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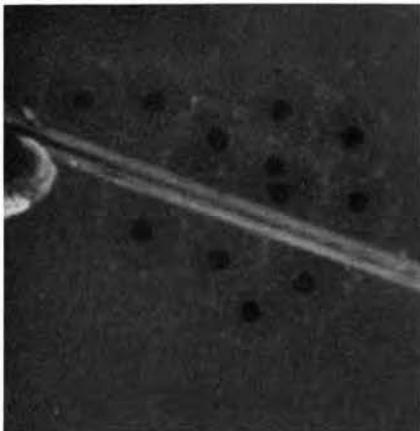
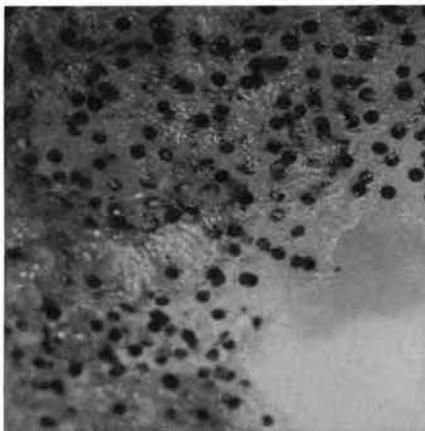
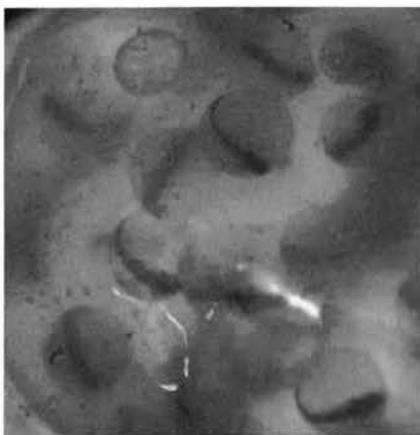
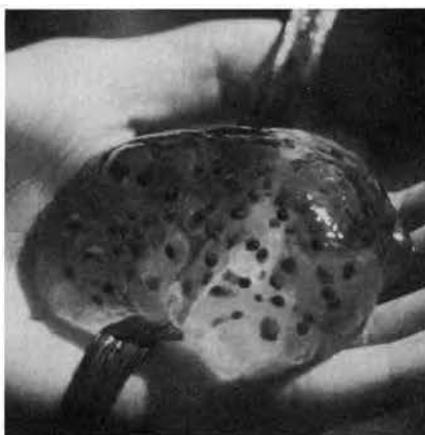
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A Key to the Eggs of Wisconsin's Amphibians

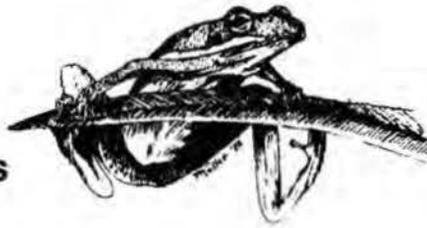
by Dreux J. Watermolen

Bureau of
Environmental Analysis and Review



Abstract: Characteristics of amphibian eggs are discussed and a key to the eggs of Wisconsin's 19 amphibians is presented. Specimen photographs for seven species are also included.

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Introduction

Several references exist for the identification of adult amphibians in Wisconsin (Zim and Smith 1956, Smith 1978, Vogt 1981, Ballinger and Lynch 1983, Conant and Collins 1992). Resources for the identification of larval amphibians are also readily available (Altig 1970, Altig and Johnston 1986, Johnston and Altig 1986). Pope (1964), Vogt (1981), and others have published descriptions, photographs, and line drawings of the eggs of many Wisconsin amphibians, and Headstrom (1970) briefly described amphibian nests. There are few keys for the identification of amphibian eggs, however, and there is none specific to Wisconsin amphibians. Here I review some important characteristics of amphibian eggs and egg masses and provide a key based on these characteristics. The intent is to provide a simple yet accurate reference to the eggs of Wisconsin's 19 amphibian species.

Characteristics of Amphibian Eggs and Egg Masses

Amphibian eggs are generally 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) (Fig. 1). The number of egg capsules varies interspecifically (Salthe 1963, Duellman and Trueb 1986). Salthe (1963) identified as many as eight capsules in salamander eggs, but the eggs of Wisconsin amphibians have no more than three and in some frogs consist of only the ovum, vitelline membrane, and a single capsule. The sizes of the ova and the capsules are highly variable (Duellman and Trueb 1986). Upon deposition the capsules swell, the outermost forming the protective jelly characteristic of amphibian eggs.

