

Drivers of Reproductive Success in the Red-cockaded Woodpecker

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RCW recovery is a conservation success story



Reproductive success is more than whether a nest succeeds...



Eggs Laid
(10-12 Day
Incubation
Period)



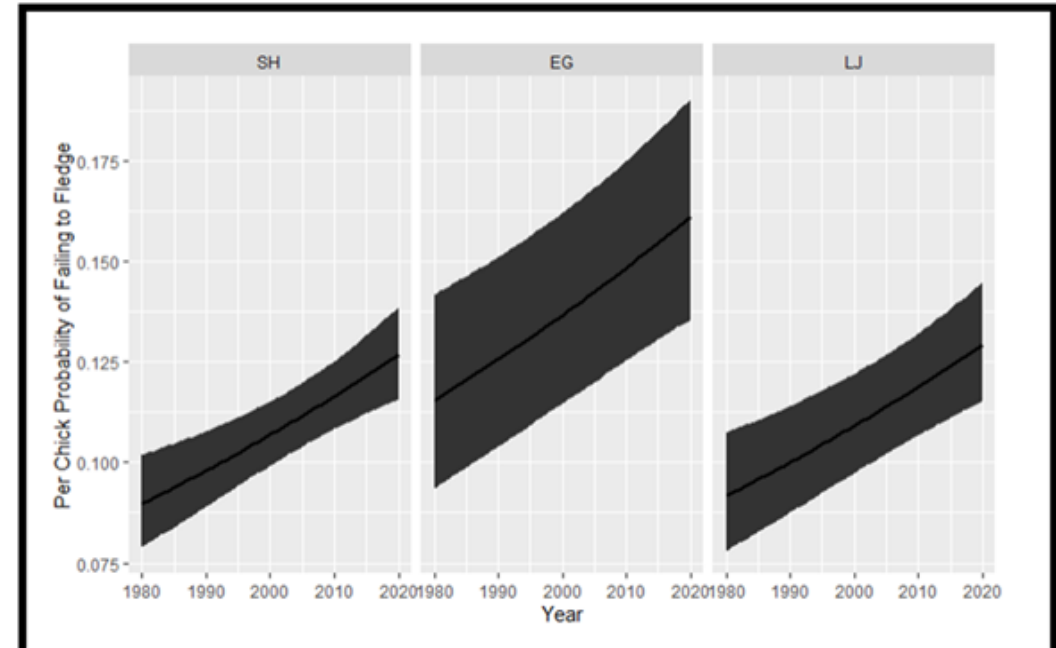
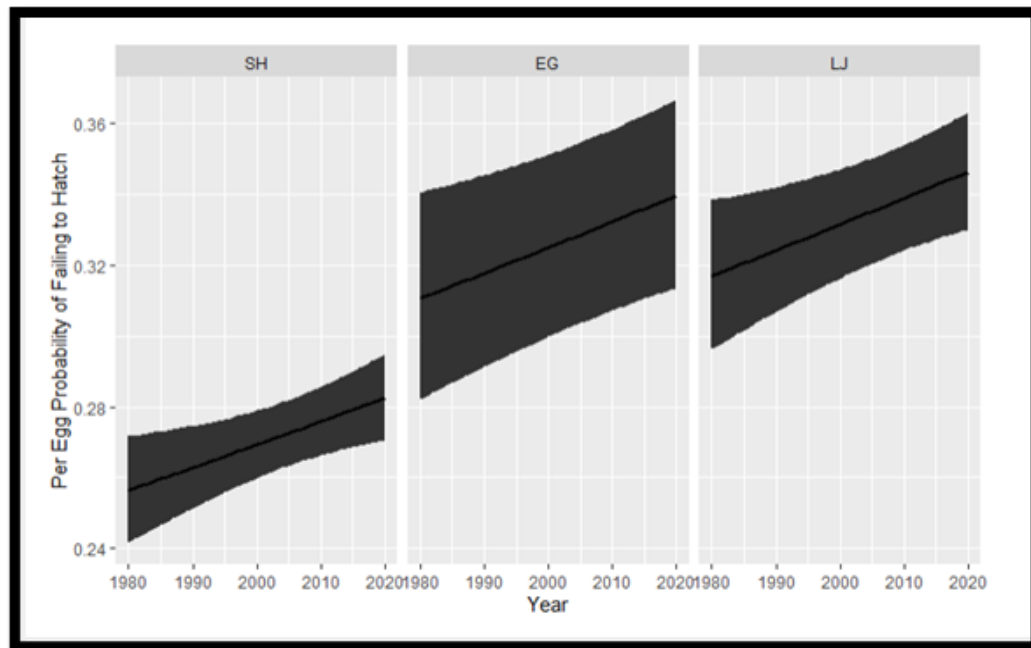
Chicks
Hatch



