geology and fossil records of South Dakota, emphasizing the towering importance of the state to the science of paleontology.

Another factor in the fossil record is the importance of facies, the aspects of the geologic record that reflect depositional environments. Intuitively one expects fossils to be confined to sedimentary rocks, but these vary according to their depositional formation, limiting our view of past life. For example, one of the most interesting fossil species to be described from South Dakota was the early fossil snake (*Coprophis dakotaensis*), which as the name implies, was found in fossil dung of Oligocene age. It probably lived (and was consumed by a predator) in an environment seldom represented in the fossil record, for only one specimen has ever been found (Parris and Holman 1978).

Although we have not checked the printed record exhaustively, it may be assumed that the vast majority of fossil species recorded from South Dakota have been cited in the Proceedings of the South Dakota Academy of Science. Those that have not are at least collectively recognized herein. Some groups have been subjected to a thorough census during recent years, but others have never been counted. In our prior work on the fossil fishes of South Dakota (Parris et al. 2005, 2007), we found about one hundred species to have been published, although not all were individually named in those papers. Similarly, in our review of the fossil waterfowl (Parris and Higgins 2010, 2014), we found about five species to be present in the regional prehistoric record, and the totality of South Dakota fossil birds would amount to about twenty species. Both of these groups, fishes and birds, would have major taphonomic factors affecting their preservation as fossils, as both birds and fishes have rather fragile skeletons which are easily destroyed with little chance of preservation.

That said, we begin our estimate of numbers of fossil taxa by reviewing the published record of the Cambrian Period, represented in South Dakota within the classic Deadwood Formation. It is the earliest of the periods of the Paleozoic, the Era of "Early Life". The paleontology of the Deadwood Formation is particularly well studied, and is primarily an assemblage of trilobites and some other calcareous fossils (Lochman 1964). This so-called "shelly" fauna is one facies, but early Paleozoic rocks may also have another facies, which is typically found

in dark-colored shales and consists primarily of floating colonial animals called graptolites. In the Deadwood Formation, both kinds of animals have been found more or less together, thus giving a fairly good coverage of the population of that early time, about thirty distinct species. If this is presumed to represent Paleozoic fossils of an epoch, a likely scenario, then we can multiply the number of well-described epochs by thirty and get an estimate of the number of described taxa, especially for South Dakota, where paleontology has been thoroughly described. There are about ten Paleozoic formations, depending on what stratigraphic classification is used, yielding an estimate of perhaps 350 taxa that have likely been described, represented primarily by fossil invertebrates:brachiopods, mollusks, and arthropods. The Paleozoic fossil vertebrates of South Dakota are represented primarily by fishes (Parris et al. 2007).

The Mesozoic, the Era of "Middle Life", also has a very substantial fossil record that occurs in the Triassic, Jurassic, and Cretaceous Periods. The Cretaceous is especially well represented in South Dakota, and is the Period in which the dark-colored shales, with their distinctive gumbo derivatives, were deposited. The most widespread is appropriately named the Pierre Shale Group (after Fort Pierre, actually), and is colloquially referred to as the South Dakota State Rock. The seven formations that make up the Pierre Shale Group have been studied extensively since the time of Lewis and Clark, and the South Dakota School of Mines and Technology has collected fossils in them continuously during the past forty years. As with almost all of the Paleozoic record, the Mesozoic record is primarily composed of marine environments that most residents do not intuitively associate with South Dakota. South Dakota presently has northern plains terrestrial environments that are inhospitable to most terrestrial lizards; only a few are known in the state (Kiesow 2006). But during the Late Cretaceous Period, the vertebrate fossil record of lizards is dominated by huge marine genera called mosasaurs, and South Dakota is one of the places most noted for producing spectacular fossil specimens of them (Russell 1967). More than a dozen species are known, most of which have been cited one or more times in publications of the South Dakota Academy of Science.

