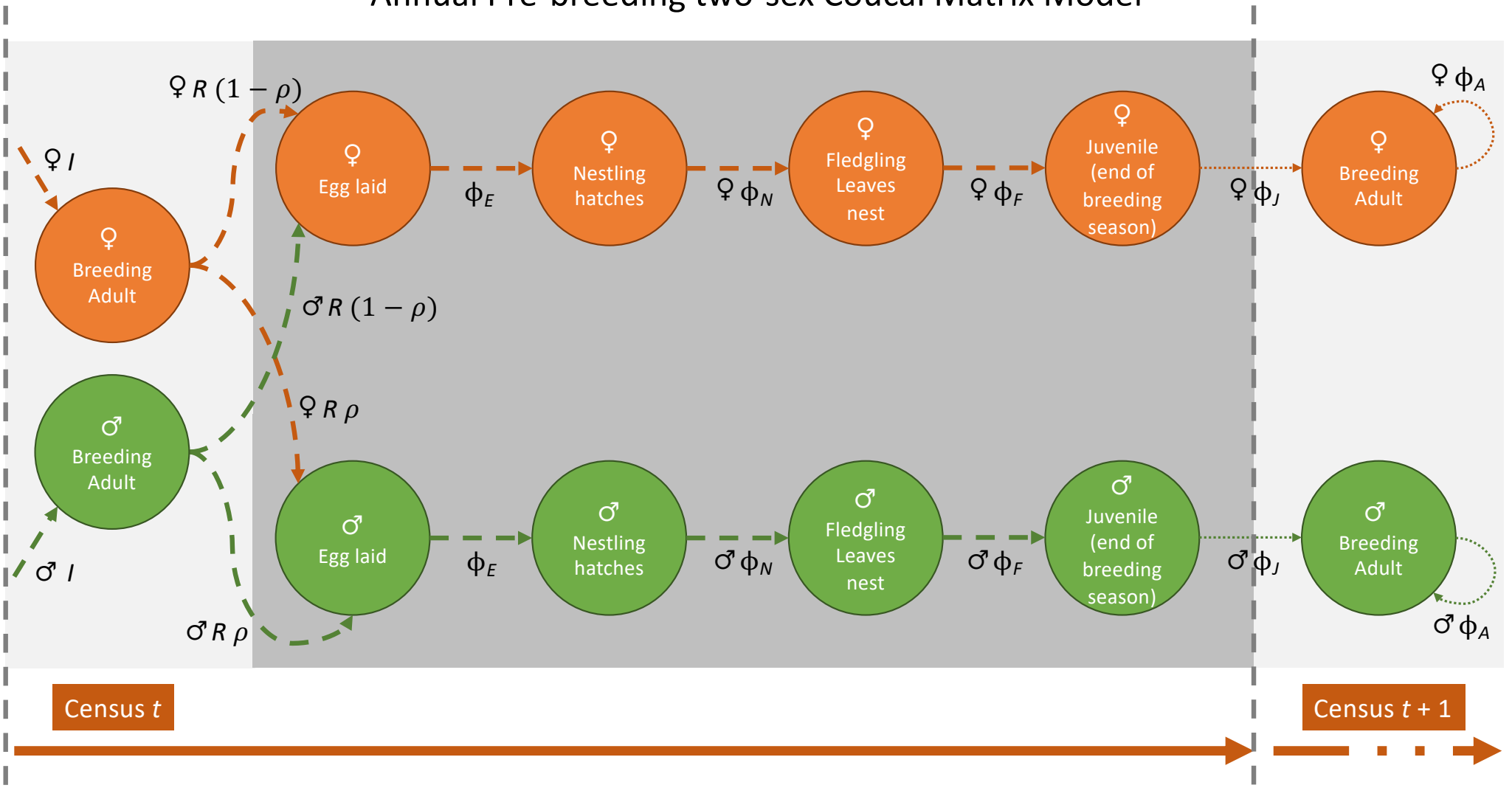
Annual Pre-breeding two-sex Coucal Matrix Model



Two-sex Leftkovitch Matrix Model

$$\mathbf{M} = \begin{bmatrix} 0 & R_{♀}(1-\rho) & 0 & R_{♂}(1-\rho) \\ S_E \times S_{N♀} \times S_{F♀} & \phi_{A♀}) & 0 & 0 \\ 0 & R_{♀}\rho & 0 & R_{♂}\rho \\ 0 & 0 & S_E \times S_{N♂} \times S_{F♂} & \phi_{A♂}) \end{bmatrix}$$