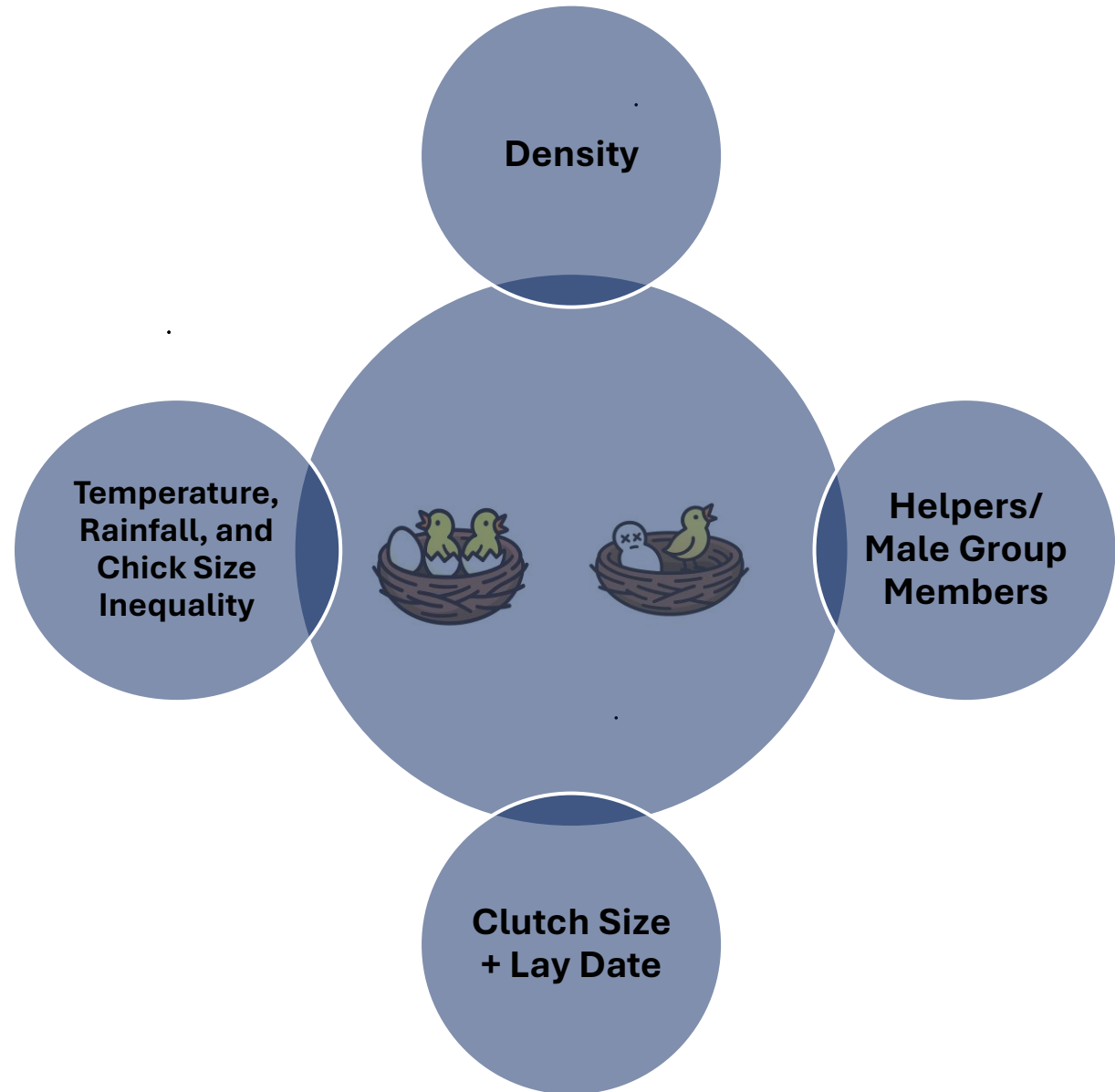
Nestlings
Banded
(Day 7-Day 8)



Nestlings
Fledge
(Day 38-40)



What could be driving brood loss?