The Pierre Shale also has a substantial record of fossil invertebrates, including the ammonites, abundant cephalopods that are very useful in biostratigraphy, along with clams and snails. A particularly well-studied unit within the Pierre Shale Group is the De Grey Formation, which has accounted for about 35 mollusk species, as noted by Fox (2007). Since there are eight formations in the Pierre Shale Group, it may be estimated that more than 250 taxa are represented in the Pierre Group among Cretaceous formations. As there are more marine Cretaceous formations other than the Pierre Group, about twenty in all, plus a very fossiliferous non-marine formation, the dinosaur-bearing Hell Creek Formation, it is quite reasonable to estimate that at least 500 Cretaceous species have been reported from South Dakota. As with each formation of the Pierre Shale Group, the underlying Niobrara Chalk Formation has an accurate census of 31 species (Martin et al. 1998).

The South Dakota Academy of Science has been actively involved with Mesozoic individual species records as well. The Sundance Formation from the Jurassic age has a significant fossil fauna of invertebrates and vertebrates, including the

first ichthyosaur record, which was reported in the Proceedings of the South Dakota Academy of Science a few years ago (Parris and Grandstaff 2000).

The Cenozoic Period, "the Era of Modern Life", is noted for its record of mammalian fossils, of which many accounts were published in a White River formation monograph many years ago (Scott et al. 1941). At that time, about 230 vertebrate species were recognized, and many others have been added since then. Even if the aspect of taxonomic splitting had been greater at that time, it is still reasonable to consider that new additions to the described fauna would maintain the number of species at well over 200, divided among three middle Cenozoic time units as in the case of the aforementioned *Coprophis*. Other vertebrate classes and invertebrates are also present in the White River Group. Since thirteen other Cenozoic formations are represented in South Dakota, all with fossil records, an estimate of 500 Cenozoic species is quite reasonable.

The Pleistocene Period of South Dakota, the so-called Ice Age, was exhaustively studied not long ago (Pinsof 1986). In that review, one hundred species of vertebrates were reported, including sixteen fishes, four amphibians, ten reptiles, three birds, and sixty-seven mammals. A few additional species of invertebrates would add to this record, which again makes it reasonable to assume that the overall number of vertebrate and invertebrate fossil species recorded from all of the geologic formations in South Dakota exceeds one thousand.

PALEONTOLOGY IN SOUTH DAKOTA ACADEMY OF SCIENCE PROCEEDINGS

As the state of South Dakota has world-renowned fossil resources, it would seem to be inevitable that museum collections of fossils would be maintained here, and also that the South Dakota Academy of Science would publish many paleontological reports. That is indeed the case; in fact, the earliest report in the Proceedings seems to have been a description of two significant fossil mammals from Slim Buttes by Kingsley (1919), which accurately predicted the importance of those Harding County sites. Various geological reports by Rothrock and others dealt with the overall geological record of the state, also forming the basis of paleontological research.

The Museum of Geology at the South Dakota School of Mines and Technology had major interests in paleontology, notably in the White River Badlands. After the Second World War, with the arrival there of James Reid MacDonald and Morton Green, published reports from the Museum increased, including submissions to the South Dakota Academy of Science. They were not the only ones, however. The report of Bolin (1952) on the microinvertebrates of the Niobrara Chalk Formation was especially significant, as it noted more than 60 species that are of great biostratigraphic value, although lacking the high profile of dinosaurs. The report of Johnson (1966) performed a similar feat for microvertebrates, adding new phyla to the White River fossil faunas that had escaped earlier detection because of their small size.

When James E. Martin joined the faculty at the Museum of Geology, he continued to present paleontological papers at the South Dakota Academy of Science and was an active member of the Academy, once serving as President.

While he and his students and other associates have continued to publish in the Proceedings to the present-day, the summary symposium about their collective researches in the Pierre Shale Group was a particularly memorable feature of the 2004 annual meeting of the Academy.