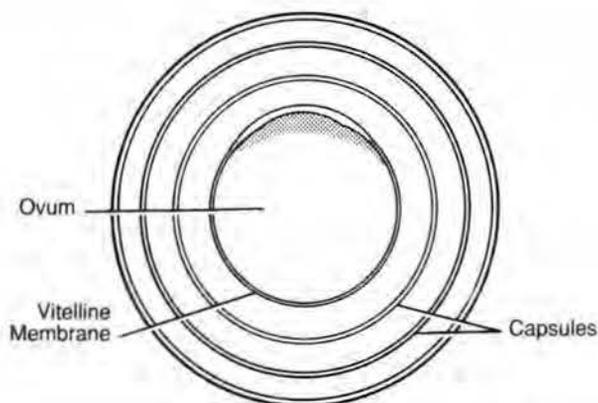


Figure 1. Diagrammatic generalized amphibian egg. The mucoïd capsules vary in number, thickness, and viscosity. (After Duellman and Trueb 1986)

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., most *Rana* and many *Ambystoma*). In other species, the eggs are deposited singly (e.g., *Notophthalmus viridescens louisianensis* and *Pseudacris crucifer*) or in several smaller packets representing only part of the ovarian complement (e.g., some *Ambystoma*). Clumps of eggs are commonly attached to sticks or vegetation in the water; this serves to maintain the position of the clutch in the pond or stream (Duellman and Trueb 1986). Some species attach the eggs to the undersurface of rocks or logs (e.g., *Necturus maculosus maculosus*). Egg masses in the form of a film at the surface of the water are characteristic of frogs that deposit in still, shallow water (e.g., *R. catesbeiana* and *R. clamitans melanota*) (Duellman and Trueb 1986) and are adaptive with respect to meeting the oxygen needs of the developing embryos (Moore 1940). In *Bufo americanus* the jelly is in the shape of paired, long strings. Finally, *Plethodon cinereus* and *Hemidactylium scutatum* lay their eggs in terrestrial environments.

Wisconsin amphibians are highly fecund, with the number of eggs laid varying greatly from species to species. In general, large species have more eggs than smaller ones, and salamanders lay fewer eggs than anurans do (Goin and Goin 1971, Duellman and Trueb 1986).

The amphibian yolk is usually creamy yellow or pale grayish yellow, with vegetal and animal poles. Eggs deposited in sites exposed to direct sunlight have melanin deposits over the animal hemisphere. The occurrence of melanin in eggs exposed to sunlight suggests that the melanin may function to protect the embryo from ultraviolet radiation (Duellman and Trueb 1986). Blanstien et al. (1994) suggest that differential sensitivity among amphibian eggs to UV radiation may contribute to suspected worldwide amphibian population declines. It is also possible that large numbers of dark-colored eggs (as in *R. sylvatica*) absorb heat faster and hold heat longer than single egg masses (Duellman and Trueb 1986, Harding and Holman 1992).

Key to Wisconsin Amphibian Eggs

The key is structured in the conventional way, with choices directing the user to the proper identification. Photographs are included for seven species. In developing the key, I relied heavily on the published works listed in the Literature Cited section as well as my own field observations. Users of the key may find it helpful to refer to other published descriptions in regional texts (e.g., Breckenridge 1944, Smith 1961, Vogt 1981) or general works (e.g., Bishop 1943, Wright and Wright 1949) for verification. Table 1 provides a cross reference to photographs and line drawings in four published works. As an additional aid, time periods from the earliest reported Wisconsin nesting date through the latest reported Wisconsin hatching date are included in parentheses with each description and are summarized in Table 2.



AMPHIBIAN EGG KEY

- 1(a)** Eggs deposited on land; under rocks or logs, or in *Sphagnum* moss **2**
1(b) Eggs deposited in water **3**
-

- 2(a)** 3-14 white, spherical eggs; 4.0-6.0 mm in diameter; often suspended by a single pedicle; often under rotting pine logs; female generally in attendance of egg clutch; found only in northern half of Wisconsin (June through early August)

Redback Salamander (*Plethodon cinereus*) (Fig. 2)

- 2(b)** 15-25 (possibly as many as 64) cream-colored eggs; 4.0-5.0 mm in diameter; suspended in *Sphagnum* 20-120 mm above running water; often in communal nests guarded by a female (late April through early August)

Four-toed Salamander (*Hemidactylium scutatum*)

- 3(a)** Eggs deposited singly **4**

- 3(b)** Eggs deposited in clumps/clusters **6**
-

- 4(a)** Eggs deposited singly (but in groups of 50-100); 5.0-6.0 mm in diameter; usually attached beneath objects at 1-3 m in depth; yolk not pigmented (late May through mid-August)

