Calculating nest survival using the **Mayfield (1975) Method** (is simple).

Biologists most often monitor landbird nests by periodically visiting the nest and recording the stage/fate of eggs or nestlings. Early on it became apparent that a simple proportional estimate of nest survival was inadequate. This ratio, the number of successful nests divided by the total number of nests observed active, likely overestimates "true" nest success because long-lived nests are more likely to be included in the sample than short-lived nests. Or, put another way, there is (theoretically) a large source of *positive* bias in calculating success based on the raw proportion of nests if your sample contains nests that are lost quickly (less likely to be found) and nests found during the nestling period (more likely to succeed having made it that far!). A simple mathematical solution is to include only nests discovered on the first day of laying, however, by now, we all recognize that this solution is logistically challenging and would greatly reduce sample sizes.

Mayfield (1961, 1975) recognized that the appropriate sampling unit was not the nest as used in the proportional estimator, but the number of *days* the nest was exposed to the hazards of predation, parasitism, foul weather, etc.

Step 1

Count the total number of days a nest was observed active and hence susceptible to failure ("exposure" days). A nest can be included only if it was truly active (i.e., had at least one egg). So, start counting exposure days on a nest located during building, for example, when the first egg was laid. On a nest located with eggs or young, start counting on find day. For nests whose outcome (fledge or fail) is known, stop counting exposure days in between the last date observed active and the subsequent nest check. For nests whose outcome is unknown, stop counting on the last active check. The most precision you need is to the half day (see example below).

Example 1 (known outcome)	*Example 2 (unknown outcome)*
10 May – found building 90% complete	10 May – 3 day old nestlings ←***Start counting*** **(day 0)**
14 May – 1 egg ←***Start counting*** **(day 0)**	14 May – 3 nestlings
18 May – 3 egg	18 May – nest empty, intact, no scolding, etc.
22 May – 3 egg	
26 May – 3 egg	
29 May – empty	
TOTAL exposure days = 13.5	***TOTAL exposure days*** = 4

Step 2

Tally up exposure days for ALL nests (that were observed active) and tally up all the nests that were known to have failed.

Step 3

The Mayfield equation:

$$1 - (\text{total number of } \textit{failed} \text{ nests} \div \text{total number of exposure days}) = \text{daily survival probability}$$

or

$$\text{daily survival probability} = (\text{exposure days} - \text{failed nests}) \div \text{exposure days}$$

Daily survival is a probability that the nest will survive from one day to the next. To calculate a survival probability for the entire nesting period or cycle (laying, incubation, nestling) raise the daily probability to a power equal to the number of days in the nest period/cycle:

$$\text{daily survival probability}^{\text{nesting period}}$$

For example, in a sample of 23 Song Sparrow nests, where there were 13 failed and there were 259.5 exposure days, the daily survival probability would be 0.94990. Using a nesting period of 26 days (4 laying, 12 incubating, and 10 nestling), the total survival probability would be 0.26283. The proportional estimate would be 0.43.

$$1 - (13 \div 259.5) = 0.94990$$

$$0.94990^{26} = 0.26283$$

Simple. **Nest survival** is the probability that a nest fledges at least one young. In the above example, there is a 26% chance that a nest will fledge at least one young.

Pertinent Literature

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