Based on the results from a rapid assessment of all the titles, abstracts, and texts that were published in the Proceedings from 1915 through 2014, we located a minimum of 42 full papers and 38 units of titles plus abstracts for a total of 79 publications relating to fossil vertebrate fauna (Table 1). The first mention of a vertebrate fossil was of a fossil fish (Lexiousaurs) on page 18 of an article about the "Natural History in the Missouri Valley" by Will Powers in the 1924 Proceedings (Vol. 9). The first full paleontological paper published in the Proceedings was authored by E.J. Bolin [1952 (Vol. 31): 190-193] and dealt with micro fossils. The first full paper with relevance to vertebrate fauna fossils was authored by J. R. MacDonald and Morton Green in the 1954 (Vol. 33: 47-49) Proceedings and was titled "The Pliocene Vertebrate Fauna of South Dakota". Thus, the first full paper concerning vertebrate fauna fossils in the Proceedings occurred 40 years after the Academy was founded in 1915.

Full papers on vertebrate fossils became more frequent beginning with the 1960s (Table 1) and have been relatively constant per decade during the 1980-2014 period. Publications of titles plus abstracts have been most frequent during the 1992-2014 period (Table 1).

A rough estimate of the numbers of fossil taxa (Invertebrates 110, Fishes 70, Amphibia 10, Reptilia 60, Birds 10, Mammals 120) that were cited and/or enumerated in Academy presentations and publications from 1915-2014 reflects the strength and weaknesses of the fossil record as a whole, as well as the principal emphases of South Dakota paleontology.

Table 1: Decadal frequency of published papers and abstracts concerning vertebrate fauna fossils in the Proceedings during 1915-2014.

	Group: Vertebrate Fossils				
Decade	**Full Papers**	**+**	**Abstracts Only**	**=**	**Total**
1915-1925	1		0		1
1926-1936	0		0		0
1937-1947	0		0		0
1948-1958	1		0		1
1959-1969	5		0		5
1970-1980	2		0		2
1981-1991	13		0		13
1992-2002	10		7		17
2003-2014	9		31		40
Totals:	**41**	**+**	**38**	**=**	**79**

SOUTH DAKOTA ACADEMY OF SCIENCE PROCEEDINGS 1915-2014 ARTICLES RELATIVE TO NON-FOSSIL WILD VERTEBRATE FAUNA

Based on the results from the same rapid assessment of the Proceedings published during 1915-2014, we identified a minimum of 306 full papers and 159 units of titles plus abstracts for a total of 465 publication accounts relating to eight non-fossil wild vertebrate fauna groups that occurred in South Dakota dating from the late 1700s A.D. through 2014 (Table 2).

Of the 465 published accounts involving the 8 groupings of vertebrates, 153 were of birds (Table 3), 139 of fishes (Table 4), 109 of mammals (Table 5), 13 of turtles (Table 6), 32 of amphibians (Table 7), 13 of snakes (Table 8), 5 of lizards (Table 9), and 1 of skinks (Table 10).

Of the 8 vertebrate groups, there were no publications (full papers or abstract article) for any of the fauna groups in 14 years of Proceedings, including 1915, 1921, 1923, 1925, 1926, 1939, 1948, 1949, 1952, 1953, 1960, 1985, 1986, and 1988. In 1976 there were no full papers and only one abstract article relative to native vertebrate fauna.

Several factors were likely responsible for the paucity of papers about wild fauna groups in South Dakota. For example, during the first decade of the Academy, farm crop damage by insects was the focus of several papers. Then, during the drought of the 1930s, funding for field studies and/or agency/university staffs was likely reduced with low levels of funding continuing at the onset of and throughout the duration of WWII and the Korean conflict.

During the early 1960s, several major changes occurred with university departments, including additional staffing and a significant increase in graduate studies involving South Dakota's natural resources. For example, at SDSU, the Wildlife and Fisheries staff separated from the Biology/Zoology Department to establish a Wildlife and Fisheries Department, and this new department was augmented with the establishment of two USDI Cooperative Research Units; one Wildlife unit and one Fisheries unit. Similar changes in staffing and departmental courses were also occurring at other institutions of higher learning in South Dakota.

