

## Identification Keys for the Eggs of South Dakota Amphibians

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### Abstract

Fifteen species of amphibians (two salamanders and 13 frogs) have been recorded in South Dakota. The physical characteristics of their eggs/egg masses, mating phenology, geographic distribution of the species, and habitats occupied facilitate the identification of the eggs of these species. Dichotomous and tabular keys using combinations of these traits are presented as an aid to field identification. Since the species assemblage largely overlaps that of species occurring in neighboring North Dakota, the keys may be of use in that state as well.

### Introduction

Due to its geographic location and predominate climate/weather patterns, South Dakota has a relatively low herpetofauna diversity with only 15 species of amphibians occurring in the state (Table 1) (Over, 1923; Fishbeck and Underhill, 1959; Del Fosse, 1973; Ballinger et al., 2000, Naugle et al., 2005). Recent field guides (Fischer et al., 1999; Kiesow, 2006) facilitate identification of the adult life stages of these species through the inclusion of descriptions, keys and photographs, but biologists have yet to produce state-specific resources for other amphibian life stages. To help remedy this situation, I developed dichotomous and tabular keys to enable field identification of the eggs of species occurring in South Dakota. Since the species assemblage in this state largely overlaps that of species occurring in neighboring North Dakota (Wheeler and Wheeler, 1966; Hoberg and Gause, 1992; Johnson and Batie, 2001; Johnson, 2015), the keys may facilitate identification of egg masses encountered in that state as well.

### Characteristics of Amphibian Eggs and Egg Masses

Amphibian eggs have a moderate sized yolk ('mesolecithal': Goin and Goin, 1971) with the ovum enclosed in a thin, tough, semipermeable vitelline membrane, which is produced by the ovary (Townes, 1953). Glands in the walls of the oviduct secrete a gelatinous substance around the eggs as they pass down to the cloaca, forming a series of concentric capsules (Lofts, 1974). The sizes of the ova and the surrounding gelatinous capsules are highly variable. The number of capsules varies interspecifically, ranging from one to eight (Salthe, 1963; Duellman and Trueb, 1986). The eggs of South Dakota amphibians, however, have no more than three capsules. Upon deposition the capsules swell, the outermost forming the protective jelly characteristic of amphibian eggs.

The manner of egg deposition varies among species. Many eggs are enclosed in a single jelly mass, which represents the entire ovarian complement in some species (e.g., *Rana pipiens*). In other species, the eggs are deposited singly (e.g., *Acris crepitans*) or in several smaller packets representing only portions of the ovarian complement (e.g., *Hyla versicolor*). Egg masses are commonly attached to submerged sticks or vegetation, thus maintaining their position in the water column (Porter, 1972; Duellman and Trueb, 1986). A few species attach their eggs to the undersurface of rocks or logs (e.g., *Necturus maculosus*). Egg masses in the form of a film at the surface of the water are characteristic of frogs that deposit them in still, shallow water (e.g., *R. catesbeiana*) and are adaptive with respect to meeting the oxygen needs of the developing embryos (Moore, 1940; Porter, 1972). In *Anaxyrus*, the jelly is in the shape of paired, long strings.

The number of eggs laid also varies interspecifically. In general, larger species have more eggs than smaller ones, and salamanders lay fewer eggs than anurans do (Goin and Goin, 1971; Duellman and Trueb, 1986). For example, the relatively small *Hyla versicolor* generally produce < 40 eggs, while large *R. catesbeiana* can produce as many as 20000.

### Identification Keys

The following key presents paired choices that direct the user to the proper identification, which is facilitated by the physical characteristics of the eggs/egg masses, mating phenology, geo-

Table 1. Amphibians reported from South Dakota.

<b>Mudpuppies (Proteidae)</b> Mudpuppy ( <i>Necturus maculosus</i> )
<b>Mole Salamanders (Ambystomatidae)</b> Tiger Salamander ( <i>Ambystoma tigrinum</i> )
<b>True Toads (Bufonidae)</b> Great Plains toad ( <i>Anaxyrus cognatus</i> ) American toad ( <i>Anaxyrus americanus</i> ) Canadian toad ( <i>Anaxyrus hemiophrys</i> ) Woodhouse's toad ( <i>Anaxyrus woodhousii</i> )
<b>Treefrogs (Hylidae)</b> Eastern gray treefrog ( <i>Hyla versicolor</i> ) Cope's gray treefrog ( <i>Hyla chrysoscelis</i> ) Chorus frog ( <i>Pseudacris maculata</i> ) Cricket frog ( <i>Acris crepitans</i> )
<b>Spadefoots (Scaphiopodidae)</b> Plains spadefoot ( <i>Spea bombifrons</i> )
<b>True Frogs (Ranidae)</b> Northern leopard frog ( <i>Rana pipiens</i> ) Wood frog ( <i>Rana sylvatica</i> ) Bullfrog ( <i>Rana catesbeiana</i> ) Plains leopard frog ( <i>Rana blairi</i> )

