

Quantifying fertility and embryonic mortality in an aerial insectivore, the tree swallow (*Tachycineta bicolor*)

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BACKGROUND

Aerial insectivores, such as tree swallows, are the fastest declining group of birds in Canada¹.
10 - 15% of tree swallow eggs fail to hatch².



Types of Inviable Eggs³

1. Infertile

Sperm failed to fuse with the ovum
Uncommon

2. Embryonic Mortality

- Early development Common
- Mid development Uncommon
- Late development Common

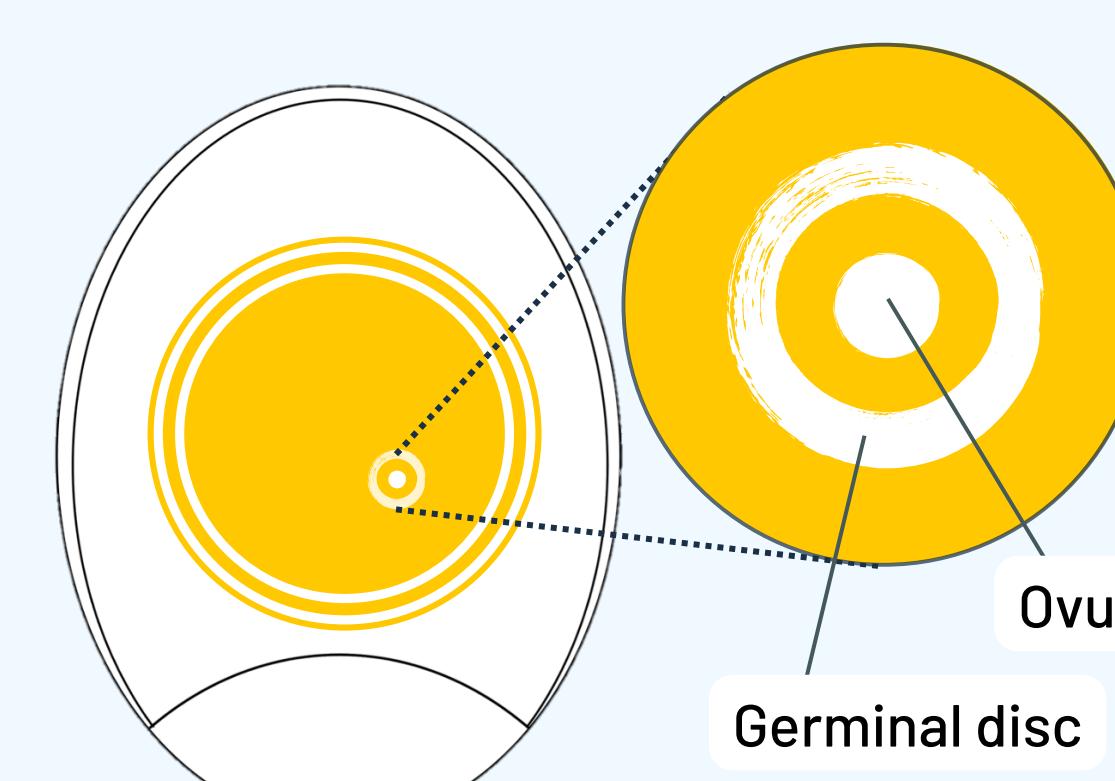
Infertility is overestimated in wild birds because fertility testing is underused⁴.