Mudpuppy (*Necturus maculosus maculosus*)

- 4(b)** Eggs deposited singly; yolk pigmented **5**
-

- 5(a)** Eggs 1.5-2.5 mm in diameter (5.0-6.0 mm in diameter with gelatinous envelope); sometimes in small clusters of up to 4 eggs (sometimes in clusters of 7-40, see choice **11a**); attached to vegetation, rocks, or debris at the pond bottom (late April through mid-May)

Blue-spotted Salamander (*Ambystoma laterale*) (Fig. 6)

- 5(b)** Eggs 1.5 mm in diameter, with yolk approximately 1.0 mm in diameter; attached to vegetation (late April through early June)

Northern Spring Peeper (*Pseudacris crucifer crucifer*)

- 5(c)** Eggs 2.0 mm in diameter; thick jelly-like substance coating each egg (6.5-8.0 mm in diameter with gelatinous envelope); elliptical in shape; eggs colored brown dorsally, yellow ventrally; often wrapped in aquatic vegetation (e.g., *Chara*) (late April through early June)

Central Newt (*Notophthalmus viridescens louisianensis*)

AMPHIBIAN EGG KEY (continued)

- 6(a)** Egg mass forming a layer on the water's surface **7**
6(b) Egg mass submerged **8**
-

- 7(a)** 1,000 to 5,000 (possibly as many as 20,000) black and white eggs; eggs 1.2-1.8 mm in diameter; deposited in a large film (up to 1 m by 1 m) in several layers; in permanent water bodies only (June through mid-July)

Bullfrog (*Rana catesbeiana*)

- 7(b)** 1,000 to 4,000 (possibly as many as 5,000) black and white eggs; eggs 1.0-1.5 mm in diameter; deposited in a thin film (up to 300 mm by 300 mm); often attached to floating or emergent vegetation (mid-May through July)

Green Frog (*Rana clamitans melanota*) (Fig. 3)

- 7(c)** Loose clusters of 10-40 eggs (sometimes laid singly); eggs 1.0-1.2 mm in diameter; sometimes attached to vegetation (mid-May through June)

Cope's Gray or Gray Treefrog (*Hyla chrysoscelis* or *H. versicolor*) (Fig. 4)

- 7(d)** 10-15 eggs (sometimes laid singly); eggs 2.0-3.0 mm in diameter; attached to vegetation, often in flowing water (late May through July)

Blanchard's Cricket Frog (*Acris crepitans blanchardi*)

- 8(a)** Eggs in a double string; black in color; sometimes threaded among emergent vegetation, but never attached (late April through mid-June)

American Toad (*Bufo americanus*) (Fig. 5)

- 8(b)** Eggs in an oval mass resembling a cluster of grapes **9**
-

- 9(a)** Eggs in a single gelatinous envelope **10**

- 9(b)** Eggs with two distinct gelatinous envelopes **11**

- 9(c)** Eggs with three distinct gelatinous envelopes; 15-110 eggs; eggs approximately 3.0 mm in diameter (10.0-12.0 mm in diameter with gelatinous envelopes); attached to vegetation near the pond bottom; found primarily in southeast and east-central Wisconsin (late March to late April)

Tiger Salamander (*Ambystoma tigrinum*)

10(a) Light brown eggs; 2.0 mm in diameter (3.0-5.0 mm in diameter with gelatinous envelope); deposited in loose globular mass (90-110 mm in diameter); attached to vegetation near the surface (late April through early June)

Pickerel Frog (*Rana palustris*)

10(b) 10 to 150 eggs, 0.5-1.3 mm in diameter; deposited in a loose, irregularly-shaped cluster (up to 25 mm in diameter); usually attached to vegetation or debris in shallow water, 70-200 mm below the surface (early March through May)

Chorus Frog (*Pseudacris triseriata*)

11(a) 7-40 eggs; 1.5-2.5 mm in diameter (5.0-6.0 mm in diameter with gelatinous envelope); attached to vegetation, rocks, or debris at the pond bottom (also see choice **5a**) (late April through mid-May)

Blue-spotted Salamander (*Ambystoma laterale*) (Fig. 6)

11(b) 50-250 eggs; 1.6-2.5 mm in diameter (6.0-7.0 mm in diameter with gelatinous envelopes); deposited in an oval mass (60-100 mm in diameter); eggs black, but jelly coating is often milky white (sometimes appears greenish due to algal growth in membranes); usually attached to vegetation near the surface; egg masses rather stiff and will hold their shape when lifted from the water; found primarily in eastern and northern Wisconsin (late April through mid-May)