Temporal projection

$$\boldsymbol{n}_t = \mathbf{M} \bullet (\boldsymbol{n}_{t-1} + \mathbf{I})$$

Female frequency dependent Reproduction

$$R_{♀}(n_{♂}, n_{♀}) = \frac{k n_{♂}}{n_{♂} + n_{♀} h^{-1}}$$

Male frequency dependent Reproduction

$$R_{♂}(n_{♂}, n_{♀}) = \frac{k n_{♀}}{n_{♂} + n_{♀} h^{-1}}$$

Population Distribution

$$\boldsymbol{n} = \begin{bmatrix} n_{♀\,\text{Juvenile}} \\ n_{♀\,\text{Adult}} \\ n_{♂\,\text{Juvenile}} \\ n_{♂\,\text{Adult}} \end{bmatrix}$$

Immigrant Distribution

$$\boldsymbol{I} = \begin{bmatrix} 0 \\ (Q-1) \times I_{♀} \\ 0 \\ Q \times I_{♂} \end{bmatrix}$$

Nestling and Fledgling Survival process

$$S_{N♀} = \prod_{i=h}^{a} S_{N♀\,h} \cdot S_{N♀\,h+1} \cdot S_{N♀\,h+2} \cdot \cdots \cdot S_{N♀\,a-1} \cdot S_{N♀\,a}$$ "nestling"

$$S_{\text{pre}♀} = \prod_{i=a}^{f} S_{F♀\,a} \cdot S_{F♀\,a+1} \cdot S_{F♀\,a+2} \cdot \cdots \cdot S_{F♀\,f-1} \cdot S_{F♀\,f}$$ "groundling"

$$S_{\text{post}♀} = \prod_{i=f}^{c} S_{F♀\,f} \cdot S_{F♀\,f+1} \cdot S_{F♀\,f+2} \cdot \cdots \cdot S_{F♀\,c-1} \cdot S_{F♀\,c}$$ "fledgling"

Constant Distributions

Egg survival
$S_E = N(\mu, \sigma)$

Prop. Male immigrants
$Q = N(\mu, \sigma)$

Mating system
$h = N(\mu, \sigma)$

Hatching sex ratio
$\rho = N(\mu, \sigma)$

Clutch size
$k = N(\mu, \sigma)$

Mating System

$$h = \frac{1}{N\ (\mu, \sigma)}$$

Clutch size and hatching sex ratio

Hatching sex ratio $\rho = N\ (\mu, \sigma)$

Clutch size $k = N\ (\mu, \sigma)$

Safari-Mnganya, Ignas

February 6, 2020 at 17:04

Details

IS

Re: Coucal survival data

To: Eberhart-Phillips, Luke, Cc: Wolfgang Goymann

Dear Luke,
The hatching sex ratios (mean[95%CI]) are as follows;
Black coucals 0.4955[0.4577 - 0.5334]
White-browed coucals 0.5198 [0.4751 - 0.5643].

the average clutch sizes (mean[95%CI]) as as follows,
black coucals 4.18 [3.83 - 4.54] and white-browed coucals 4.19[3.84-4.53]
The later estimates are from Goymann et al 2015 Social monogamy vs. polyandry.
best regards,
safari

See More from Safari-Mnganya, Ignas

Nest survival

Egg survival

$S_E = N\ (\mu, \sigma)$

Wolfgang Goymann July 22, 2020 at 17:16

Re: Egg survival rate?

To: Eberhart-Phillips, Luke, Safari-Mnganya, Ignas

Hi Luke,

in the JEB paper (Goymann et al. 2015) in Table 4 you can see the number of eggs versus the number of young for both species. In that paper you can also see nest predation (p. 1345), the rate of which is for black coucals: 0.49 [0.40–0.56] (credible intervals), and for white-browed coucals 0.32 [0.23–0.40]). Most of the difference in nest predation rates comes from egg predation during the incubation stage. the rate is 0.32 [0.25–0.39] for black coucals and 0.18 [0.11–0.25] for white-browed coucals.

Does that help?

best Wolfi

See More from Eberhart-Phillips, Luke

Immigration sex ratio

Assumption: observed breeding sex ratio is the immigration sex ratio

Prop. Male immigrants

$$Q = N\ (\mu, \sigma)$$

Wolfgang Goymann July 17, 2020 at 08:42

adult sex ratios

To: Eberhart-Phillips, Luke

Siri found new contact info Wolfgang Goymann goymann@orn.mpg.de add...

Hi Luke,

that was a nice little party yesterday and I enjoyed chatting with you and Anne.

