

Figure 1. A simple apparatus for candling turtle eggs utilizing a light bulb and a clay flower pot.

requiring some experience for proper interpretation.

A total of 40 eggs of six species were examined by candling after 10 days of incubation at 80° F. At this time, a penny-sized pink membrane could be seen, usually near the top of the egg. Variations in embryo size were observed within clutches as well as interspecifically. The six species observed were *Clemmys guttata*, *C. insculpta*, *Cuora flavomarginata*, *Emydoidea blandingii*, *Graptemys kohnii*, and *Trionyx ferox*. Arteries, heads, eyes, shells, feet, and yolk became progressively visible with time. The yolk is always on the bottom and glows yellow to orange when candled. Fertile eggs with soft shells usually turn chalky white after a few days, while infertile eggs tend to turn yellow and develop dents.

Figures 2 and 3 are of an egg almost half way through a 60 day incubation period. These figures demonstrate how to interpret the candled image.



Figure 2. Photograph of a candled *Pelomedusa subrufa subrufa* egg on the 27th day of the 60-day incubation period. Compare with Figure 3. (Photograph by Ted Colvin and Ann B. Bryan).

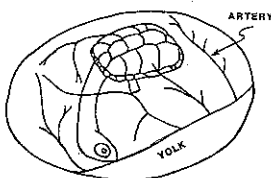


Figure 3. A sketch of the candled egg shown in Figure 2 showing the location and position of the embryo and the location of the yolk and arteries.

It is not uncommon for hard-shelled eggs to develop permanent air pockets which increase in size during incubation. They can occupy up to one-third of the volume of the egg with no adverse effects on the embryo. Eggs with free-floating air bubbles or cracked shells never hatch. The senior author had one instance of an egg which was punctured from within. It oozed a drop of blood, which was wiped off, and the puncture was sealed with Elmer's® glue. The turtle hatched a month later.

Late in the incubation period the shell, four legs, and head are evident. The head end contains the smallest and fewest blood vessels.

Since turtle eggs develop best when the embryo is at the top of the egg, candling allows one to determine when eggs are not properly oriented and rotate them if necessary. There is currently disagreement on whether or not rotation during incubation is harmful to turtle eggs. Except for this initial reorientation of the egg, the authors do not recommend rotation. Candling also minimizes a disorder that the senior author has termed "full term egg death." This is a condition in which individuals attain full hatching size but fail to hatch. We believe the cause of full term egg death to be related to the membrane enclosing the turtle within the egg. This membrane, through which the turtle respire while in the egg, is withdrawn into the turtle's abdomen at hatching time. If the turtle cannot break out soon after this happens, it will drown. If eggs are opened slightly just before hatching, they will usually survive.

To open an egg, one must candle it daily during the last week of incubation. When an area clear of blood vessels appears at the head end, mark it with a pencil. Then, using a sterilized pin, carefully make a small puncture and wipe away as much liquid as possible, leaving an air pocket in which the turtle may breathe. Return the egg to the incubator and it should hatch by itself.

The following species were hatched in 1985 using the above technique: 50 *Clemmys insculpta*, 8 *C. guttata*, 12 *C. muhlenbergii*, 20 *Terrapene carolina*, 12 *Cuora amboinensis*, 6 *C. flavomarginata*, 2 *Chrysemys picta*, 3 *Cyclonemys dentata*, 5 *Chelodina longicollis*, 3 *Graptemys kohnii*, and 18 *Pseudemys scripta elegans*. Three of the *P. s. elegans* had no legs and would not have been able to hatch on their own. They were euthanized two weeks after hatching.

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LIFE HISTORY NOTES

LIFE HISTORY NOTES is analogous to Geographic Distribution. Individual notes are to concern only one species, and authors are requested to choose a keyword which **BEST** describes the nature of their note (e.g., Reproduction, Coloration, Morphology, etc.). Figures are permissible to illustrate any data, but should **REPLACE** words rather than embellish them. Reports of clutch or litter size should include snout-vent and total lengths of females. The section's intent is to convey information rather than demonstrate prose. Articles will still be reviewed and edited prior to acceptance.

General format is: SCIENTIFIC NAME in caps (Common Name in parentheses — use Collins, *et al.* 1982. STANDARD COMMON AND CURRENT SCIENTIFIC NAMES FOR NORTH AMERICAN AMPHIBIANS AND REPTILES, for North American forms). KEYWORD in caps. Data on the animal (references may be *briefly* cited in text — **DO NOT** include complete literature reviews — use summary articles wherever possible). Place of deposition or intended deposition of specimen(s) and catalog number(s). Then, skip a line and close with Submitted by (Name(s) in caps) (addresses). Recommended citation for items appearing in this section is as for Geographic Distribution notes.

Please submit Life History Notes in the standard format directly to the **SECTION EDITOR** to avoid delays in publication: Peter J. Tolson, Toledo Zoological Gardens, 2700 Broadway, Toledo, Ohio 43609, U.S.A.

ANURA

HYLA REGILLA (Pacific Treefrog). **PREDATION.** An adult Male *Hyla regilla* (2.4 g, 33 mm snout-urostyle length) was observed struggling in the jaws of an adult male red-leg frog *Rana aurora* (45 g, 80 mm SUL). The incident occurred at Blumpond, a stock pond (15 m in diameter, less than 1 m deep) in oak woodland, immediately adjacent to the NW border of Hastings Natural History Reservation, elev. 518 m, Carmel Valley, Monterey Co., CA on 19 January 1986, 2035 h, during a light rain. The *Rana aurora* rested on a mat of aquatic vegetation in the center of the pond. The *Rana* released the *Hyla* during capture but later ingested him in the collecting bag. Approximately 100 male *Hyla regilla* were chorusing in the pond and several male-female pairs were observed in amplexus. Only the one *Rana aurora* was observed.

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RANA CATESBEIANA (Bullfrog). **PREDATION.** Bullfrogs are known to be preyed upon by birds (Chapin 1908. Proc. Staten Is. Assoc. Arts Sci. 2:3-8; Jenni 1969, Ecol. Monogr. 39:245-270; Niethammer and Kaiser 1983.