Weight Vs Colony Size Results with instar as numeric

Ruth Sharpe

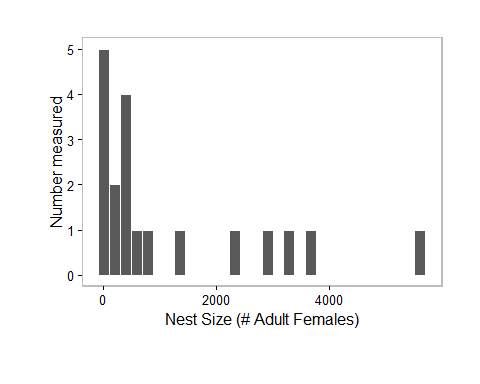
22 December, 2016

## Count of number of spiders

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Adult | Sub2 | Sub1 | Juv4 | AdMale | SubMale |
| 401 | 250 | 284 | 233 | 106 | 32 |

*Count of the number of spiders weighed and measured*

## Histogram of nest sizes measured



1. *Figure :Histogram of the size of nests measured*

## Leg length against colony size

The model with the lowest AIC value included the two-way interaction colony size by instar age and the three-way interaction colony size by instar age by instar sex as fixed effects, but did not include the instar age by instar sex interaction (table 2). After confirming, not surprisingly, that leg length was highly correlated with instar age (lmer; 2~4 ,7~= 4342.93, p = < 0.001 \*\*\* ), we found that

leg length increased increases as colony size increased (lmer; 24 ,7= 63.64, p = < 0.001 \*\*\* , (figure 2),

but there was a significant two-way interaction between colony size and instar age (lmer; 2~5 ,7~= 53.57, p = < 0.001 \*\*\* )

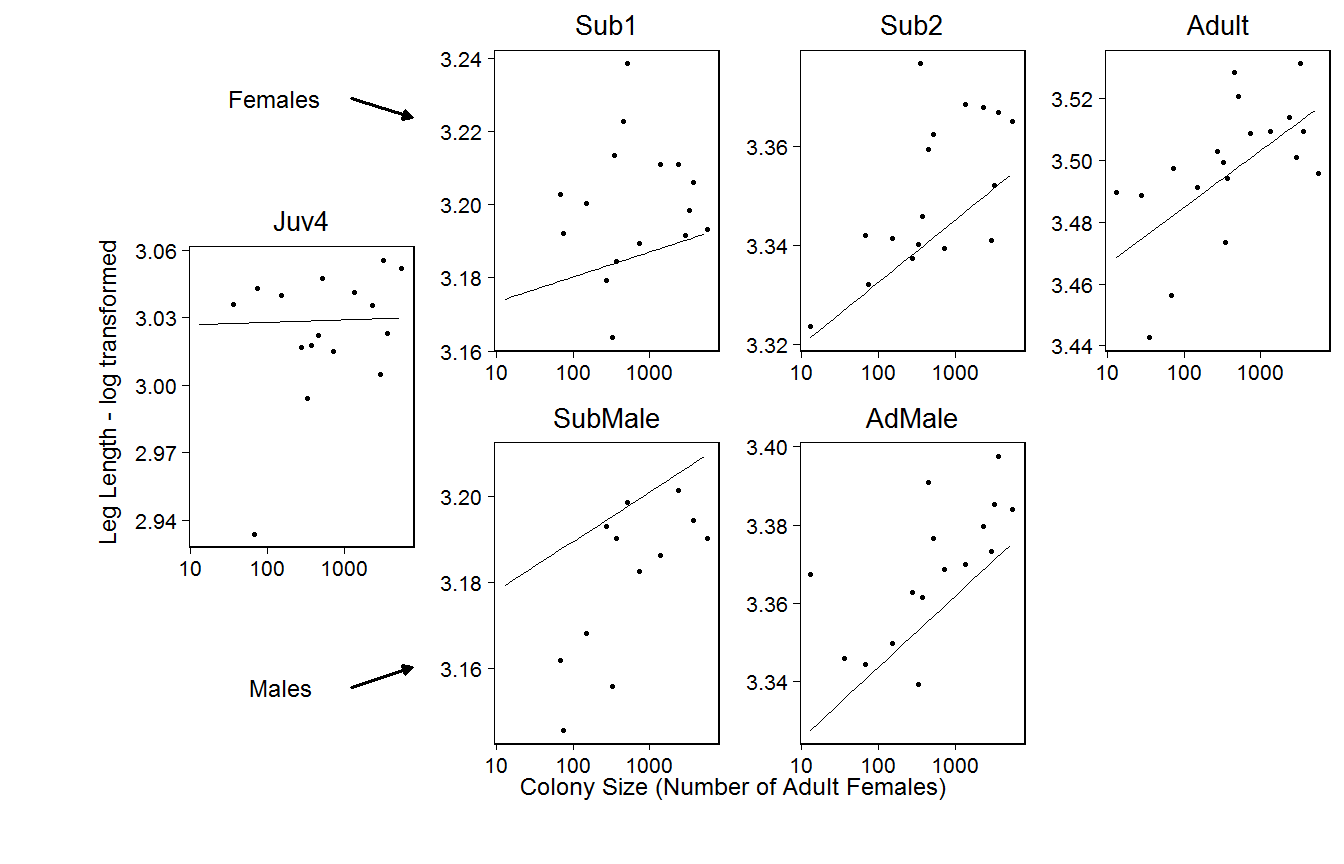
and a significant three-way interaction between colony size, instar age and instar sex (lmer; 26 ,7= 30.4, p = < 0.001 \*\*\* ).