Spotted Salamander (*Ambystoma maculatum*) (Fig. 7)

11(c) 500-800 (possibly up to 3,000) darkly pigmented (brown to black) eggs; 1.5-2.0 mm in diameter; in globular masses 50-100 mm in diameter, attached to submerged branches or plant stems, usually near the surface; often multiple clusters in the same general vicinity; egg masses rather flimsy and do not hold their shape when lifted from the water; the outer jelly capsule may have a bluish tint and often becomes semi-opaque and overgrown with algae prior to hatching (early June through mid-July)

Wood Frog (*Rana sylvatica*) (Fig. 8)

11(d) 2,000-4,000 brown-black eggs; 2.0 mm in diameter; in a loose globular mass attached to submerged vegetation, usually 1 m or greater in depth (early June through mid-July); found primarily in the northern third of Wisconsin

Mink Frog (*Rana septentrionalis*)

11(e) 1,000-6,000 black eggs; 1.0-1.8 mm in diameter (egg and gelatinous envelope approximately 5.0 mm in diameter); deposited in a tight, oval mass (100-160 mm in diameter); often attached to vegetation (early April through May)

Northern Leopard Frog (*Rana pipiens*)

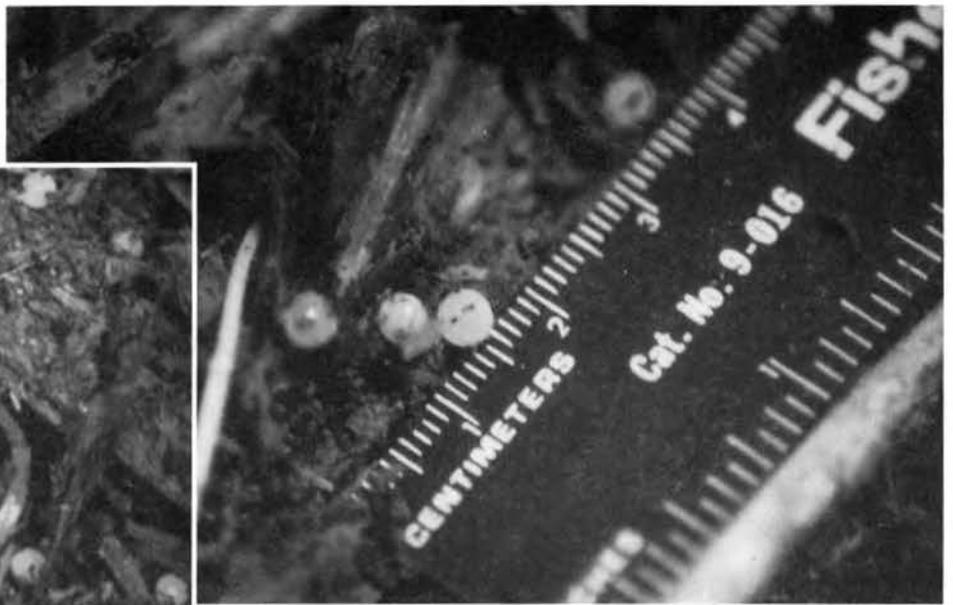


Figure 2. *Redback Salamander* (*Plethodon cinereus*). Note the clutch of white, spherical eggs, attended by the female (left).

PHOTOS: GARY S. CASPER

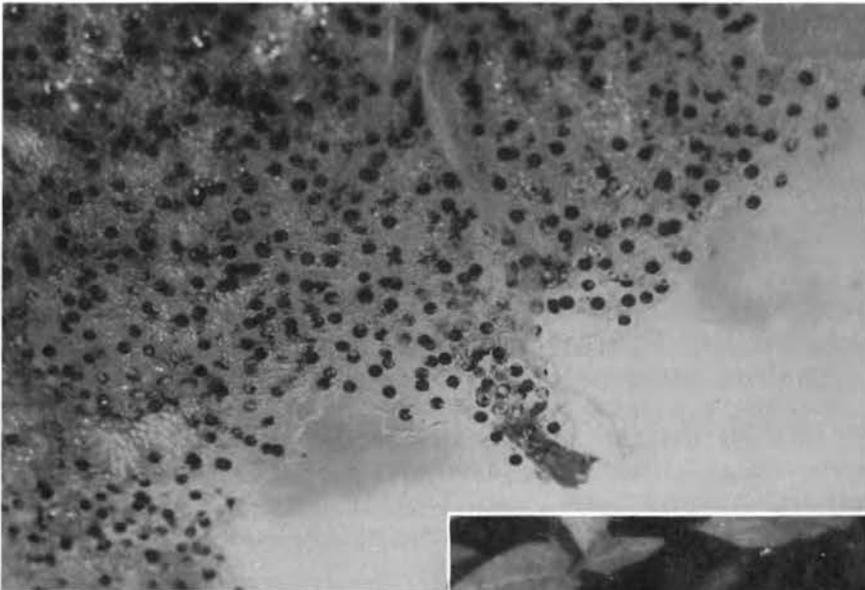


Figure 3. *Green Frog* (*Rana clamitans melanota*). Note the mass of numerous black and white eggs attached to vegetation.



