On 19 February 2012, SDP again noted at least six eggs present at the location, including a moving embryo with eyes, tail, and gills (stage 37–46) in a partially open egg sac. The wetland had some scattered small puddles of water at the time. On 20 February, an embryo with forelimbs (stage 40–46) was moving within an intact egg; the soil was saturated with water but no standing water was present. Anticipating a prescribed fire at the location, a fire resistant marker (large bolt with washer) was placed ca. 10 cm from the eggs on the evening of 21 February. On the morning of 22 February, at least four live eggs were observed. Later that day, the wetland was burned by a prescribed fire that burned through the entire wetland, but did not consume all of the herbaceous plant material in areas with moist soil.

On the morning after the burn, two apparently healthy embryos were visible and one moved, but some embryos were clearly dead. Charred vegetation was present immediately above the eggs, indicating that fire passed directly over the eggs (Fig. 1). The dead embryos were closer to the charred vegetation at the surface, and their skins were grayish rather than brightly colored. The dead embryos had fully formed mouths (stage 43–46); one was measurable and was ca. 11.3 mm total length. Live eggs were present at the site as late as 25 February, when two embryos moved in partially open egg sacs and an intact egg with an apparently healthy embryo inside was nearby. All of the eggs were dead by 28 February.

Prescribed fires in pine flatwoods are usually implemented during the winter months when wetlands typically retain water (Bishop and Haas 2005. Nat. Areas J. 25:290–294). However, this prescribed fire was in an uncharacteristically dry wetland, so the fire successfully carried through the wetland. Based on our observations it appears that in some cases eggs laid terrestrially can survive fire. Additional observations of eggs before and after fires would be necessary to determine how fire may affect egg survival rates or influence populations.

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**AMBystoma mavortium** (Barred Tiger Salamander). **Behavior Underneath the Ice.** Larval **Ambystoma mavortium** in North Dakota spend the winter months (late October–early April) restricted underneath a thick (0.5–1.3 m) ice sheet. During February and March 2012, we observed larval A. mavortium in Swalls Lake, Ward Co., North Dakota, USA (48.1044′N, 101.1644′W). We drilled holes in the ice using an ice auger equipped with 20.3 cm blade. We established three ice-hole grids. Each grid had nine holes in a 3 x 3 arrangement on a 20 x 20 m square (i.e., four holes were the corners of the square). Thus, we established 27 observation holes over three locations on the lake. We could drill and observe nine holes during a four-hour observation period. We completed four, four-hour observation periods before the ice became unsafe.

To make observations, we used an Aqua-Vu underwater 760 color camera equipped with video recorder. When salamanders were viewed among vegetation, we used an average callait stem diameter of 11.8 mm for calibration using ImageJ to estimate salamander size. Water temperatures ranged from 2.2 to 3.0°C. Observation depths ranged from 0.2 to 2 m.

Because each hole is 10 m from the nearest hole, we assumed that the number of individual salamanders observed more than once during a visit was minimal. Visibility was estimated as 0.7 m in any direction, thus a full rotation of the camera covered a circular area with a radius of 0.7 m and a circular viewing area of 1.54 m². Given this viewing area at each hole, we observed 13.86 m² during each trip to the pond (i.e., nine holes, each 1.54 m²). We viewed a total of 224 salamanders during our four observation periods (i.e., an average of 56 salamanders observed in an area of 13.85 m², or 4.04 salamanders/m²). Using a total lake area of 45,285 m² provides a coarse winter population estimate of approximately 183,102 salamanders in Swalls Lake. This estimate falls within our previous catch-per-unit effort and PIT tag mark-recapture estimates (Poitra et al. 2007. Proc. NDAS 61:15). Salamanders measured (N = 11) averaged 128.1 mm SVL (standard deviation 17.2). All observed salamanders were large (range 99.1–151.2 mm SVL).

The Amphibian Growth Project (AGP) has been monitoring Swalls Lake as part of a long term population monitoring program since 2005. Metamorphosis of A. mavortium at Swalls Lake occurs during August and September at ca. 98 mm SVL. Swalls Lake is a semi-permanent wetland that last dried completely in the late 1980s. This wetland is irregular in shape and is surrounded by farmland maintained by the North Central Research Extension Office of North Dakota State University. When full of water, the maximal depth in this wetland is 2.8 m. In summer months, the Ambystoma population at Swalls Lake consists of a mixed population of immature larvae, sexually mature larvae (i.e., paedomorphs), immature transformed salamanders, and sexually mature transformed salamanders (Poitra et al. 2007. op. cit.). We did not observe any transformed salamanders in the pond although it is likely that these salamanders that we viewed consist of both immature and mature larvae. Both salamanders with and without swollen cloacae were observed.

Most of the salamanders observed were active. No aggression among salamanders was observed. In several cases, the salamanders were crowded such that they are nearly always in contact with another salamander. Movement up and down in the water column was very common. We often observed salamanders slowly ascending to the top of the water column (i.e., to the bottom of the ice cover) and then swimming rapidly downwards. This is a behavior seen when salamanders gulp air from the surface during ice-free months. Lung inflation in amphibians occurs during long term restriction from surface area and can be a cause of significant mortality (Ultsch et al. 2004. Comp. Biochem. Phys. Part A 139:111–115). However, the salamanders were able to maintain position in the water with no effort, i.e., were buoyant. Therefore we suggest that these salamanders are able to maintain inflated lungs during the winter. We are unable to determine at this time if the salamanders are gulping from pockets of air under the ice.