Due to this significant interaction we preformed tests on each instar individually. We found that leg length increased with colony size in the older instars, but not significantly so in the younger ones ,  
(figure 2).

*Table 1: Results of individual analysis of leg length against colony size for each instar. Leg length increases as colony size increases, but when tested individually is significant only for the older instars.*

|  |  |  |  |
| --- | --- | --- | --- |
| Instar | Instar Age | 2 | p value |
| Juv4 | 4 | 1.48 | 0.224 |
| Sub1 Female | 5 | 0.29 | 0.588 |
| Sub2 Female | 6 | 10.66 | < 0.001 \*\*\* |
| Adult Female | 7 | 8.54 | 0.003 \*\* |
| Sub Male | 5 | 6.7 | 0.01 \*\* |
| Adult Male | 6 | 11.8 | < 0.001 \*\*\* |

Note: If line on graph is blue R could not plot the lmer, plotting a simple lm instead[1] "lmer"



1. *Figure: Leg length against colony size with the full linear model superimposed. Overall leg length increased with* *colony size (p = < 0.001 \*\*\* ), but, as there was a significant interaction between colony size and instar, post-hoc tests in instars individually showed that only the older instars were significant. n = 19 colonies.*

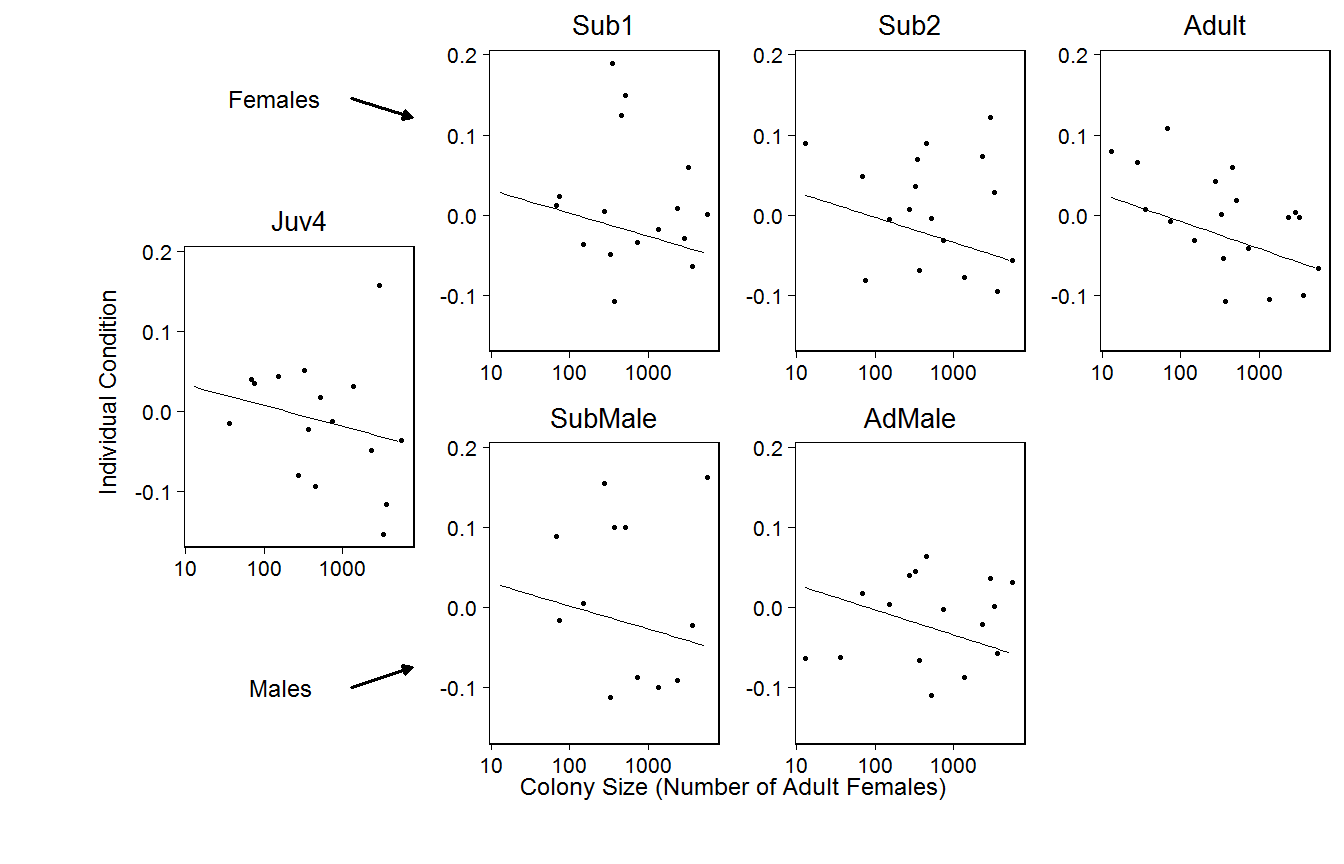
## Individual condition against colony size

The model with the lowest AIC value included only one interaction term, instar age by colony size and did not include instar sex or instar age as fixed effects (table 2) . Colony size was significant (lmer; 23,5 = 11.12, p = 0.004 \*\* ) with individual condition decreasing as colony size increased (figure 3).