PHOTOS: JAMES H. HARDING

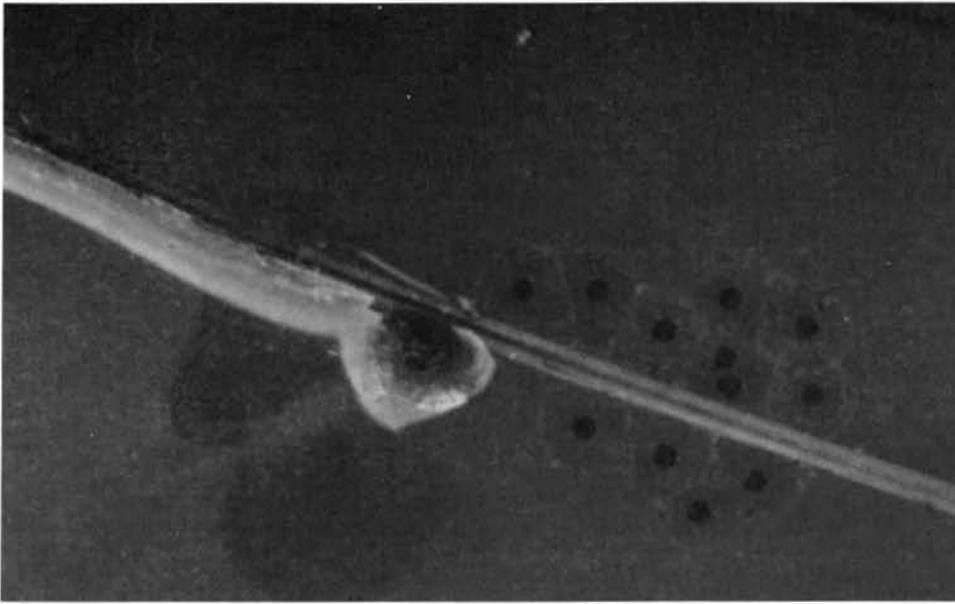
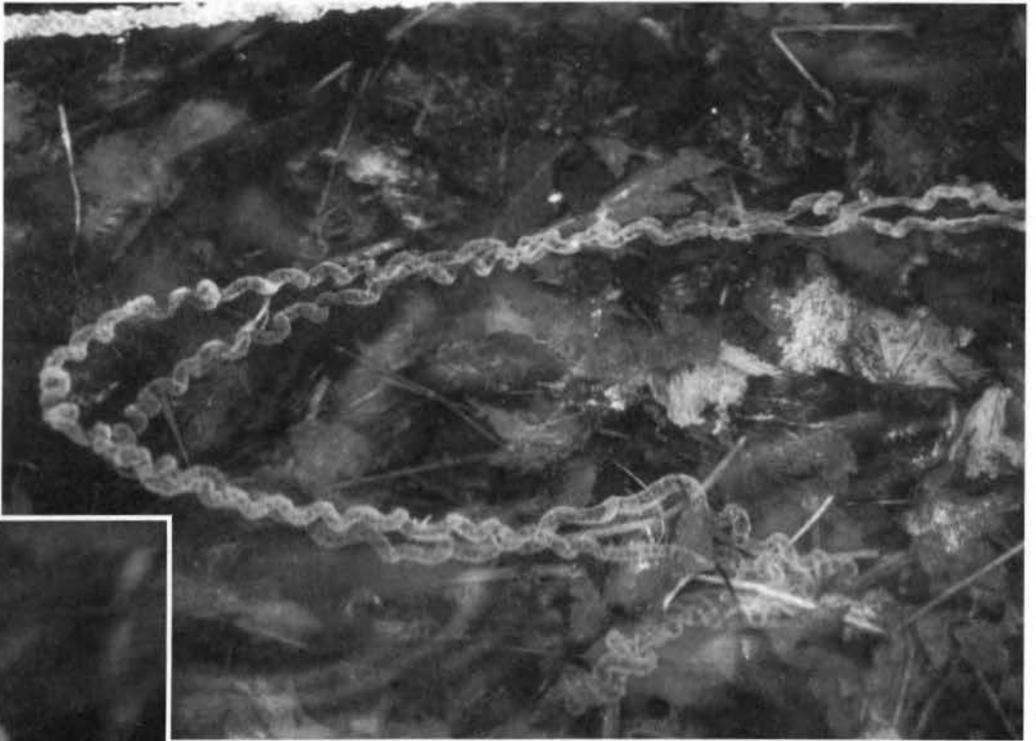