Safari once extracted the ASRs from the coucal paper 2015: for black coucals it is 0.738+/-0.037 and for white browed coucals it is 0.524+/-0.027

best wishes

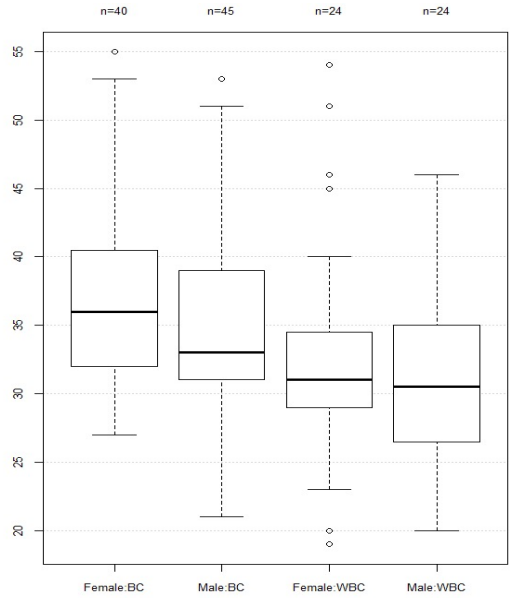
Wolfgang

Stages of ontogeny

"Nestling phase" from hatch to leaving nest

left the nest or the nest was depredated. Black coucal young typically leave the nest when they are about 13 days old and white-browed coucals when they are about 14 days old (Goymann et al. 2015, 2016). For the purpose of this study,

"Groundling phase" from leaving nest to first flight:



"Fledgling phase" from first flight to 70th day (i.e., the end of the sampling period for radio tracked offspring)

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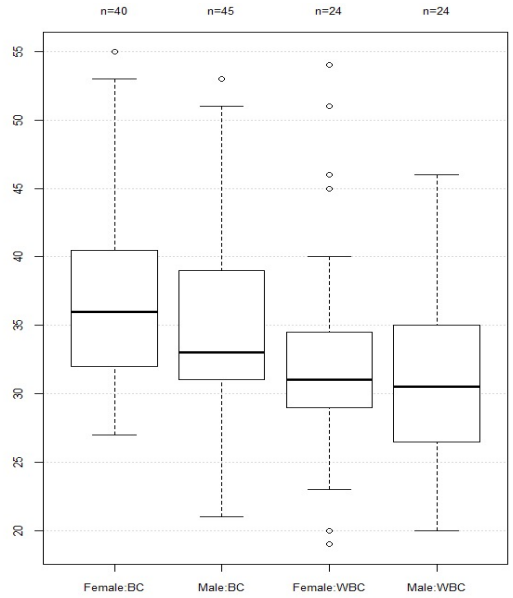