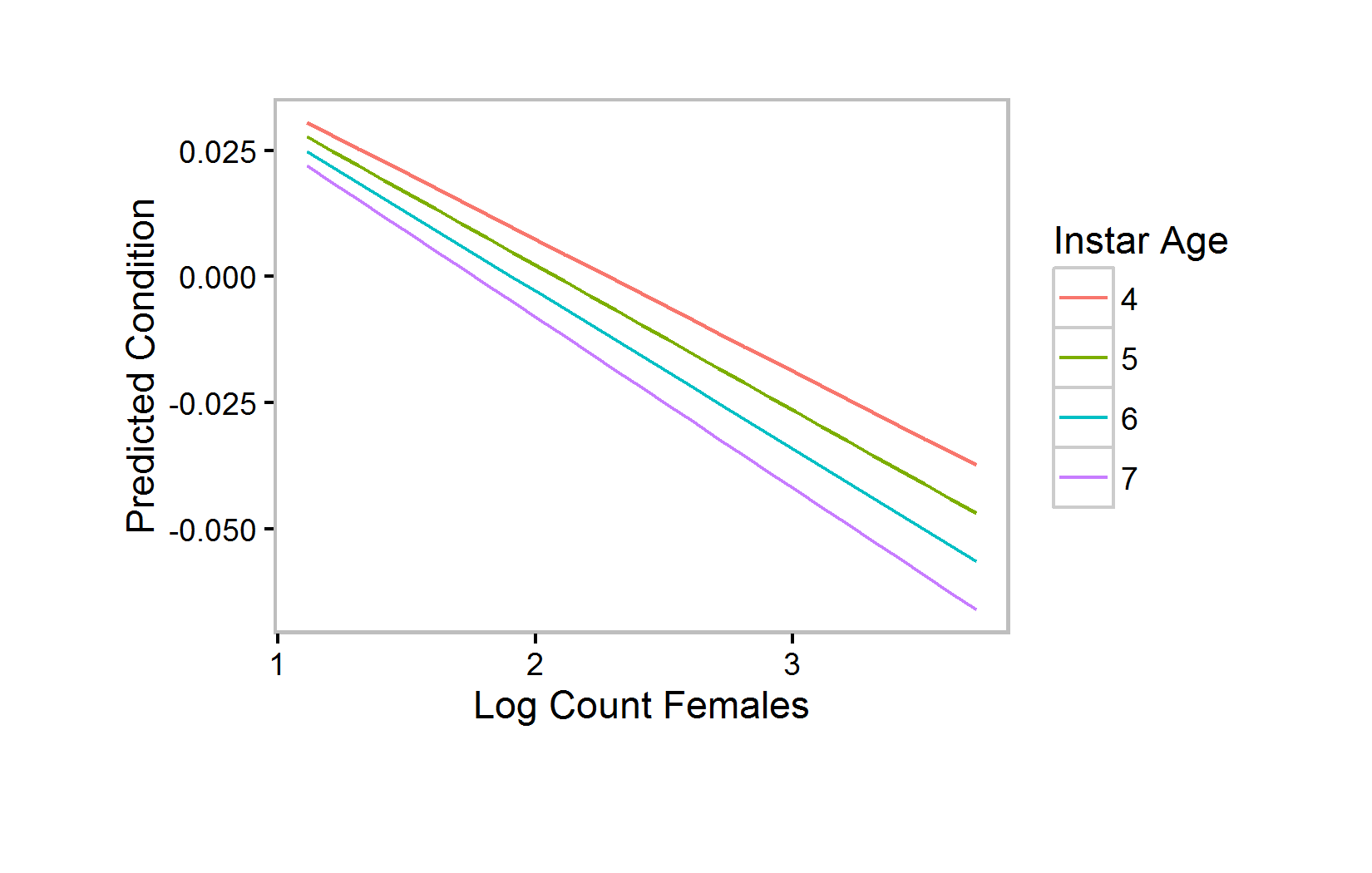
There was a significant interaction between instar age and colony size (lmer; 2~4, 5~ = 6.76, p = 0.009 \*\* ), with condition appearing to decrease at a faster rate with colony size as the instar age increases (figure 4).

However, when performing tests on the instars individually due to the significant interaction, we found that only adult female condition decreased significantly with colony size (lmer; 2~3, 4~ = 7.64, p = 0.006 \*\* ).

Note: If line on graph is blue R could not plot the lmer, plotting a simple lm instead[1] "lmer"



1. *Figure : Individual condition against colony size, with the full linear model superimposed. Overall condition decreases with colony size (p = 0.004 \*\* ), with a significant interaction with instar age (p = < 0.001 \*\*\* ).*



1. *Figure : The predicted values, by instar age, from the full linear model of individual condition against colony size. As instar age increases, the gradient of the line increases. n = 19 colonies.*

## Within-colony variance against colony size

### Leg length variance

There was no significant effect of nest size on within-colony variance in leg length. However, before transformation, the average leg variance was 0.09 0.02, which is small given that the range of possible values is between zero and one.

