

## A NEW METHOD FOR MATCHING HATCHLINGS WITH THEIR EGGS

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Studies of certain breeding adaptations in birds, such as hatching asynchrony, may be handicapped unless hatchlings can be associated with their eggs. Investigators have tried several methods for doing this. A common method involves making frequent visits during hatching time (e.g., Howe 1976, Zach 1982), but this can cause excessive disturbance and abandonment. Schifferli (1973) removed eggs from nests of Great Tits (*Parus major*), but this reduced hatching success. Recently, Rotterman and Monnett (1984) dyed young Red-winged Blackbirds (*Agelaius phoeniceus*) in the egg following pipping.

The objective of our study was to develop a superior method for matching hatchlings with their eggs. We used eggs of Tree Swallows (*Tachycineta bicolor*) because they were readily available from the colony established in our nest boxes. We compared our new method, which involved glueing thread around eggs to prevent complete hatching, with the laboratory incubation method. The embryo-dyeing method was not included because we had difficulties finding eggs in the pipping stage.

## METHODS

The study was carried out in 1983 in a Tree Swallow colony at the Whiteshell Nuclear Research Establishment near Pinawa in southeastern Manitoba, Canada.

**Field method—glueing thread.** One hundred and twelve eggs from 20 clutches ( $5.6 \pm 0.1$  eggs) were numbered with a felt marker as they were laid. At the start of incubation, we randomly chose an egg from each clutch and affixed a thin white thread that had been soaked in glue in one of three different ways (Fig. 1). Another randomly chosen egg from each clutch was similarly glued just before the estimated hatching date. The remaining eggs were used as controls. In preliminary studies, we tried several different types of glue. We had good results with Lepage's Bond Fast white glue, which is fast-drying, transparent, and forms a good bond. Nest boxes were checked daily for abandonment, removal of glued eggs by adults, or hatching. When the experimental eggs hatched, we cut the threads with scissors to release the hatchlings from the eggshells. Only young which had broken the eggshell into two complete halves were freed (Fig. 1). We individually marked experimental nestlings by tying a colored thread around one tarsus. A randomly selected control nestling, which had hatched from one of the unglued eggs, was also marked. Nest boxes were checked daily. We weighed experimental and control nestlings in a small plastic bag with a Pesola spring scale to the nearest 0.1 g at 5-day intervals until fledging. We designated the day of hatching as day 1.

**Laboratory method—artificial incubation.** We removed a total of 22 eggs from four clutches just before the estimated hatching date. Other Tree Swallow eggs were substituted to prevent adults from abandoning their nests. The experimental eggs were put into subdivided cartons in a darkened incubator. The temperature was maintained at  $35.0 \pm 0.1^\circ\text{C}$ . Two trays of water were used to raise the relative humidity to about 80%. While in the incubator, the eggs were not turned systematically, although we moved them daily to check for signs of pipping. The eggs were in

the incubator  $1.5 \pm 0.6$  days before hatching. We weighed all hatchlings to the nearest 0.01 g on a digital balance. After hatching, we returned the young to their respective nests and removed the substituted eggs. Nest boxes were checked daily until fledging.

All means are quoted with their standard errors. Statistical tests and procedures were taken from Sokal and Rohlf (1969).

## RESULTS AND DISCUSSION

**Hatching and fledging success.** The hatching success of the 20 eggs glued at the start of incubation was 95% because one egg was infertile. The hatching success of the 20 eggs glued just before the estimated hatching date was 90%. One egg was infertile and another was removed from the nest, probably by one of the adult swallows. The 72 control eggs had a hatching success of 82%. Five eggs were infertile, seven eggs were removed from five different nests, presumably by adult swallows, and one egg was pecked, possibly by a House Wren (*Troglodytes aedon*; Kendeigh 1941, Chapman 1955). The fledging success of the 19 nestlings from eggs glued at the start of incubation, the 18 nestlings from eggs glued just before the estimated hatching date, and the 59 nestlings from the control eggs was 95%, 94%, and 91%, respectively. Fledging success was reduced in each of the two glued groups by a dead nestling. In the control group, four young died and another disappeared. Most nestling deaths were probably caused by four days of cold and wet weather (1-4 July 1983), which can be detrimental to Tree Swallow nestlings (Paynter 1954, Chapman 1955, Zach and Mayoh 1982a). Our results show that affixing thread with glue does not adversely affect egg fertility, incubation, hatching success, or fledging success.