Infertility vs. Early Embryonic Mortality

Can only be determined via egg dissection and fertility testing⁵

Infertile

No evidence of embryonic cells in the germinal disc



Possible factors³

- Lack of sperm
- Poor genetic compatibility
- Maternal effects

Early Mortality

Microscopic embryonic cells present in the germinal disc



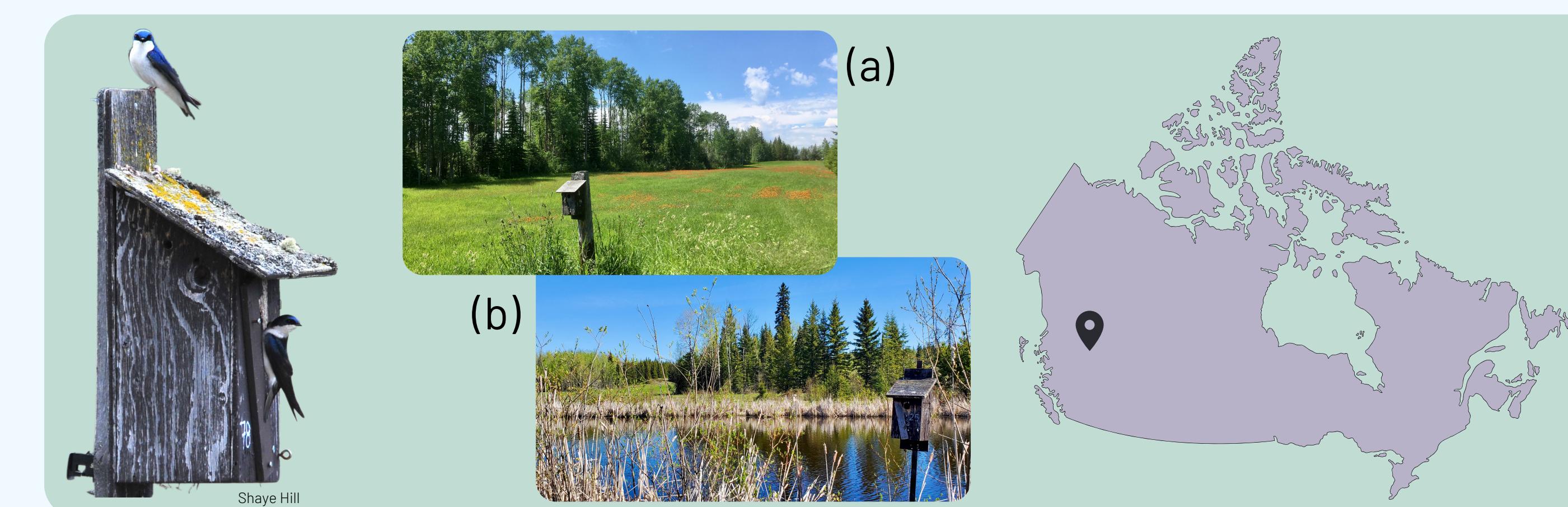
Possible factors³

- Elevated temperature
- Female age and condition
- Poor shell quality
- Genetics

This project will quantify fertility and embryonic mortality in tree swallows.