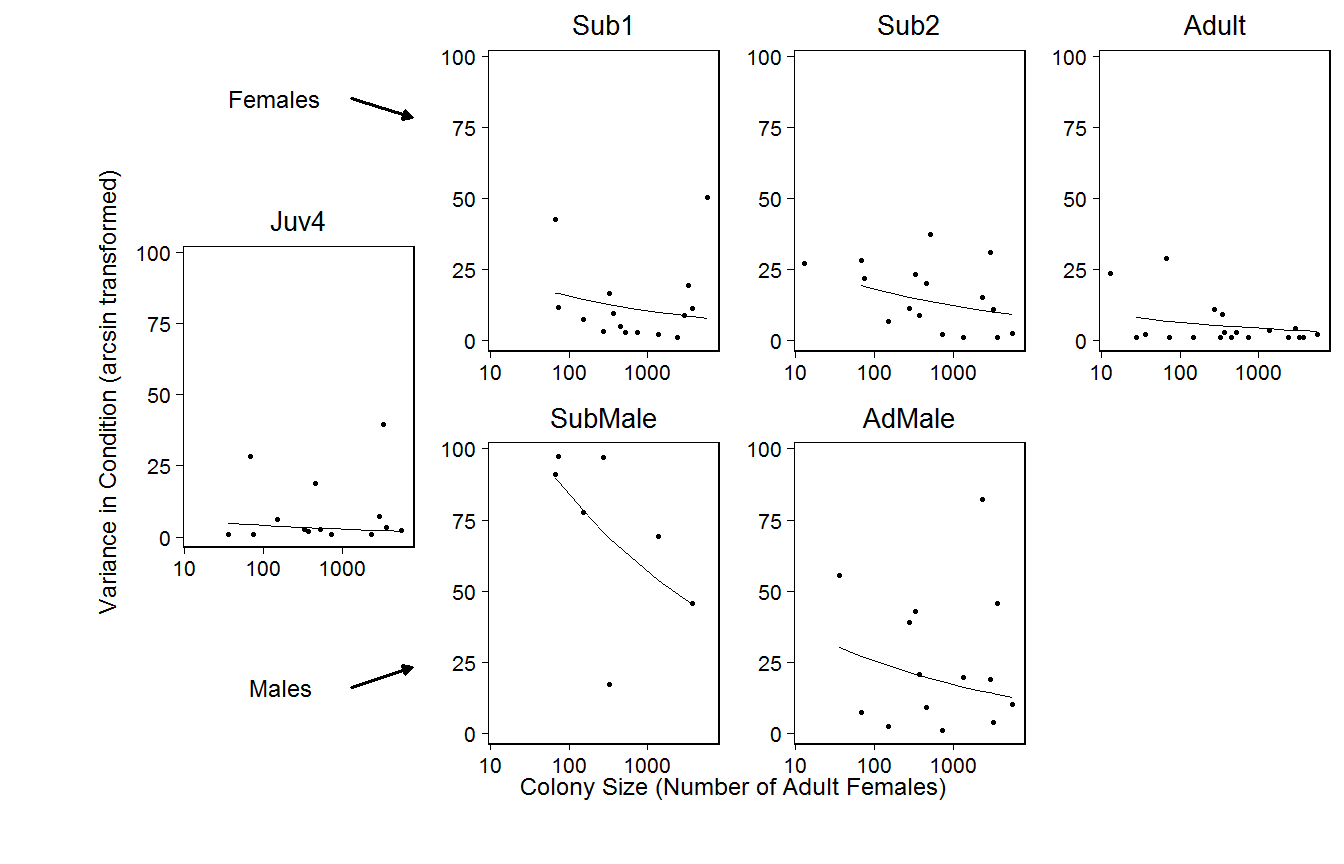
### Condition Variance

The average within-colony condition variance was also small at 0.07 0.02. However, there were significant fixed effects. The final model included only colony size, the two-way interaction instar age by sex interaction and the two-way interaction instar age squared by instar sex (table 2). Colony had a significat effect (glmmPQR; 21 = 7.244, p = 0.007 \*\* ) as within-colony condition variance decreased with increasing colony size (figure 5). Any interactions of instar age or sex with colony size was not significant.