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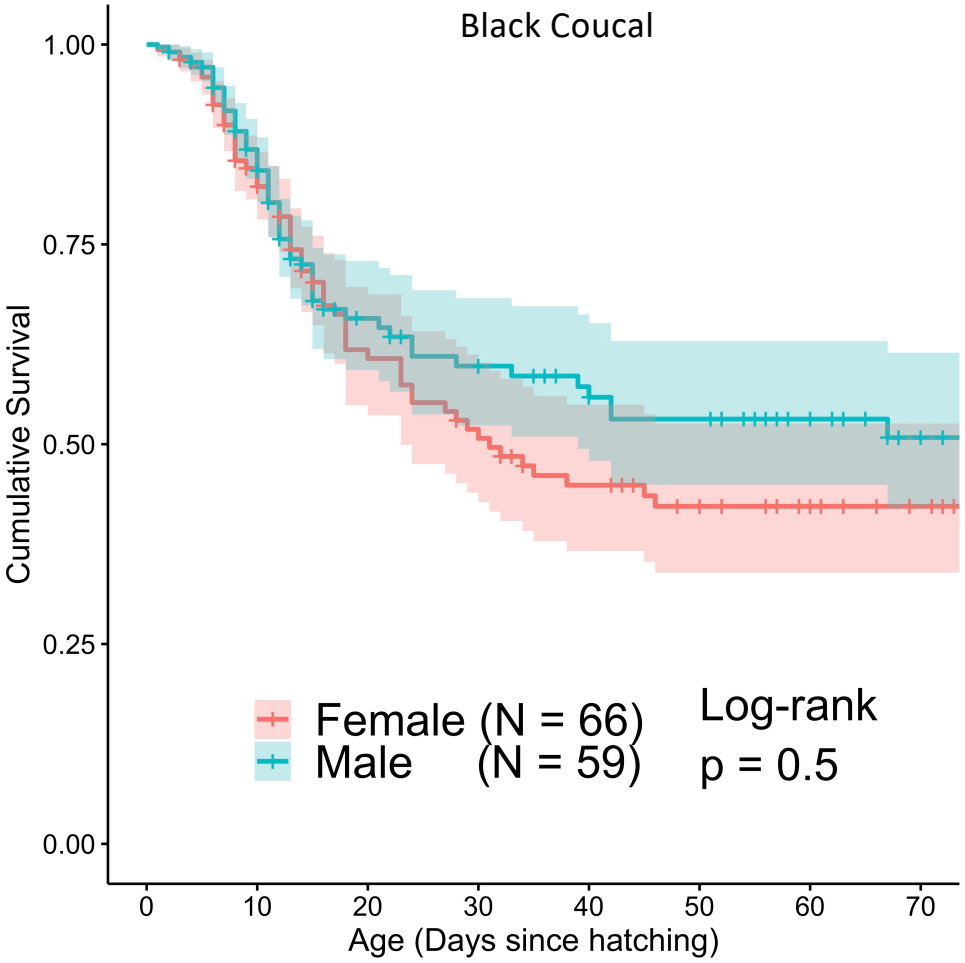