graphic distribution of the species, and habitats typically occupied. Tabular keys (Tables 2–5) present similar choices graphically to further facilitate identification. Features of the eggs of *Spea bombifrons* are included in the key, but are omitted from the tables. The eggs of this species develop quickly, hatching in less than 1 or 2 days, and the larvae reach metamorphosis in as little as 2–3 weeks (King, 1960; Justus et al., 1977; Kiesow, 2006).

1a. Eggs suspended under a cover object, generally a large, flat stone; laid separately, but in small clusters of individual eggs; restricted to permanent lakes and streams in northeastern South Dakota-----*Necturus maculosus*<sup>1</sup>

1b. Eggs not under a cover object; laid individually, in long strings, or in globular masses----- (2)

2a. Eggs laid in long, paired strings; frequently entangled around submerged vegetation-----*Bufonidae* (3)  
See also Table 3

2b. Eggs laid individually or in a floating surface film or submerged clustered masses----- (6)

3a. Eggs with a single gelatinous envelope; eggs with no partitions between vitelli----- (4)

3b. Eggs with two gelatinous envelopes; eggs with partitions between vitelli----- (5)

4a. Vitelli in a single row; often along margins of larger permanent water bodies; restricted to eastern South Dakota-----  
-----*Anaxyrus hemiophrys*

4b. Vitelli in one or two rows; occurring in a variety of wetland habitats; found statewide-----*Anaxyrus woodhousii*

5a. Envelope straight along sides; eggs laid in mid-May to mid-June; occupying a variety of habitats, including small, temporary water bodies, ditches, etc.; restricted to eastern South Dakota-----*Anaxyrus americanus*

5b. Envelope scalloped along sides; generally occurring in seasonally flooded wetlands with minimal vegetation; found statewide-----*Anaxyrus cognatus*

6a. Eggs laid individually or in small globular masses < 5 cm in diameter-----*Hylidae* (7)  
See also Table 4

6b. Eggs laid in floating sheets or globular masses > 5 cm in diameter-----*Ambystomatidae*, *Ranidae* and *Scaphiopodidae* (9)  
See also Table 5

7a. Eggs laid individually, occasionally in small, loose clusters, but not in a cohesive mass; vitelli brown and buff; eggs laid in late May to mid-July; restricted to extreme southeastern South Dakota-----*Acris crepitans*<sup>2</sup>

7b. Eggs laid in small, loose masses, usually with < 35–40 eggs----- (8)

8a. Two gelatinous envelopes surrounding vitelli; eggs laid in late May through June; restricted to northeastern and southeastern counties, in suitable habitats; a small remnant population of *H. chrysozelis* occurs below the Oahe Dam in the central part of the state (Kiesow, 2006)----*Hyla versicolor* / *H. chrysozelis*<sup>3</sup>

8b. One gelatinous envelope surrounding vitelli; eggs laid in mid-April to late May; occurs statewide----*Pseudacris maculata*

9a. Eggs in floating sheets with a single gelatinous envelope; masses can be > 1 m in diameter, with as many as 20000 eggs; eggs laid from mid-June to mid-July; found in permanent waters; restricted to southern South Dakota, primarily along the Missouri River-----*Rana catesbeiana*

9b. Eggs in globular masses with two or three gelatinous envelopes; usually attached to submerged vegetation----- (10)

10a. Three gelatinous envelopes surrounding vitelli; vitelli large (2–3 mm); masses firm, usually with about 50 eggs, but as many as 100+ have been reported; occurs statewide-----  
-----*Ambystoma tigrinum*

10b. Eggs with two gelatinous envelopes----- (11)

11a. Egg masses linear/cylindrically shaped, with 10–250 eggs; eggs hatch in < 1–2 days; found in small ponds in areas with sandy or loose soils after heavy rains; most often attached to vegetation; eggs laid in mid-June; restricted to western and southeastern South Dakota---(*Scaphiopodidae*) *Spea bombifrons*

11b. Egg masses globular, often with > 500 eggs----- (12)