RCW Nest Monitoring Sites (Southeastern US)

# of RCW Groups

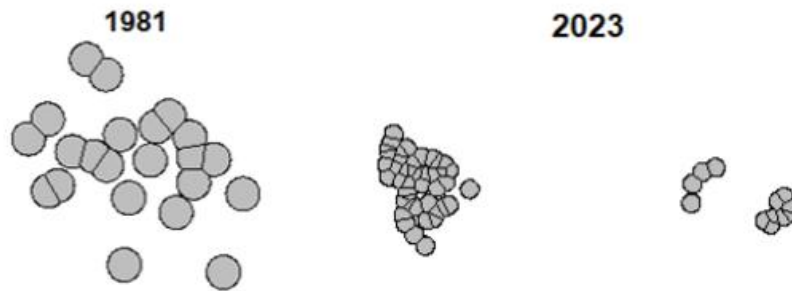
(1980-2023)

NC Sandhills: **813**Lejeune: **136**Eglin: **533**

Does increasing density reduce reproductive success?

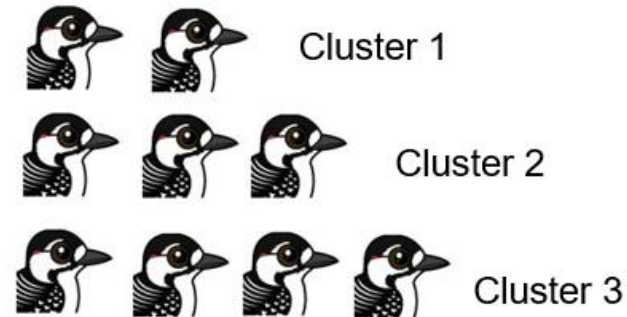
Group Density

of groups in an area



Group Size

of birds in a group



Prediction:

More groups → greater competition → greater brood loss

Result 1 - Density was not the driver

No evidence that group density predicted EPBL or LPBL.

Instead, brood loss was associated with:

larger clutches ↑

later lay dates ↑

recent years ↑

mixed-female presence ↓



Decreased in nests with more male presence



Increased in nests with larger clutches



Increased in nests with later lay dates

1980-2023

Increased in nests in later years *



Decreased in nests with more female presence *

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 Research Article



Ornithological
Applications

OXFORD

Increasing density from population recovery does not explain elevated partial brood loss in a threatened cooperative breeder

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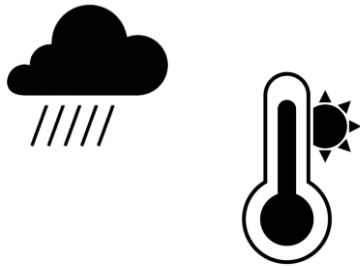
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Weather exposure changes across the breeding cycle



Climate drivers (temp, rain) → laying → incubation → post-hatch → brood outcomes

Weather exposure changes across the breeding cycle



Climate drivers (temp, rain) → **laying** → incubation → post-hatch → brood outcomes



>26 °C / 78 °F → heat risk for eggs, can trigger premature embryo development

Weather exposure changes across the breeding cycle



Climate drivers (temp, rain) → laying → **incubation** → **post-hatch** → brood outcomes



>40 °C / 104 °F → high temps can overheat embryos,
nestlings can't regulate body heat early

Weather exposure changes across the breeding cycle



Climate drivers (temp, rain) → laying → incubation → post-hatch → **brood outcomes**

Weather exposure changes across the breeding cycle



Climate drivers (temp, rain) → **laying** → **incubation** → **post-hatch** → brood outcomes