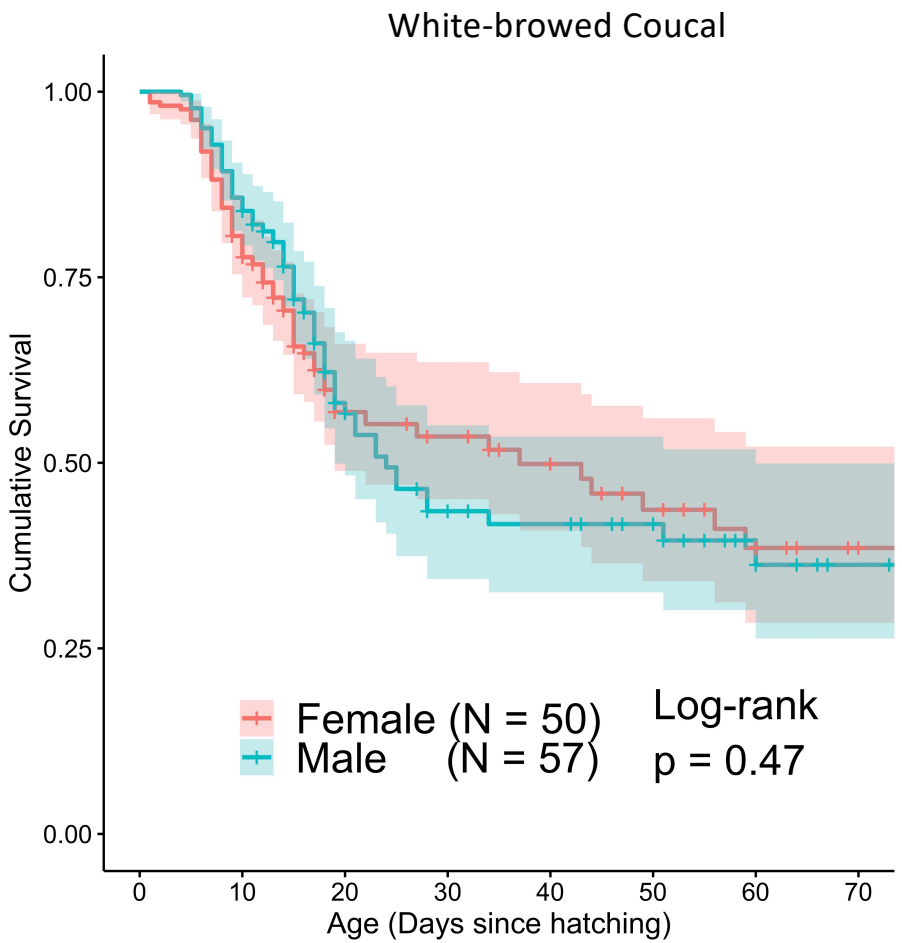
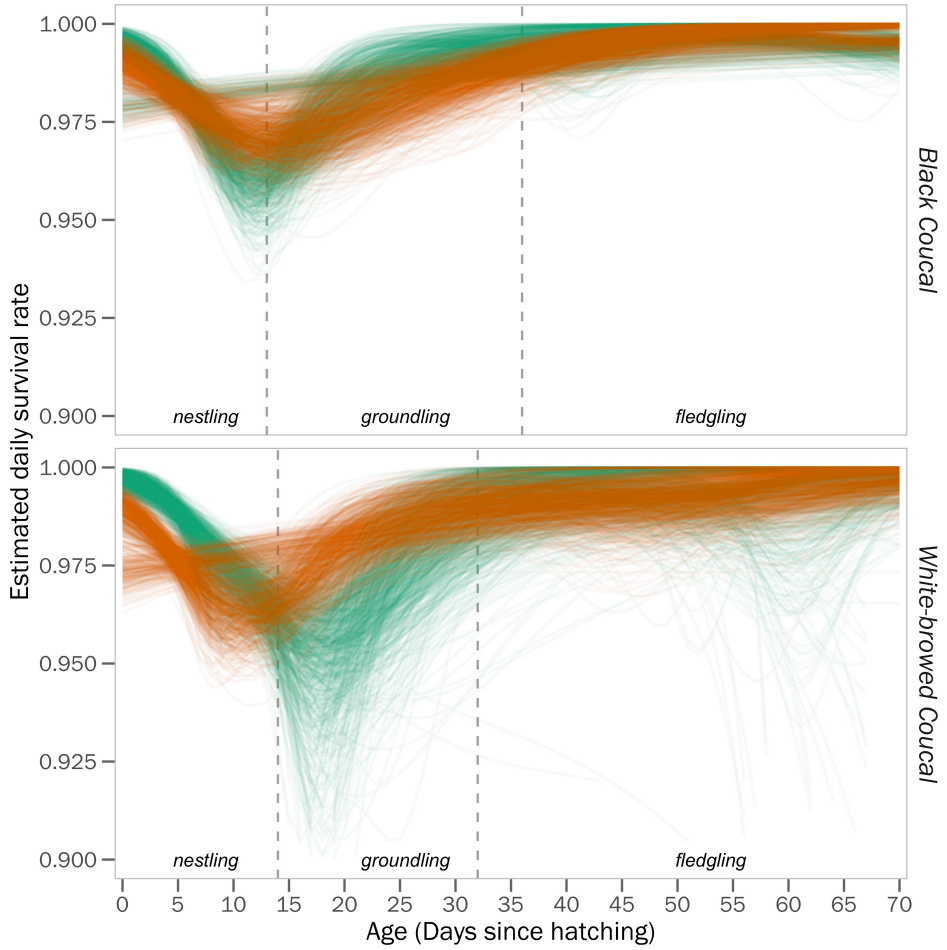
Cumulative survival functions