12a. Egg masses cohesive, with as many as 1000 eggs; laid communally, in bottom of temporary ponds; eggs laid in April; in semi-permanently flooded woodlands or wetlands; restricted to coulees in Roberts County in extreme northeastern South Dakota-----*Rana sylvatica*

12.b Egg masses not cohesive, tending to separate when removed from water, with as many as 6000 eggs; eggs laid in mid-April to early June; in permanent water bodies, often attached to vegetation-----*Rana pipiens* (statewide) / *R. blairi* (restricted to the extreme southeast)<sup>4</sup>

1. Although there are historic records of mudpuppies in northeastern counties (e.g., Over, 1923; O’Roke, 1924), little information is available on the current distribution and status of this species in South Dakota (Nixon, 2014).

2. Historical records of cricket frogs from four counties in south-central and southeastern South Dakota exist (Over, 1923; Fishbeck and Underhill, 1959, 1960; Dunlap, 1967; Ballinger et al., 2000; McCallum and Trauth, 2004). More recent survey efforts, however, have either failed to find evidence of breeding populations and turned up only a small number of isolated individuals (Naugle et al., 2005) or found this species to be only seasonally common and occupying only portions of its former range (Burdick and Swanson, 2010).

3. It is not possible to distinguish between the eggs of these two treefrogs without genetic information. Both species are relatively rare in South Dakota.

4. The eggs of these two leopard frogs are difficult to distinguish. There are historical records of plains leopard frogs from southeastern South Dakota, but recent survey efforts (e.g., Naugle et al., 2005) have failed to find any evidence of significant breeding populations of this species.

**Table 2.** Tabular key for identifying the eggs of South Dakota amphibian families.

<b>Eggs suspended under a cover object</b>	<b>Eggs not suspended under a cover object</b>		
In permanent lakes and streams in northeastern counties (Proteidae) – <i>Necturus maculosus</i>	Eggs laid in long, paired strings (Bufonidae) – See Table 3	Eggs laid individually or in loose masses < 5 cm in diameter (Hylidae) – See Table 4	Eggs laid in globular masses or floating sheets > 5 cm in diameter (Ambystomatidae and Ranidae) – See Table 5

**Table 3.** Tabular key for identifying the eggs of South Dakota true toads (Bufonidae).

<b>Eggs laid in long strings</b>			
<b>Eggs enclosed in a single gelatinous envelope, with no partitions between vitelli</b>		<b>Eggs enclosed in two gelatinous envelopes, with partitions between vitelli</b>	
Vitelli in a single row; restricted to eastern South Dakota – <i>Anaxyrus hemiophrys</i>	Vitelli sometimes in 1 but generally in 2 rows – <i>Anaxyrus woodhousii</i>	Envelope with relatively straight sides – <i>Anaxyrus americanus</i>	Envelope with scalloped sides – <i>Anaxyrus cognatus</i>

**Table 4.** Tabular key for identifying the eggs of South Dakota treefrogs (Hylidae).

<b>Eggs laid individually or in loose masses &lt; 5 cm in diameter</b>		
<b>Eggs laid individually, or occasionally in loose clusters</b>	<b>Eggs laid in loose masses &lt; 5 cm in diameter, usually &lt; 35–40 eggs</b>	
Vitelli brown and buff – <i>Acris crepitans</i>	Eggs surrounded by one gelatinous envelope – <i>Pseudacris maculata</i>	Eggs surrounded by two gelatinous envelopes; restricted to northeastern and southeastern counties – <i>Hyla</i> spp.

**Table 5.** Tabular key for identifying the eggs of South Dakota true frogs (Ranidae) and tiger salamanders (Ambystomatidae).

<b>Eggs laid in globular masses or floating sheets &gt; 5 cm in diameter</b>			
<b>Eggs laid in a floating sheet; a single gelatinous envelope</b>	<b>Submerged, globular masses of 1,000 or more eggs; two gelatinous envelopes</b>		<b>Submerged, globular masses of ~50 eggs</b>
Restricted to southern South Dakota – <i>Rana catesbeiana</i>	Eggs laid communally, in temporary ponds; restricted to Roberts County – <i>Rana sylvatica</i>	Not laid communally, usually in permanent water bodies – <i>Rana pipiens</i> / <i>Rana blairi</i>	Eggs with three gelatinous envelopes – <i>Ambystoma tigrinum</i>