PHOTO: WILLIAM B. PRESTON

Figure 4. *Cope's Gray or Gray Treefrog* (*Hyla chrysoscelis* or *H. versicolor*). Note the loose cluster of eggs attached to vegetation.



PHOTOS: GARY S. CASPER

Figure 5. *American Toad* (*Bufo americanus*). Note the double string of eggs among, but not attached to, vegetation.



PHOTO: GARY S. CASPER

Figure 6. *Blue-spotted Salamander* (*Ambystoma laterale*). Note the egg mass is attached to vegetation, generally at the bottom of the pond.

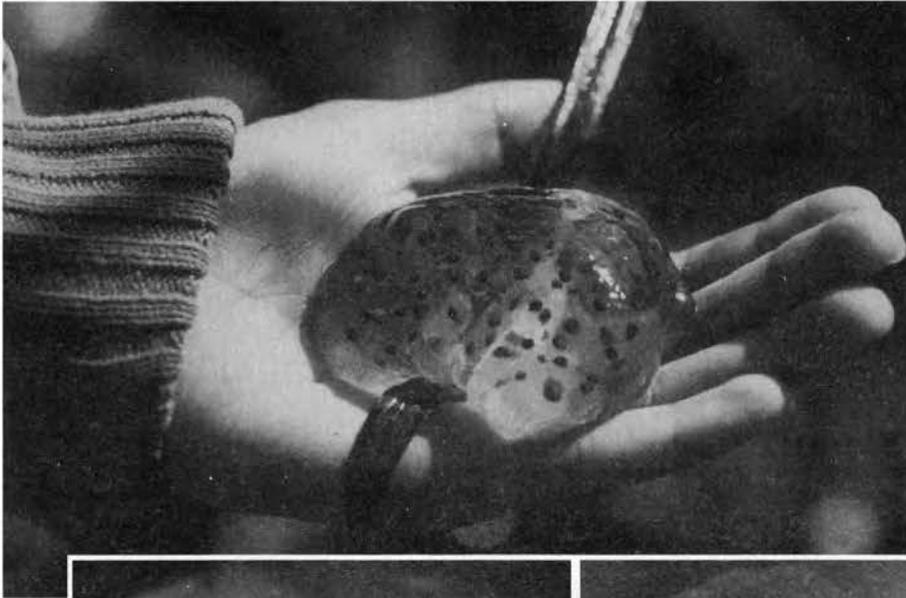
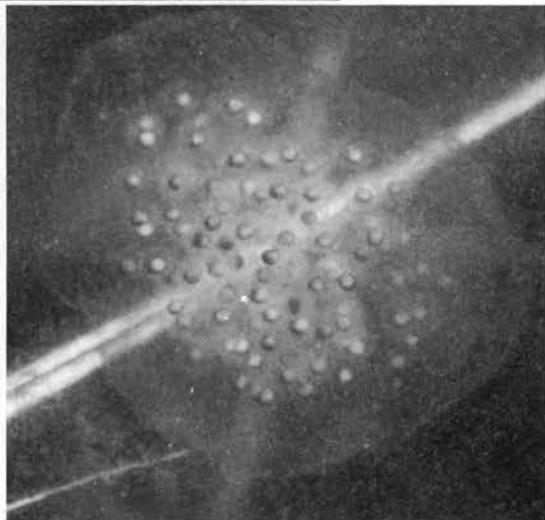
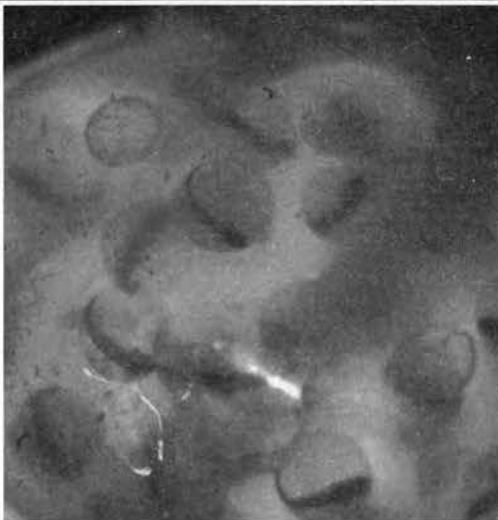


Figure 7. *Spotted Salamander* (*Ambystoma maculatum*). Note the oval mass of eggs, black within light-colored membrane, which holds its shape when handled.