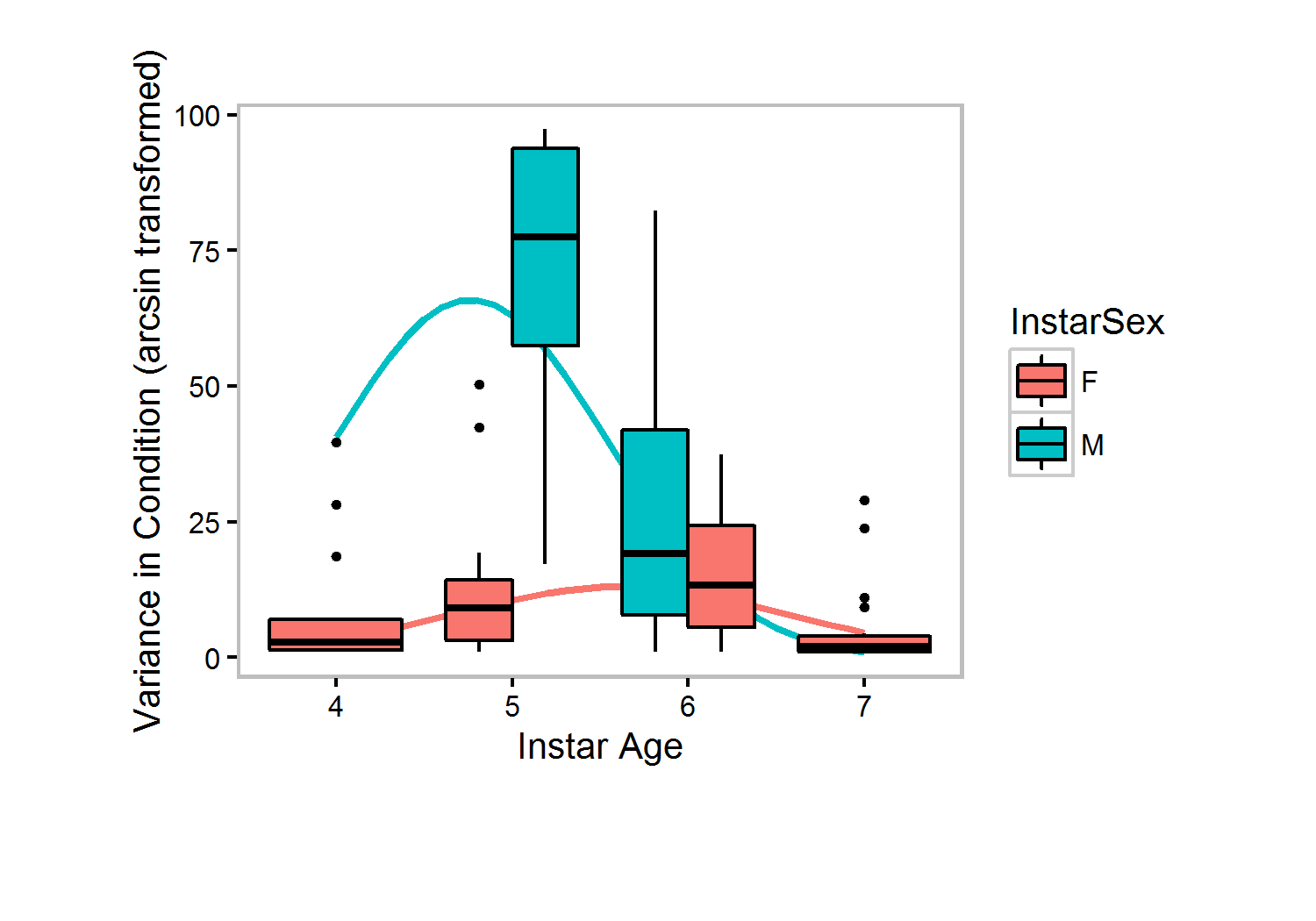
The interaction instar age by sex was significant (glmmPQR; 22 = 30.525, p < 0.001 \*\*\* ), as was instar age squared crossed with sex (glmmPQR; 22 = 25.315, p < 0.001 \*\*\* , (figure 5). Within-colony variance in condition peaked at intermediate instar ages and was higher for males (figure 6).

Note: If line on graph is blue R could not plot the lmer, plotting a simple lm instead[1] "glmmpql"

Warning: Removed 1 rows containing missing values (geom\_path).  
  
Warning: Removed 1 rows containing missing values (geom\_path).