Result 2 - Heat emerged as the stronger climatic signal for early loss

Higher post-hatch maximum temperatures → ↑ EPBL

Rainfall: little evidence of an EPBL effect

Temperature: effects varied among populations and breeding stages



SH

Increased with higher
post-hatch max temps



SH

Increased in nests
with later lay dates



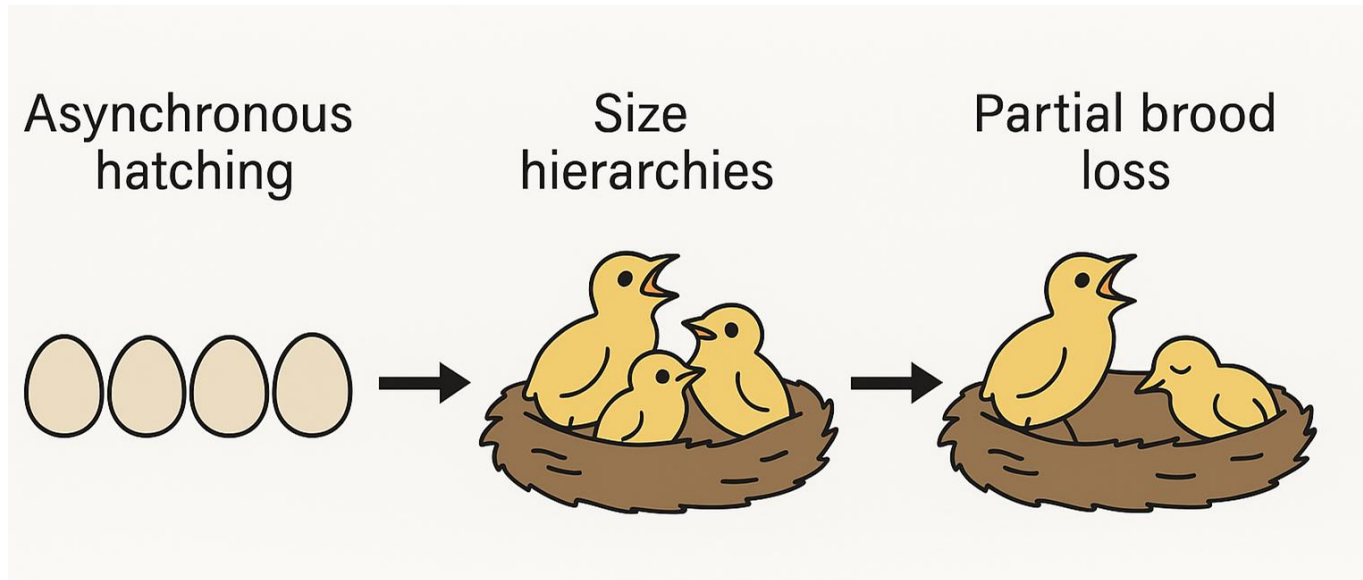
Increased in nests
with larger clutches



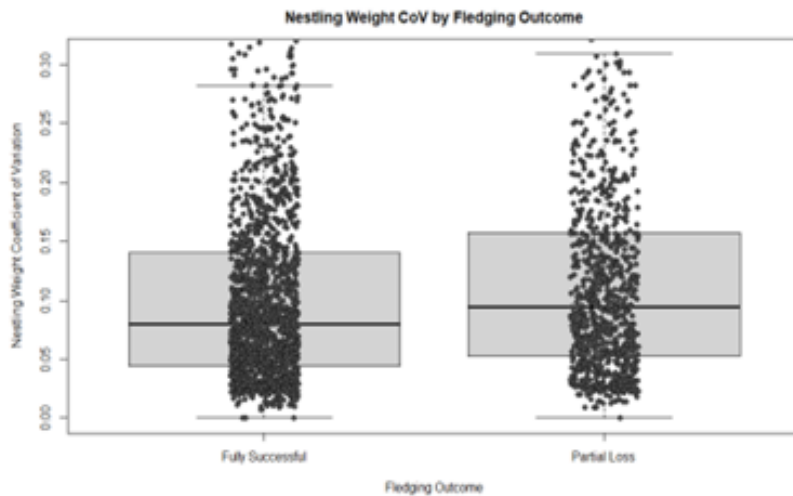
SH & LJ

Decreased in nests
with more male
presence

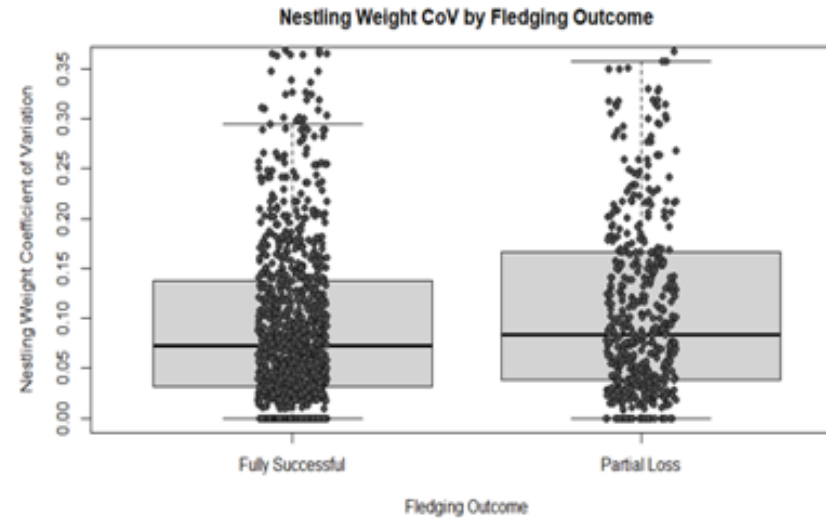
Not all chicks within a brood are starting from the same place