The 1960s also brought on several environmental programs that affected wildlife, landscapes and citizens at mega scales, including but not limited to the Clean Air and Clean Water Acts, the Endangered Species Act, the USDA's Soil Bank Program, and the US Fish & Wildlife's Small Wetlands Program, which had its beginnings in South Dakota.

The paucity of papers in the 1980s was likely related to staff retirements and the hiring of new faculty at various universities and colleges. With new faculty and the recruitment of new graduate students, there is usually a delay of two to three years before research is completed and papers are produced for publication.

Also, beginning with the 1980s, there was a stronger emphasis for faculty and agency researchers to publish more articles per year and to publish in journal outlets of higher ranking and higher impact merits (e.g. the frequency of times the article is cited in other articles) in order to achieve set thresholds in promotion standards. The 1980s was also the decade in which personal computers and statistical programs enabled individuals to manage larger and more complicated

data sets in less time, resulting in faster outputs of articles for publication. This facilitated greater ease of conducting seminars and training workshops, and promoted greater capacity for instant communication and transfer of concepts, data and publications among other researchers via emails etc., all of which have resulted in more publications (full papers and abstract articles) in the Proceedings during the 1990s and the first 15 years of the new millennium.

Considering all of the above, it is apparent that during the past century the South Dakota Academy of Science and its Proceedings have provided many substantial publications that have enhanced our understanding of the State's native vertebrate fauna and fossils. It is also apparent from our review of the Proceedings that scientific studies and education efforts within our state could be greatly enhanced during the next century according to the following three themes of approach.

While researching articles in the Proceedings of the past century (1915-2014), we noticed three readily apparent themes: (1) a lot of scientific research and general observations and collections have been published and/or archived with regard to South Dakota's prehistoric and post-prehistoric flora and fauna. However, the bulk of the publications and a significant portion of the collection items (e.g. fossil flora and fauna; reference and/or teaching collections of plants and animals) are scattered throughout North America and in some foreign countries; (2) even though several private, non-profit, and public agencies, institutions, and associations periodically provide status reports and/or inventory results relative to various flora and fauna within the State, it is very apparent that large gaps still exist in collections and data bases, both temporally and spatially; and (3) apparently, there is no overall master plan available nor is there a dedicated source of annual funding with relevance to a master plan that would support future inventories and demographic status ratings of the State's flora and fauna (prehistoric and currently). Nor is there a single comprehensive compilation of former reference materials and/or reference guides to the locations of SD flora and fauna specimens that occur in various repositories, personal and teaching collections such as museums and universities in South Dakota and elsewhere. For example, in a March 27, 2015 communication, Dr. Robert Timm of the University of Kansas in Lawrence reported that their records indicate that 2,103 vertebrate specimens from South Dakota were archived in their collections, including 780 birds, 669 mammals, 582 herps (reptiles and amphibians), and 72 fish.

Some recent examples lend support that an overall statewide inventory of natural resources, their distributions and the former inventory efforts and publications concerning current populations of native flora and fauna is possible. For example, in a recent effort, Lewis (2014) located over 600 publications about South Dakota's waterfowl (ducks, geese, and swans) that had been published since the late 1800s. Hoagstrom et al. (2006), during river surveys, found that 35 species of fish had declined from one or more river drainages, 8 former fish species had become extinct from the State, and 10 other fish species are currently listed as state or federal threatened or endangered in status. Agency records also show that 9 species and 2 subspecies of birds and 7 species and 1 subspecies of mammals and 12 species of fish species were extirpated from the state at one time or another (Table 11).

In addition to the thousands of scientific publications, numerous examples of field guides exist relative to South Dakota's wild fauna, including but not limited to the State's fishes (Neumann and Willis 1994), mammals (Higgins et al. 2000), amphibians (Fischer et al. 1999), turtles (Bandas and Higgins 2004), amphibians and reptiles (Kiesow 2006), plus many more. Occasionally, some comprehensive, specific area surveys, such as the first "Bio-Blitz" (Higgins et al. 2005) that was conducted at Oakwood Sate Park in Brookings County in 2003, are jointly performed as public learning exercises and flora and fauna inventories. In summary, we believe that unified inventories of the State's natural resources, past, present and future and their distribution and status have merit and are possible pending the development and coordination of a plan, a leadership commitment, and some support funding.