### Literature Cited

- Ballinger, R. E., J. W. Meeker and M. Thies. 2000. Checklist and distribution maps of the amphibians and reptiles of South Dakota. *Transactions of the Nebraska Academy of Sciences* 26:29-46.
- Burdick, S. L., and D. L. Swanson. 2010. Status, distribution and microhabitats of Blanchard's cricket frog *Acris blanchardi* in South Dakota. *Herpetological Conservation and Biology* 5(1):9-16.
- Del Fosse, E. S. 1973. *Amphibians and reptiles of South Dakota: A manual of identification and species distribution*, 3rd ed. Gainesville, Florida: privately published.
- Duellman, W. E., and L. Trueb. 1986. *Biology of amphibians*. New York, NY: McGraw-Hill.
- Dunlap, D. G. 1967. Selected records of amphibians and reptiles from South Dakota. *Proceedings of the South Dakota Academy of Science* 46:100-106.
- Fischer, T. D., D. C. Backlund, K. E. Higgins and D. E. Naugle. 1999. A field guide to South Dakota amphibians. SDAES Bulletin 733. Brookings: South Dakota State University.
- Fishbeck, D. W., and J. C. Underhill. 1959. A check list of the amphibians and reptiles of South Dakota. *Proceedings of the South Dakota Academy of Science* 38:107-113.
- Fishbeck, D. W., and J. C. Underhill. 1960. Amphibians of eastern South Dakota. *Hepetologica* 16(2):131-136.
- Goin, C. J., and O. B. Goin. 1971. *Introduction to herpetology*. San Francisco: Freeman & Co.
- Hoberg, T., and C. Gause. 1992. Reptiles and amphibians of North Dakota. *North Dakota Outdoors* 55(1):7-18.
- Johnson, D. H., and R. D. Batie. 2001. Surveys of calling amphibians in North Dakota. *Prairie Naturalist* 33(4):227-247.
- Johnson, S. 2015. *Reptiles and amphibians of North Dakota*. Bismarck: North Dakota Game and Fish Department.
- Justus, J. T., M. Sandomir, T. Urquhart and B. O. Ewan. 1977. Developmental rates of two species of toads from the desert southwest. *Copeia* 1977(3):592-594.
- Kiesow, A. M. 2006. *Field guide to amphibians and reptiles of South Dakota*. Pierre: South Dakota Department of Game, Fish and Parks.
- King, O. M. 1960. Observations on Oklahoma toads. *Southwestern Naturalist* 5(2):102-103.
- Lofts, B. 1974. Reproduction. Pp. 107-218. *In*: B. Lofts, editor, *Physiology of the amphibia*, Vol. 2. New York: Academic Press.
- McCallum, M. L., and S. E. Trauth. 2004. Blanchard's cricket frog in Nebraska and South Dakota. *Prairie Naturalist* 36(2):129-135.
- Moore, J. A. 1940. Adaptive differences in the egg membranes of frogs. *American Naturalist* 74:89-93.
- Naugle, D. E., T. D. Fisher, K. F. Higgins and D. C. Backlund. 2005. Distribution of South Dakota anurans. Pp. 283-291. *In*: M. Lannoo, editor, *Amphibian declines: The conservation status of United States species*. Berkeley: University of California Press.
- Nixon, L. 2014. The case of the missing mudpuppies; USD biologist trying to sleuth out salamander species not seen here for decades. *Capital Journal* (June 11, 2014). Available online at <[www.capjournal.com/the-case-of-the-missing-mudpuppies-usd-biologist-trying-to/article\\_f1405718-f1eb-11e3-a199-0019bb2963f4.html](http://www.capjournal.com/the-case-of-the-missing-mudpuppies-usd-biologist-trying-to/article_f1405718-f1eb-11e3-a199-0019bb2963f4.html)>. Accessed 16 June 2014 and 05 September 2017.
- O'Roke, E. C. 1924. The amphibians of South Dakota. *Proceedings of the South Dakota Academy of Science* 9:13-15.
- Over, W. H. 1923. Amphibians and reptiles of South Dakota. *University of South Dakota, Geological and Natural History Survey Bulletin* 12:1-34.
- Porter, K. R. 1972. *Herpetology*. Philadelphia: W. B. Saunders.
- Salthe, S. N. 1963. The egg capsules in Amphibia. *Journal of Morphology* 113(2):161-171.
- Townes, R. L. 1953. Effects of proteolytic enzymes on the fertilization membrane and jelly layers of the amphibian embryo. *Experimental Cell Research* 4(1):96-101.
- Wheeler, G. C., and J. Wheeler. 1966. *The Amphibians and reptiles of North Dakota*. Grand Forks: University of North Dakota.