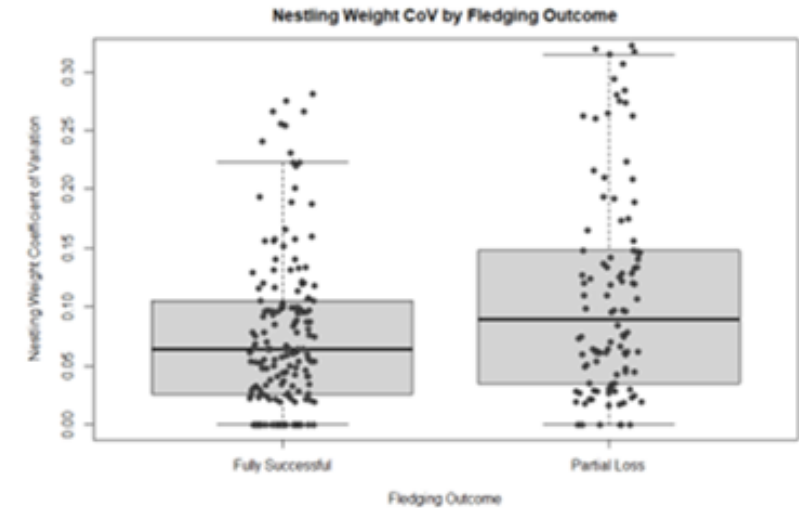
Within-brood inequality predicts vulnerability