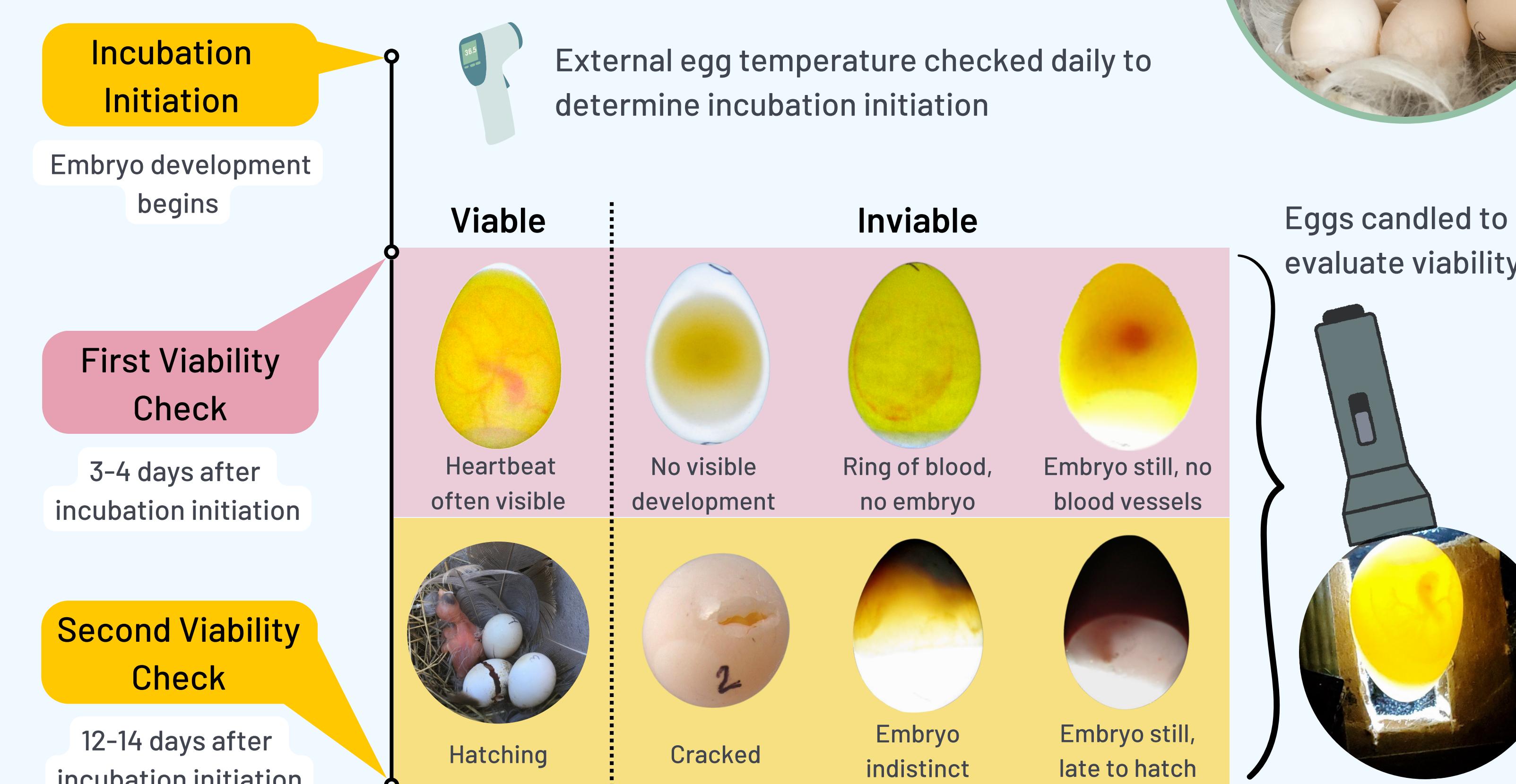
METHODS

In 2022, we monitored 475 eggs from 78 occupied nest boxes at (a) an agricultural site and (b) a managed wetland site 30 km west of Prince George, British Columbia.



Collection of Inviable Eggs

Eggs were assessed twice during incubation for viability. Inviable eggs were collected for dissection.



Egg Dissections

No Macroscopic Development

Fertility Testing

We removed the perivitelline membrane surrounding the germinal disc and used Hoechst 33342 dye to stain embryonic cells blue under fluorescent light (Fig. 1).

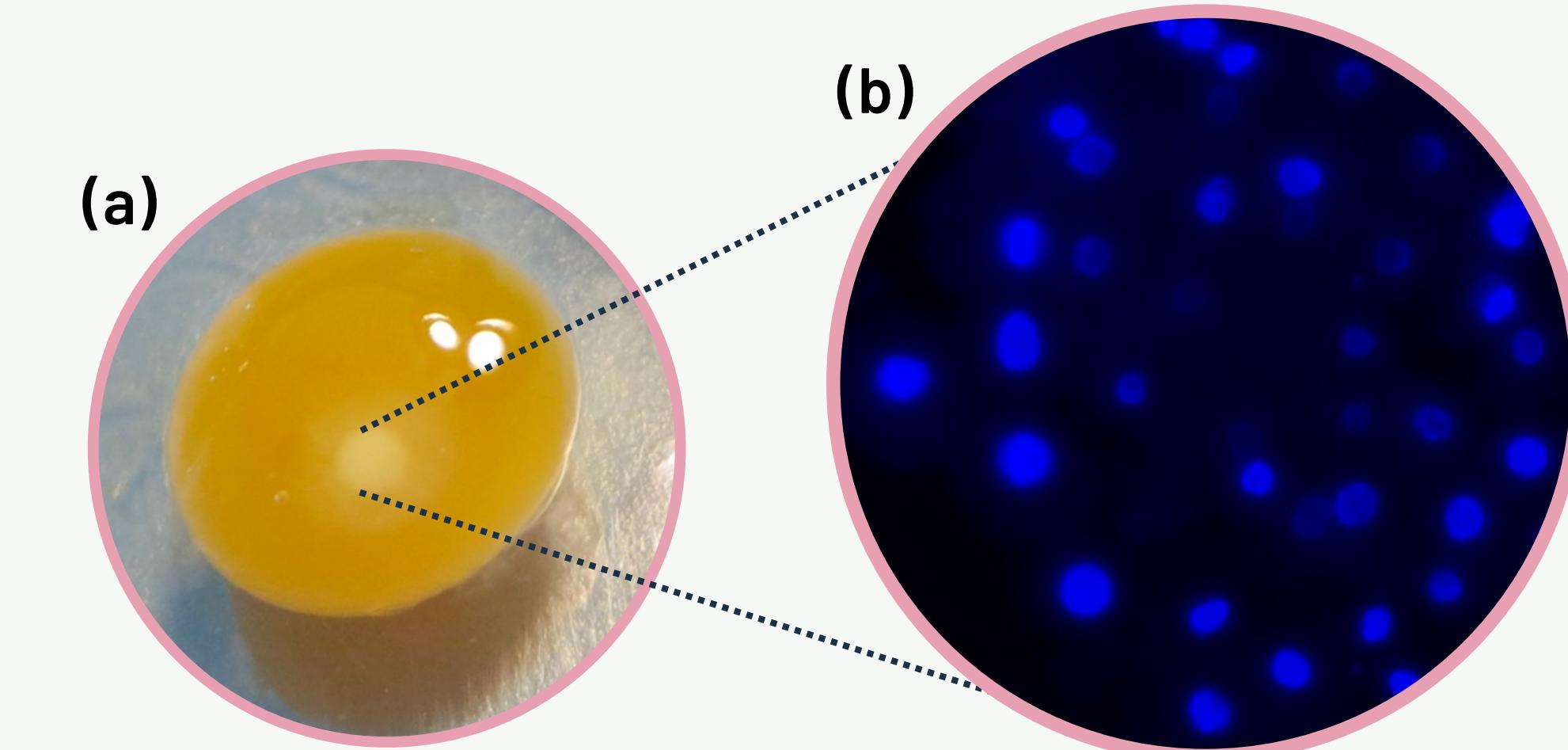
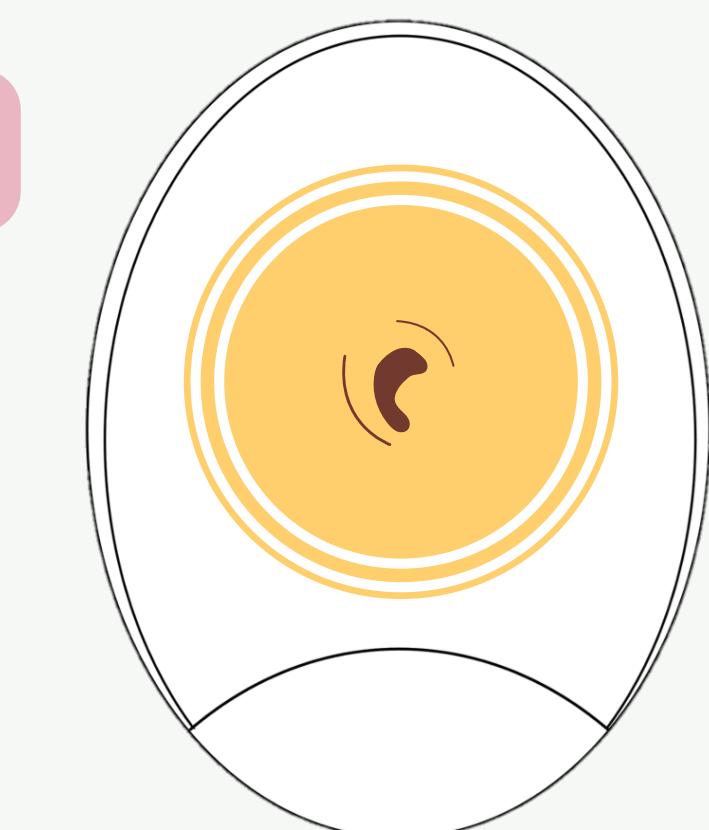