Amphibians often overwinter under the ice. For example, adult Northern Leopard Frogs (*Lithobates pipiens*) can spend winter months dormant in shallow pits on the pond bottom (Emery et al. 1972. Copeia 1972:123–126), and adult Red-spotted Newts (*Notophthalmus viridescens*) spend their lives in ponds that can freeze over (Berner and Puckett 2010. J. Exp. Zool.
313A:231–239). In these reports, overwintering amphibians are slow or dormant. Our observations indicate high activity levels on larval A. marmoratum under the ice. This high activity is seen in the other organisms in Swalls Lake. Aquatic arthropods were also seen at high density and high activity. In addition, bubbles were constantly forming and releasing from the surface of cat-tail stems that were covered with biofilms (presumably algae and cyanobacteria).

Our video recordings are archived at amphibian.org and at youtube.com/user/Kidbeachy. The AGP is supported by grants from the National Center for Research Resources (5P20RR16471-12) and the National Institutes of General Medical Sciences (8 P20 GM103442-12) from the National Institutes of Health to CKB and D. Sens. Long term access to Swalls Lake is kindly provided by the North Central Research Extension Center of North Dakota State University and its director, J. Fisher.

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CRYPTOBRANCHUS ALLEGANIENSIS ALLEGANIENSIS (Eastern Hellbender). AGGREGATE BEHAVIOR. Cryptobranchus alleganiensis is a large, fully-aquatic salamander that resides beneath boulders and in bedrock crevices in cool, swift flowing streams throughout much of the eastern USA (Nickerson and Mays 1973. The Hellbenders: North American “Giant Salamanders.” Milwaukee Public Museum, Milwaukee, Wisconsin. 106 pp.; Smith 1907. Biol. Bull. 13:35–39). Hellbenders are typically described as a solitary and territorial species (Humphries and Pauley 2005. Amer. Midl. Nat. 154(1):135–142; Nickerson and Mays 1973, op. cit.; Smith 1907, op. cit.). However, during the breeding season (late summer and fall) sexually mature adults are known to congregate briefly at rock nesting cavities and may aggressively defend rock shelters from conspecifics (Smith 1907, op. cit.). Rarely, more than one hellbender has been located beneath a single rock for reasons other than breeding (Hillis and Bellis 1971. J. Herpetol. 5(3-4):121–126; Nickerson and Mays 1973, op. cit.). Nickerson and Mays (1973, op. cit.) located three Ozark Hellbenders (C. a. bishopi) from beneath a single rock on two occasions, and two individuals from beneath a single rock on 14 occasions in North Fork of the White River, Missouri, USA. Hills and Bellis (1971, op. cit.) found more than one Eastern Hellbender (C. a. alleganiensis) under a single rock once during a study in French Creek, Pennsylvania, USA. Because reports of hellbender cohabitation by Nickerson and Mays (1973, op. cit.) and Hills and Bellis (1971, op. cit.) resulted from rock-lifting surveys, it remains unclear whether cohabitants beneath a single rock may have been compartmentalized from each other and whether cohabitation may have been a short-term artifact of disturbance caused by survey methods. For example, Hills and Bellis (1971, op. cit.) report that hellbenders being pursued would often crawl beneath a nearby rock sometimes occupied by another hellbender.

On 16 September and 27 October 2012, we observed an aggregation of nine and four hellbenders, using a single bedrock cavity in a stream within the South Fork Holston River drainage (HUC 06010102), Washington Co., Virginia, USA. Due to the current status of C. alleganiensis (Fed. Register 2011a. 76(194):61956–61978; Fed. Register 2011b. 76(194):61978–61985) and threats of illegal collection we do not report the specific locality of our observations. The site consisted of an approximately 10-m long pool just below a large riffle. Though numerous large rocks occurred upstream of the adjacent riffle and downstream of the pool, suitable shelter for hellbenders within the immediate vicinity largely consisted of bedrock crevices. We used snorkeling gear and dive lights (Underwater Kinetics, Poway, California, USA) to peer into crevices and locate animals. On 16 September 2012 we observed eight hellbenders in a single cavity (85 cm long × 5.4 cm high) at ca. 1700 h (water temperature 17°C; air temperature 19.2°C). The cavity was located along a submerged bedrock face, and was oriented horizontal to but ca. 30 cm below the water surface and 66 cm above a rock ledge that was elevated 109 cm above the stream bed. While photographing the aggregation of hellbenders, we observed a ninth individual approaching from upstream apparently intending to enter the cavity. We captured the ninth individual by hand and noted a lack of morphological characteristics indicating sexual maturity (lack of a swollen cloaca or gravid appearance; Makowsky et al. 2010. Herpetol. Conserv. Biol. 5(1):44–48). Upon release at the location of capture the ninth individual readily entered the cavity without obvious protest from the crevice dwellers. All of the hellbenders we observed were facing the cavity opening and were in physical contact with at least one other individual (http://youtu.be/x-ErTB1ulg). To rule out the possibility that our observation represented an isolated aberration from normal behavior, we revisited the site on 27 October 2012 at ca. 1300 h (water temperature 14.4°C; air temperature 17.2°C) and observed four individuals using the same cavity (Fig. 1). Though our observations occurred during the breeding season for hellbenders in Virginia (late August–October), we consider it unlikely that the aggregation was an attempt to breed based on the lack of evidence of a nest within the cavity (i.e., no eggs were observed), entrance of an apparently immature individual into the cavity, lack of obvious aggression noted between conspecifics, and observation of the behavior outside a single occasion. Our observations indicate hellbenders may aggregate for reasons other than breeding, though the reason and commonality of such behavior across the range of C. alleganiensis is unclear.

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