Sandhills



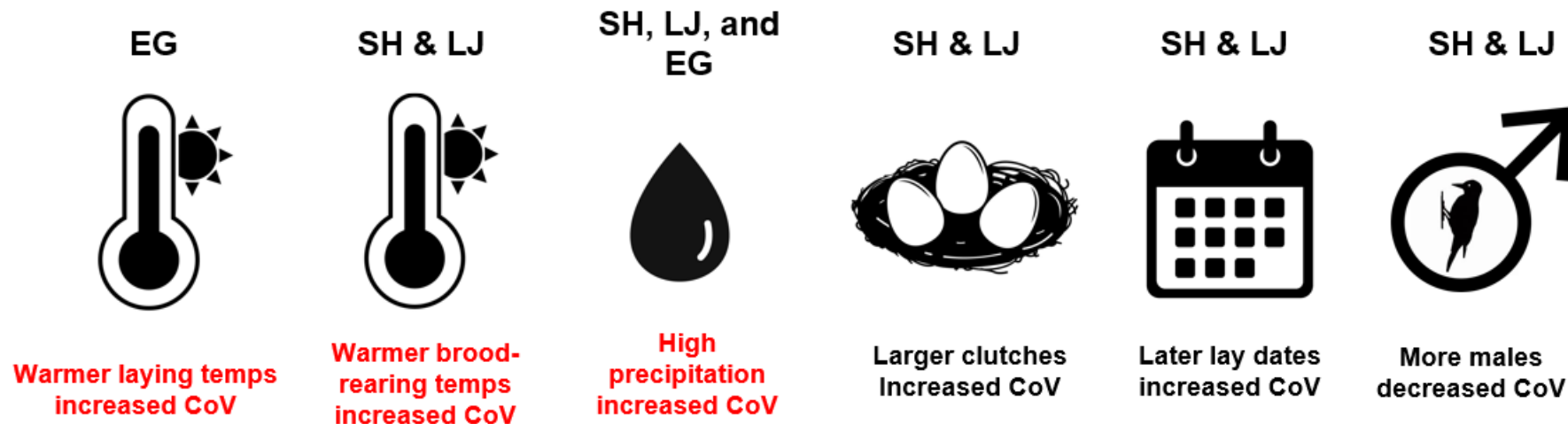
Lejeune



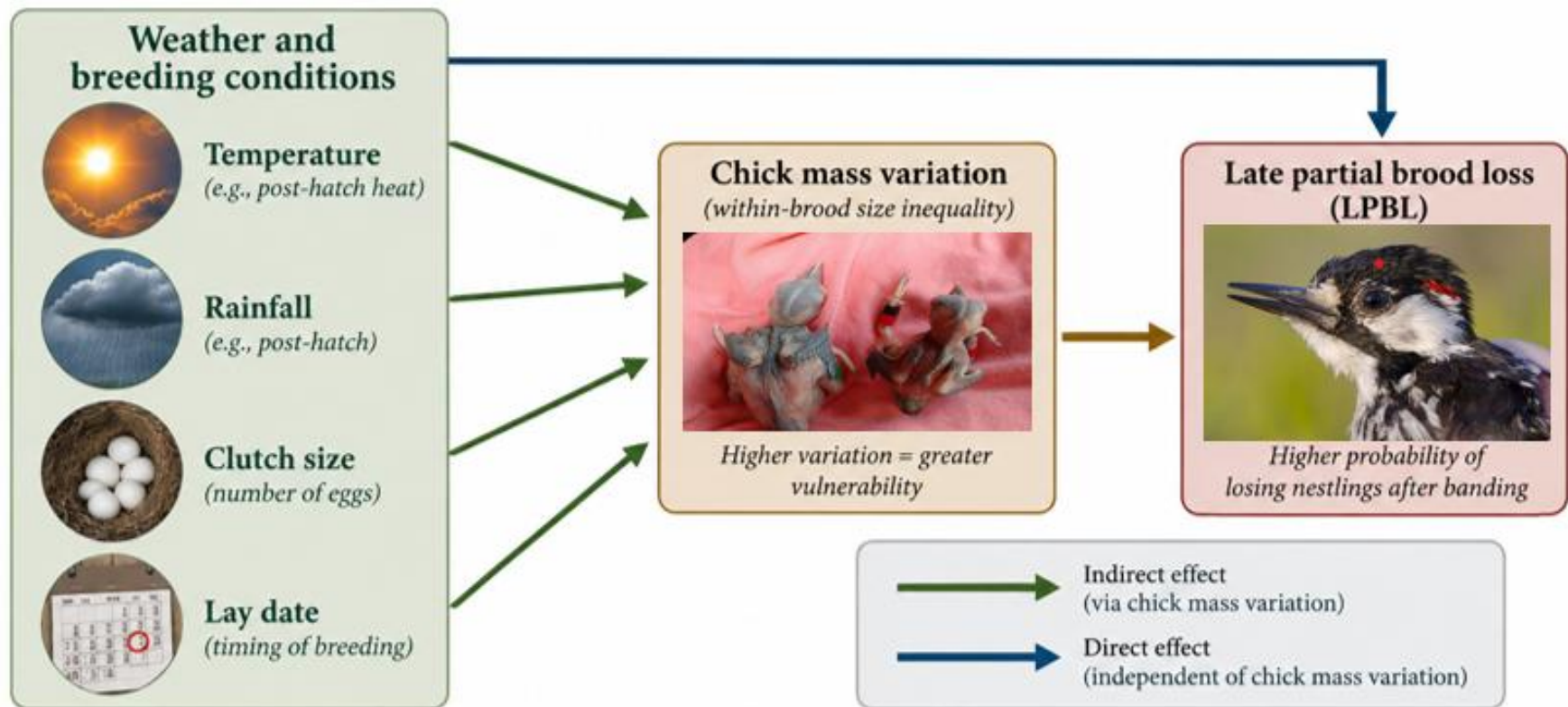
Eglin

Result 3 - Chick mass variation was one of the clearest predictors of late loss

Across all three populations:
Greater chick mass variation → greater probability of LPBL



Weather can act directly, and indirectly through brood condition



One signal kept appearing across the dissertation



Social Group Composition

More males = lower brood-loss risk



**What does
this mean for
conservation?**

Recovery isn't just about how many groups we have.

- **Continue long-term monitoring**
 - Population growth $\neq$ reproductive health.
- **Track breeding phenology**
 - Later nests face greater risk.
- **Monitor nestling condition**
 - Size inequality may signal brood loss.
- **Consider social structure**
 - Additional males may increase resilience.
- **Expect site-specific responses**
 - Climate effects vary among populations.

Thank You!

Questions?

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