1. *Figure : Within-colony condition variance against colony size with the generalized linear model superimposed. Colony size was significant (p = 0.007 \*\* ), but all of the colony size interactions were not.*

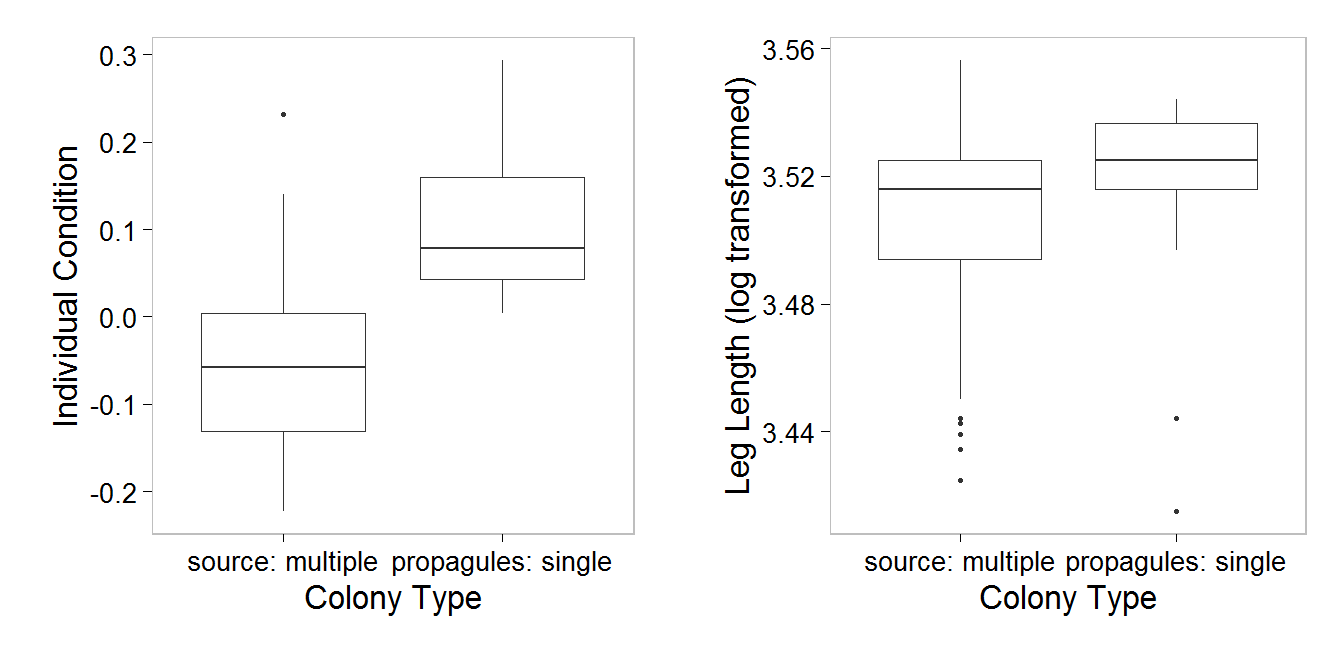


1. *Figure :Within-colony condition variance by instar age and sex. Overlaid is the generalized linear model, which has the square of instar age as a significant term.*

## Size and condition of dispersers against philopatric conspecifics

Adult female leg length was larger in propagules compared to adult females from their natal colonies (lmer; 24,5= 3.9, p = 0.048 \* ),