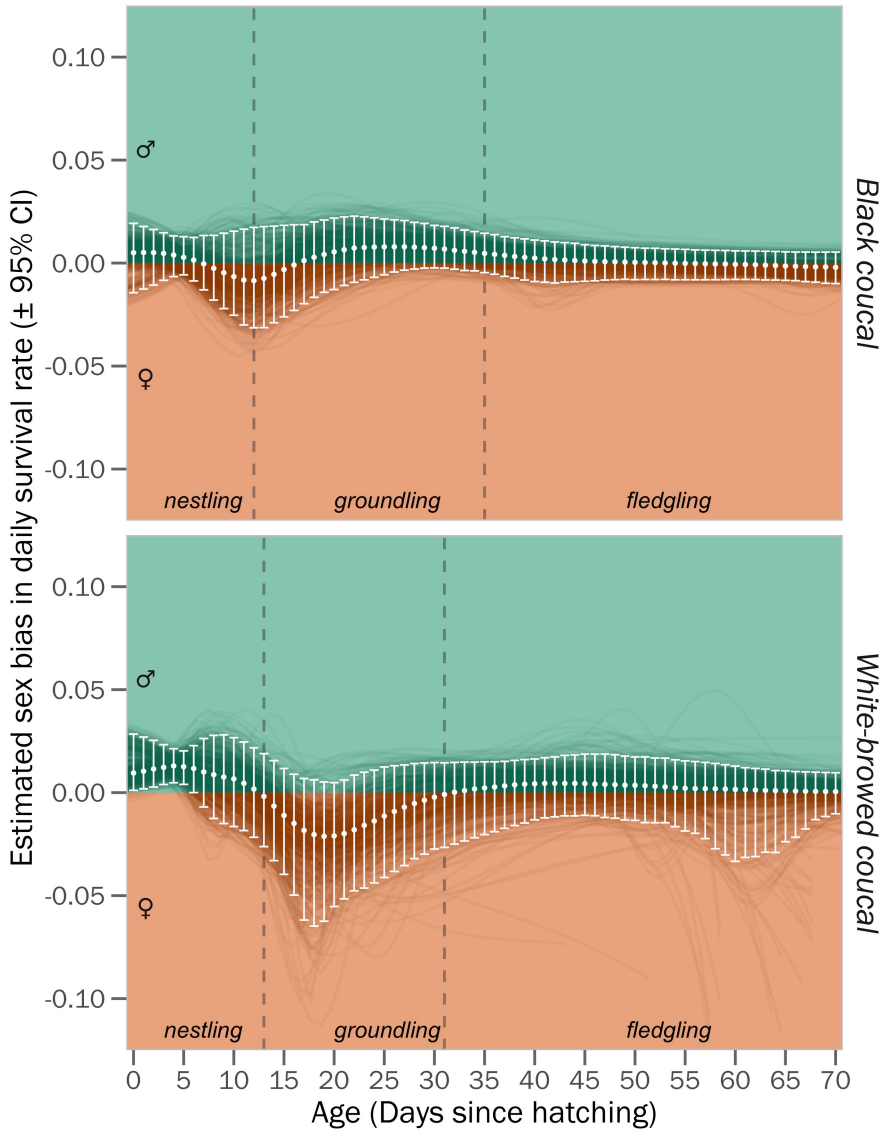


Daily age-specific survival rates of offspring

Smoothed spline of hazard function of the cumulative survival curves



Daily sex differences in survival

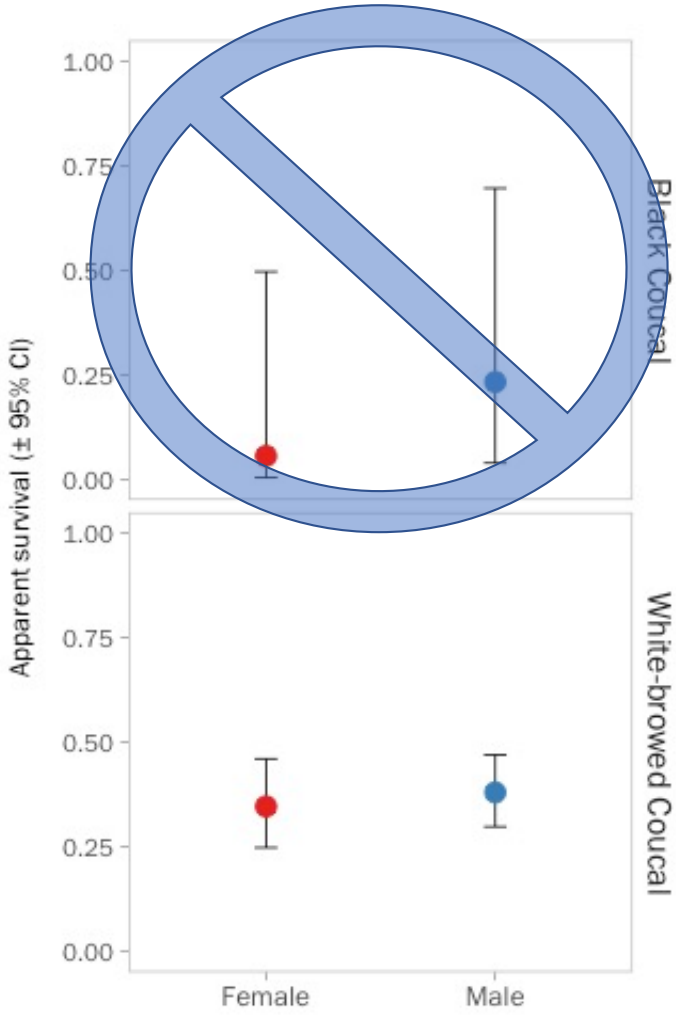


Sex specific adult survival

Black Coucal: 151 females and 129 males (only 1 female and four males that have ever re-encountered between years)

White-browed Coucal: 57 females and 87 males (19 females and 27 males that have been re-encountered between years, with perfect detection)

Conservatively assume that the sex-specific survival rates of BC are the same as WBC (i.e., sampling is way too low for meaningful estimates for BC)