The 22 artificially incubated eggs had a hatching success

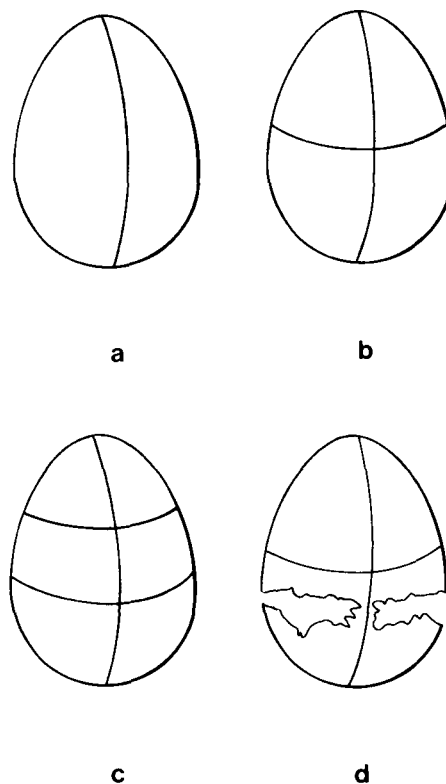


FIGURE 1. Three methods of glueing thread to eggs (a, b, c) and a partially hatched egg before cutting the threads (d).

TABLE 1. Mean body mass ( $\bar{x} \pm SE$  in g) of Tree Swallow nestlings from glued and control eggs.<sup>a</sup>

Time of glueing	Age (d)				
	1	5	10	15	20
Start of incubation	1.21 $\pm$ 0.03*	7.49 $\pm$ 0.20*	20.46 $\pm$ 0.47	21.67 $\pm$ 0.26	19.15 $\pm$ 0.34
Before hatching	1.31 $\pm$ 0.04*	7.33 $\pm$ 0.32*	21.34 $\pm$ 0.28	22.68 $\pm$ 0.38	20.21 $\pm$ 0.24
Control	1.52 $\pm$ 0.06	8.42 $\pm$ 0.15	21.57 $\pm$ 0.33	21.91 $\pm$ 0.22	20.24 $\pm$ 0.15

\*  $P < 0.005$ , analysis of variance and a priori multiple comparisons of each treatment group with control.

<sup>a</sup>  $n$  ranges from 13–20.

of 95% because one egg was infertile. This contrasts with the low hatching success of 67.6% in Schifferli's (1973) study. In our study, none of the four nest boxes was abandoned by the adults following substitution of other eggs or the sudden introduction of nestlings. The fledging success of artificially incubated hatchlings was 95%. We attribute the death of a single nestling to adverse weather conditions.

For both methods tested, the hatching and fledging successes were comparable to unmanipulated eggs or young, which usually ranges from about 80% to 90% (Zach and Mayoh 1982a, b).

**Hatchling identity.** For the glued eggs, 75% of the hatchlings could be matched with the appropriate eggs. The remainder could not be associated because they managed to hatch either on their own or, perhaps, with the help of an adult. On the basis of daily visits, only 10% of the hatchlings from control eggs could be assigned. The three ways of glueing eggs (Fig. 1) were equally efficient in preventing complete hatching.

For the artificially incubated eggs, all of the hatchlings could be associated with their eggs, as in Schifferli's (1973) study. In a study of the Common Grackle (*Quiscalus quiscula*; Howe 1976), 50% of the young could be matched with the appropriate eggs with absolute certainty, 40% could be reasonably assigned, and 10% could not be assigned. These results were based on three to five visits to each nest daily. Using frequent visits, we had similar difficulties in matching Tree Swallow young to their eggs (Zach 1982). Egg glueing and artificial incubation are better methods for assigning young to eggs than making frequent visits. Unfortunately, Rotterman and Monnett (1984) did not give the success rate of associating hatchlings with specific eggs for their embryo-dyeing technique.

**Nestling growth.** On days 1 and 5, nestlings hatched from glued eggs weighed significantly less than the controls, irrespective of the time of glueing (Table 1). This is probably because the young were temporarily restrained within the partially opened shell, and could not be fed during this period. The experimental nestlings did not weigh as much as the control nestlings until after day 5. The mean body mass of nestlings hatched in the incubator was 1.49  $\pm$  0.02 g, and did not differ significantly from control nestlings (Table 1). Hatching in the incubator did not affect the body mass of hatchlings and presumably later growth. Rotterman and Monnett (1984) reported that weights did not differ significantly between dyed and control 8-day-old nestling blackbirds.

## CONCLUSIONS

Both the methods tested for matching hatchlings with their eggs did not interfere with hatching in Tree Swallows. In

most cases, adults accepted glued eggs and the glued eggs did not hatch completely until we released the young. Taking eggs temporarily into the laboratory for hatching and then suddenly introducing hatched young into the nest did not interfere with breeding. The artificial incubation method was better than the glued-thread method for Tree Swallows because all the hatchlings could be matched with their eggs and growth in body mass seemed to be unaffected.

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