Table 2: The number of published articles per decade in the past century (1915-2014) of the Proceedings that had relevance to wild vertebrate fauna of the post fossil era.

Group: Vertebrate Fauna Groups: Post Fossil Era					
Decade	**Full Papers**	**+**	**Abstracts Only**	**=**	**Total**
Birds	103		50		153
Fish	95		43		138
Lamprey Eel*	1		0		1
Mammals	66		43		109
Turtles	7		6		13
Amphibians	23		9		32
Snakes	9		4		13
Lizards	5		1		5
Skinks	1		1		1
Totals:	**306**	**+**	**159**	**=**	**465**

An eel-like primitive fish that may or may not be classified as a true fish.

Table 3: The number of published articles per decade in the past century (1915-2014) of the Proceedings that had relevance to birds.

Group: Birds					
Decade	**Full Papers**	**+**	**Abstracts Only**	**=**	**Total**
1915-1925	4		0		4
1926-1936	9		0		9
1937-1947	5		1		6
1948-1958	10		0		10
1959-1969	10		1		11
1970-1980	19		5		24
1981-1991	3		2		5
1992-2002	25		20		45
2003-2014	18		21		39
Totals:	**103**	**+**	**50**	**=**	**153**

Table 4: The number of published articles per decade in the past century (1915-2014) of the Proceedings that had relevance to fish.

Group: Fish					
Decade	**Full Papers**	**+**	**Abstracts Only**	**=**	**Total**
1915-1925	3		0		33
1926-1936	5		0		5
1937-1947	6 (1) *		0		6
1948-1958	1		0		2
1959-1969	10		1		11
1970-1980	10		3		13
1981-1991	4		3		7
1992-2002	34		18		52
2003-2014	23		18		41
Totals:	**95**	**+**	**43**	**=**	**139**

**** One paper in this decade also mentioned a lamprey which is an eel-like fish.***

Table 5: The number of published articles per decade in the past century (1915-2014) of the Proceedings that had relevance to mammals.

Group: Mammals					
Decade	**Full Papers**	**+**	**Abstracts Only**	**=**	**Total**
1915-1925	3		0		3
1926-1936	4		0		4
1937-1947	4		0		4
1948-1958	1		0		1
1959-1969	9		2		11
1970-1980	9		6		15
1981-1991	6		4		10
1992-2002	13		11		24
2003-2014	17		20		37
Totals:	**66**	**+**	**43**	**=**	**109**

Table 6: The number of published articles per decade in the past century (1915-2014) of the Proceedings that had relevance to turtles.

Group: Turtles					
Decade	**Full Papers**	**+**	**Abstracts Only**	**=**	**Total**
1915-1925	1		0		1
1926-1936	0		0		0
1937-1947	2		0		2
1948-1958	0		0		0
1959-1969	3		0		3
1970-1980	0		0		0
1981-1991	0		0		0
1992-2002	1		2		3
2003-2014	0		4		4
Totals:	**7**	**+**	**6**	**=**	**13**

Table 7: The number of published articles per decade in the past century (1915-2014) of the Proceedings that had relevance to amphibians.

Group: Amphibians					
Decade	**Full Papers**	**+**	**Abstracts Only**	**=**	**Total**
1915-1925	2		0		2
1926-1936	0		0		0
1937-1947	3		0		3
1948-1958	1		0		1
1959-1969	10		0		10
1970-1980	2		2		4
1981-1991	1		1		2
1992-2002	4		4		8
2003-2014	0		2		2
Totals:	23	+	9	=	32

Table 8: The number of published articles per decade in the past century (1915-2014) of the Proceedings that had relevance to snakes.