PHOTOS: GARY S. CASPER

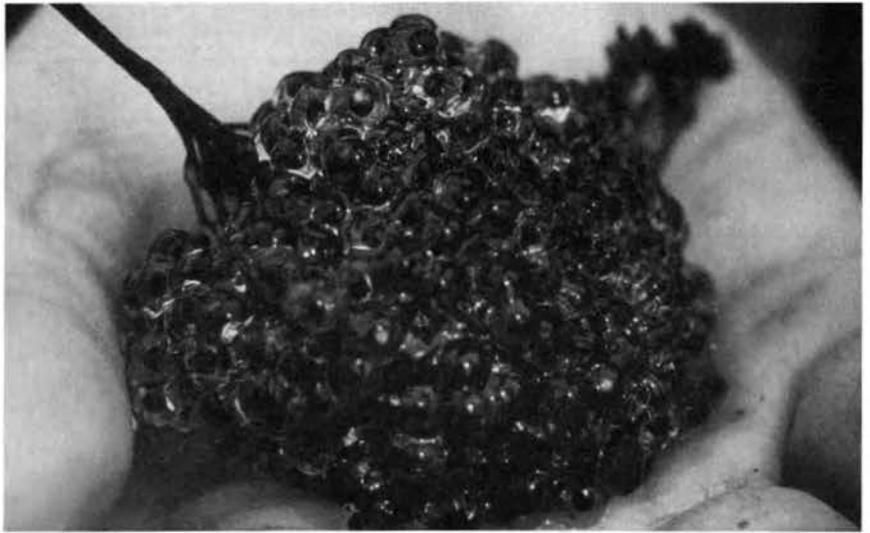


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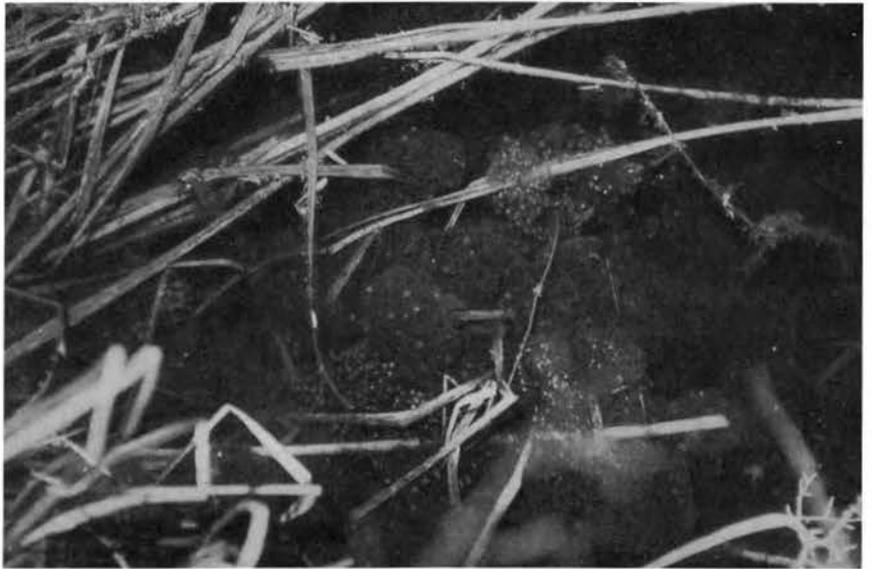


PHOTO: GARY S. CASPER

Figure 8. *Wood Frog (Rana sylvatica)*. Mass is flimsy and does not maintain shape when lifted from water (top). Note the multiple clusters attached to stems (middle) and the darkly pigmented eggs (bottom).