Figure 1: (a) The yolk of an abandoned, unincubated Tree Swallow (*Tachycineta bicolor*) egg contains a germinal disc with no macroscopic development. (b) Embryonic cells from the same egg were stained with Hoechst 33342 dye and imaged at 200x magnification, confirming fertility of this egg.

Macroscopic Development

Embryonic Staging

Embryos will be aged to developmental stage⁶ and date of death.



PRELIMINARY RESULTS

Depredated and abandoned clutches were excluded, leaving 435 total eggs for analysis:

- 98.6% (n = 429) were confirmed fertile
- 12.2% (n = 53) failed to hatch
 - One-third of inviable eggs did not contain macroscopic development (Fig. 2)

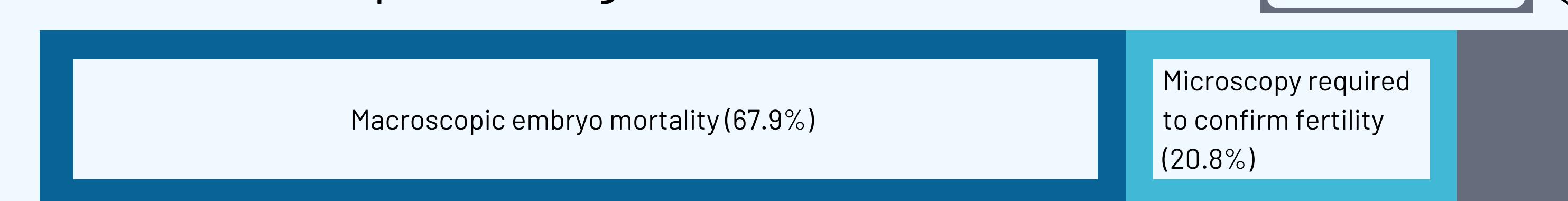


Figure 2: After excluding depredated and abandoned eggs, 53 eggs were inviable and failed to hatch. Embryos were visibly dead in 36 eggs. The remaining 17 eggs required microscopic testing to identify the presence of embryonic cells. Fertility was confirmed in 11 of these eggs. Five eggs were inconclusive due to degraded samples.

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