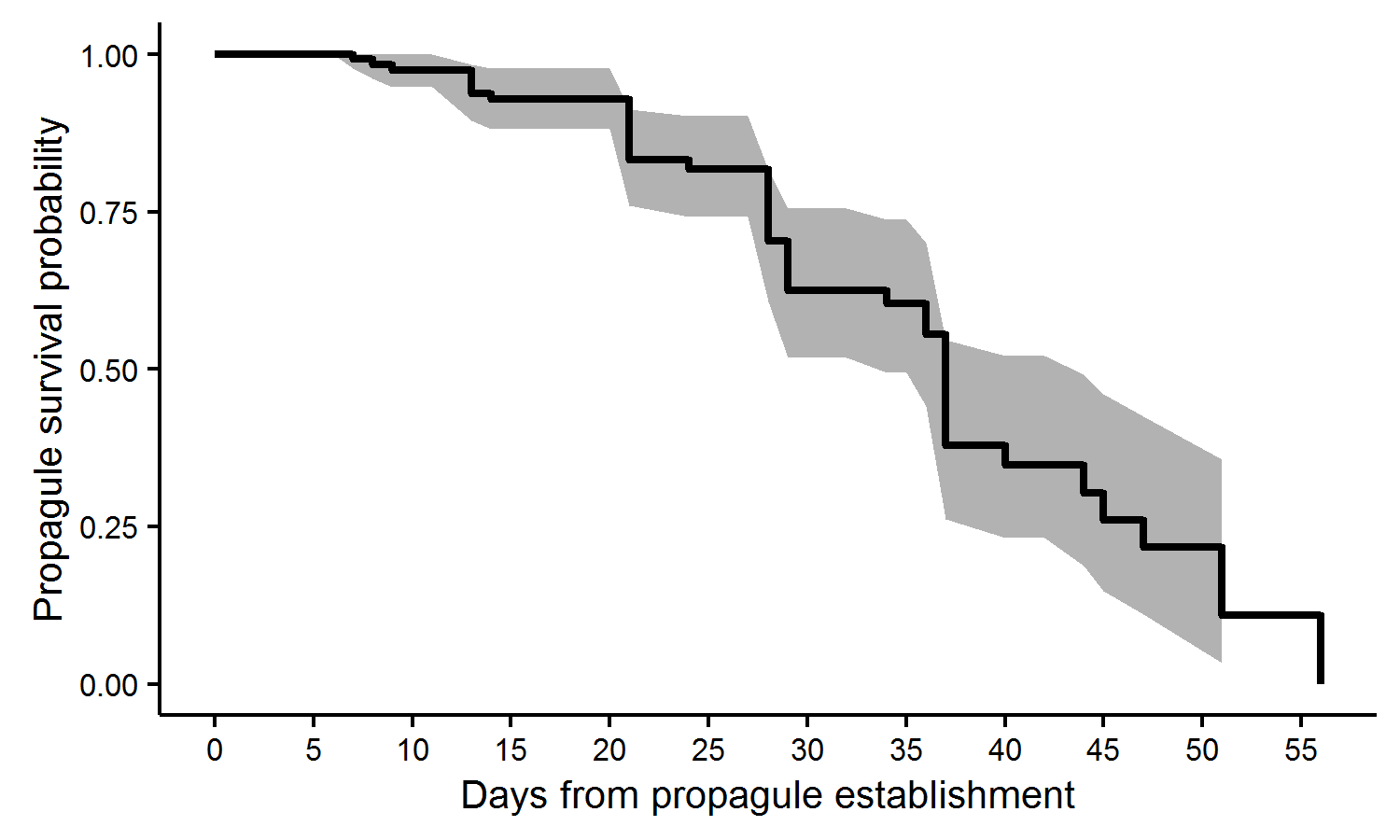
and the individual condition of dispersers was higher (lmer; 24,5= 9.45, p = 0.002 \*\* , (figure 7)



1. *Figure: Condition and leg length of adult females in propagues compared to adult females in their natal colony. Both were significant, n source colonies = 2, n propagules = 39*

## Single female colony survival

We found that colonies with single female colonies had a very low survival rate, with there being only around a 15% chance that a single colony would survive to 50 days after establishment (figure 8).



1. *Figure: The survival function of 40 propagules from 10 source colonies. Grey shading represents the 95% confidence interval.*

## List of full models used

*Table 2: The full models used for each test. Varibles printed as (1|\*\*\*\*\*) indicate random factors.*

|  |  |
| --- | --- |
| Test | Full Model |
| Leg length vs. colony size | log(LegLength)=log(ColonySize) + InstarAge + log(ColonySize):InstarAge + log(ColonySize):InstarAge:InstarSex + (1|Colony) |
| Condition vs. colony size | Condition=log(ColonySize) + log(ColonySize):InstarAge + (1|Colony) |
| Condition Variance vs. colony size | Variance=log(ColonySize) + InstarAge:InstarSex + InstarSex:sqr(InstarAge) |
| Leg length dispersed female vs. source colony | log(LegLength)=ColonyType + (1|Colony) + (1|SourceColony) |
| Condition dispersed female vs. source colony | Condition=ColonyType + (1|Colony) + (1|SourceColony) |