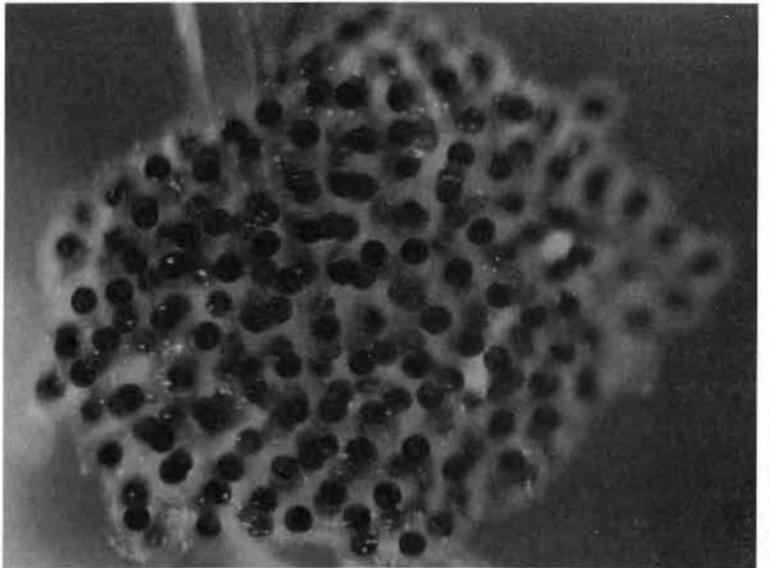


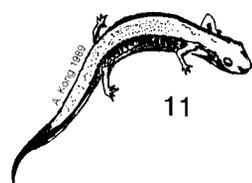
PHOTO: WILLIAM B. PRESTON

Table 1. Cross reference to photographs (P) and line drawings (L) of amphibian eggs in four published works. Numerals are page numbers in the respective works.

Species	Vogt 1981	Pope 1964	Harding and Holman 1992	Preston 1982
Blue-spotted Salamander <i>Ambystoma laterale</i>	P-42			
Spotted Salamander <i>Ambystoma maculatum</i>	P-44	L-39	P-27	
Tiger Salamander <i>Ambystoma tigrinum</i>	P-47			
Central Newt <i>Notophthalmus viridescens louisianensis</i>	P-51			
Four-toed Salamander <i>Hemidactylium scutatum</i>	P-53		P-53	
Redback Salamander <i>Plethodon cinereus</i>	P-55	L-43		
Mudpuppy <i>Necturus maculosus maculosus</i>		P-13, 50		
American Toad <i>Bufo americanus</i>	P-61	L-73	P-113	P-34
Blanchard's Cricket Frog <i>Acris crepitans blanchardi</i>				
Northern Spring Peeper <i>Pseudacris crucifer crucifer</i>	P-67	L-97		
Chorus Frog <i>Pseudacris triseriata</i>	P-66			
Cope's Gray Treefrog <i>Hyla chrysoscelis</i>				P-34, 56
Gray Treefrog <i>Hyla versicolor</i>				P-56, 34
Bullfrog <i>Rana catesbeiana</i>		L-115		
Green Frog <i>Rana clamitans melanota</i>	P-77		P-79	
Pickerel Frog <i>Rana palustris</i>	P-80			
Northern Leopard Frog <i>Rana pipiens</i>	P-83			P-68
Mink Frog <i>Rana septentrionalis</i>	P-85			
Wood Frog <i>Rana sylvatica</i>	P-87		P-99	P-66

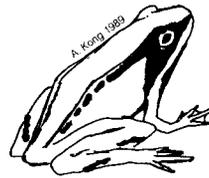
Table 2. Period from the earliest reported Wisconsin nesting date through the latest reported Wisconsin hatching date.

Species	March	April	May	June	July	August
Blue-spotted Salamander <i>Ambystoma laterale</i>			←→			
Spotted Salamander <i>Ambystoma maculatum</i>			←→			
Tiger Salamander <i>Ambystoma tigrinum</i>	←→					
Central Newt <i>Notophthalmus viridescens louisianensis</i>			←→			
Four-toed Salamander <i>Hemidactylium scutatum</i>			←→	←→	←→	←→
Redback Salamander <i>Plethodon cinereus</i>				←→	←→	←→
Mudpuppy <i>Necturus maculosus maculosus</i>				←→	←→	←→
American Toad <i>Bufo americanus</i>			←→	←→		
Blanchard's Cricket Frog <i>Acris crepitans blanchardi</i>				←→	←→	←→
Northern Spring Peeper <i>Pseudacris crucifer crucifer</i>			←→	←→		
Chorus Frog <i>Pseudacris triseriata</i>	←→	←→	←→			
Cope's Gray Treefrog <i>Hyla chrysoscelis</i>				←→	←→	
Gray Treefrog <i>Hyla versicolor</i>				←→	←→	
Bullfrog <i>Rana catesbeiana</i>				←→	←→	
Green Frog <i>Rana clamitans melanota</i>				←→	←→	←→
Pickerel Frog <i>Rana palustris</i>			←→	←→		
Northern Leopard Frog <i>Rana pipiens</i>		←→	←→			
Mink Frog <i>Rana septentrionalis</i>				←→	←→	
Wood Frog <i>Rana sylvatica</i>				←→	←→	



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