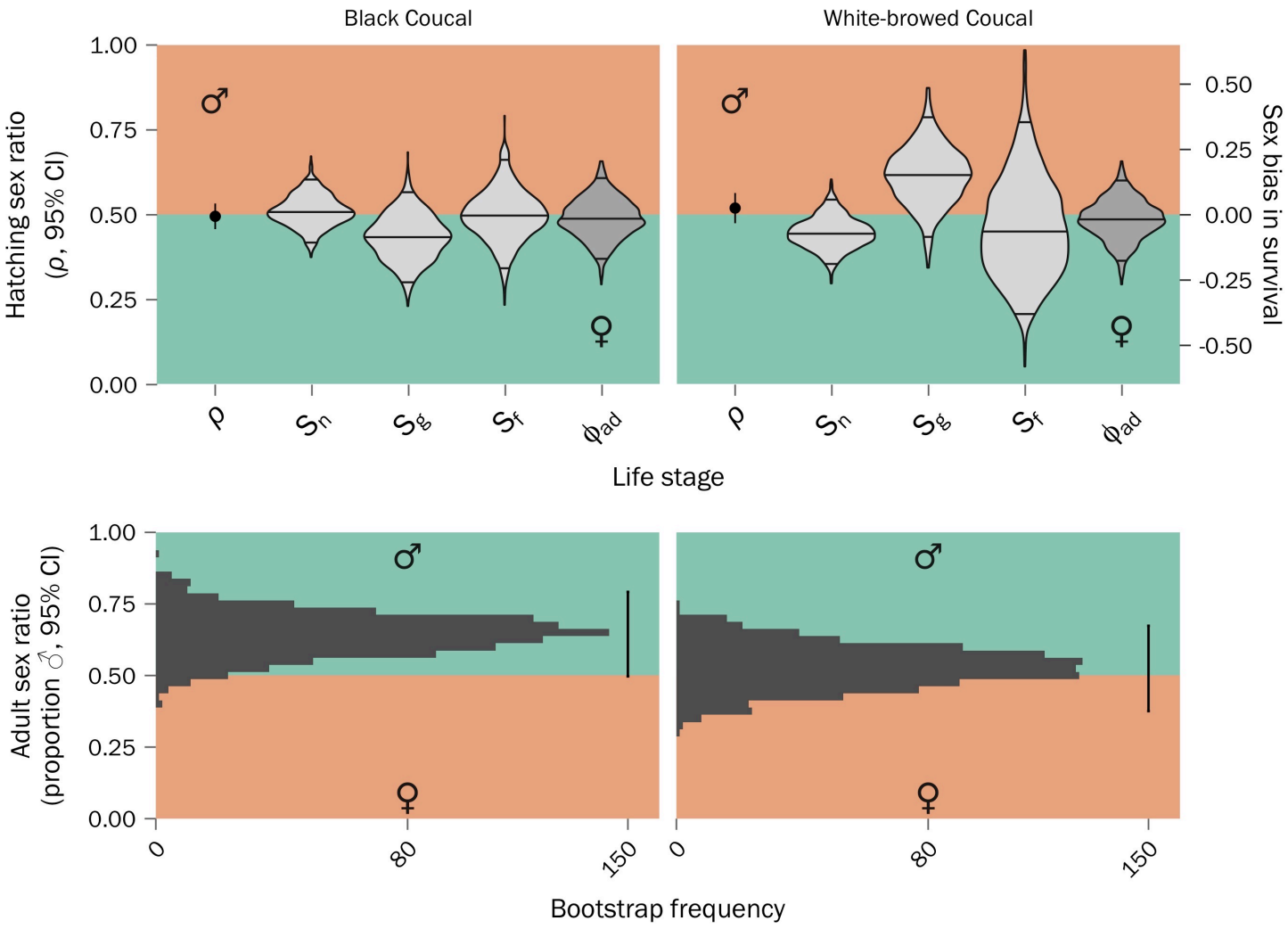


Matrix model results

ASR estimates look reasonable and match *a priori* expectation

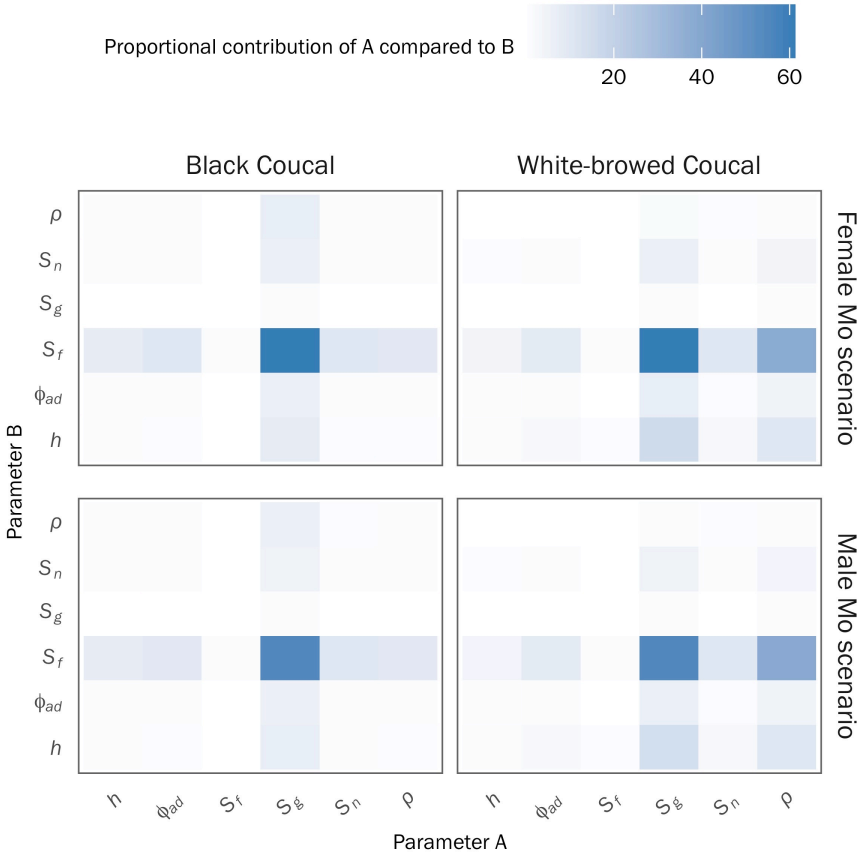
Try:

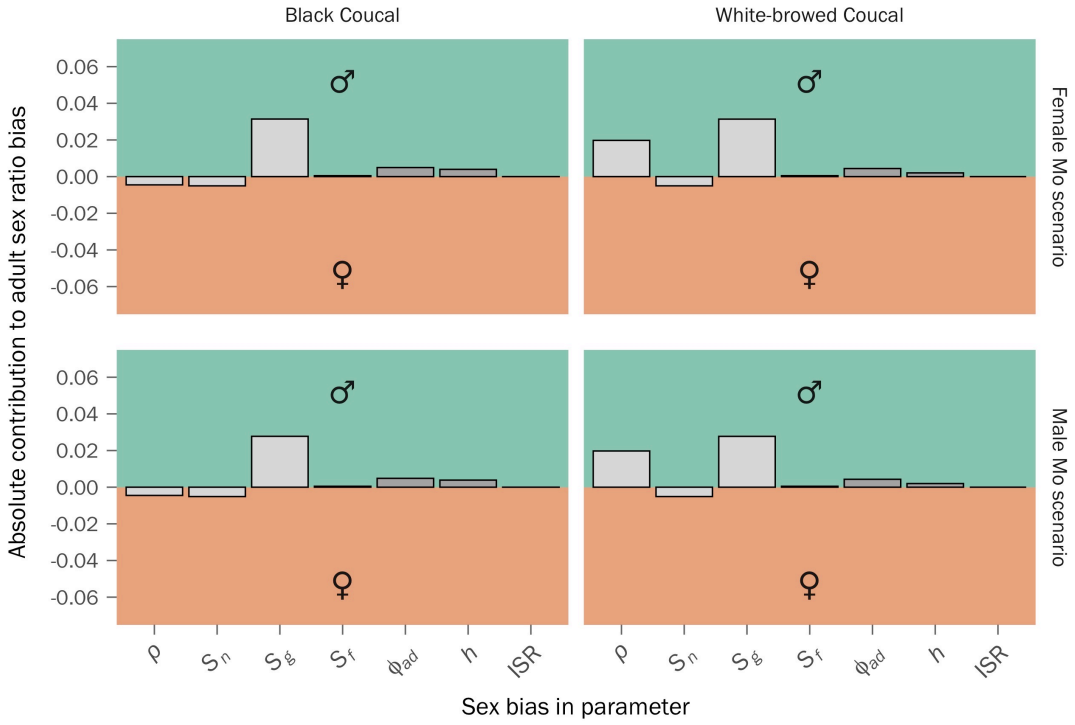
- 50/50 HSR
- Look into the adult radio tag data to estimate survival



At what point in coucal life history do sex differences in demography matter?

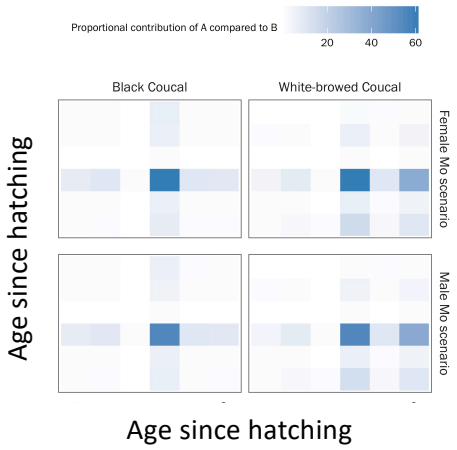
- sex-biased survival during the groundling phase was most important *in both species*
- Male-biased HSR in WBC seems to counter-balance the effect of female-biased groundling survival





Next steps…

- Apply the sensitivity analysis to a single season model to see exactly which age (i.e., days after hatching is most) important for the Juvenile Sex Ratio (JSR)
- Heat map of all daily ages after hatch



- Link to growth data after leaving the nest (i.e., similar to Lina's analysis on the nestlings)
- Link to movement analysis (already finished)