Group: Snakes					
Decade	**Full Papers**	**+**	**Abstracts Only**	**=**	**Total**
1915-1925	0		0		0
1926-1936	0		0		0
1937-1947	2		0		2
1948-1958	0		0		0
1959-1969	3		0		3
1970-1980	0		0		0
1981-1991	1		0		1
1992-2002	2		0		2
2003-2014	1		4		5
Totals:	9	+	4	=	13

Table 9: The number of published articles per decade in the past century (1915-2014) of the Proceedings that had relevance to lizards.

Group: Lizards					
Decade	**Full Papers**	**+**	**Abstracts Only**	**=**	**Total**
1915-1925	0		0		0
1926-1936	0		0		0
1937-1947	0		0		0
1948-1958	0		0		0
1959-1969	1		0		1
1970-1980	0		0		0
1981-1991	0		0		0
1992-2002	0		1		1
2003-2014	0		3		3
Totals:	**1**	**+**	**4**	**=**	**5**

Table 10: The number of published articles per decade in the past century (1915-2014) of the Proceedings that had relevance to skinks.

Group: Skinks					
Decade	**Full Papers**	**+**	**Abstracts Only**	**=**	**Total**
1915-1925	0		0		0
1926-1936	0		0		0
1937-1947	0		0		0
1948-1958	0		0		0
1959-1969	1		0		1
1970-1980	0		0		0
1981-1991	0		0		0
1992-2002	0		0		0
2003-2014	0		0		0
Totals:	**1**	**+**	**0**	**=**	**1**

Table 11: Wild fauna extirpated from South Dakota complied in April 2014 with the assistance of John Carreiro, Gene Galinat, Casey Heimerl, John Kanta, Silka Kempema, Andy Lindbloom, and Chelsey Pasbrig at South Dakota Game, Fish and Parks; Scott Larson at U.S. Fish and Wildlife Service; Jacob Kerby at the University of South Dakota; Katie Bertrand at South Dakota State University; and Nancy Drilling at the Rocky Mountain Bird Observatory.

Number of species or subspecies extirpated before 1915	**Number of species or subspecies extirpated after 1915**
Birds: 10	Birds: 1
Bald Eagle (*Haliaeetus leucocephalus*)	Peregrine Falcon (*Falco peregrinus*)
Osprey (*Pandion haliaetus*)	
Carolina Parakeet (*Conuropsis carolinensis*)	
Passenger Pigeon (*Ectopistes migratorius*)	
Sandhill Crane (*Grus canadensis*)	
Blue Grouse (*Dendragapus obscurus*)	
Common Raven (*Corvus corax*)	
"Giant" Canada Goose (*Branta canadensis maxima*)	
Eastern Wild Turkey (*Meleagris gallopavo silvestris*)	
Trumpeter Swan (*Cygnus buccinators*)	
Mammals: 6	Mammals: 2
Grizzly Bear (*Ursus arctos*)	Gray wolf (*Canis lupus*)
Black Bear (*Ursus americanus*)	Black-footed Ferret (*Mustela nigripes*)
Elk (*Cervus canadensis*)	
Audubon's bighorn sheep (*Ovis canadensis auduboni*)	
River otter (*Lontra canadensis*)	
American marten (*Martes americana*)	
Fishes: 0	Fishes: 12
	Silver Lamprey (*Ichthyomyzon unicuspis*)*
	Mooneye (*Hiodon tergisus*)
	Silverband Shiner (*Notropis shumardi*)
	Northern Hogsucker (*Hypentelium nigricans*)
	Black Buffalo (*Ictiobus niger*)
	Slenderhead Darter (*Percina phoxocephala*)
	Bowfin (*Amia calva*)
	Blackchin Shiner (*Notropis heterodon*)
	American Eel (*Anguilla rostrata*)
	Banded Darter (*Etheostoma zonale*)
	Mimic Shiner (*Notropis volucellis*)
	Mottled Sculpin (*Cottus bairdii*)
Total: 16	**Total: 15**

**** An eel-like fish.***

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