

# Copepod Sex-Ratios May Be Female-Biased at Birth



Zair Burris & Hans G. Dam



## SUMMARY

- Field populations of *Acartia tonsa* are often female-biased, which may be due to skewed sex-ratios at birth.
- Offspring sex-ratios from field-caught *A. tonsa* females were determined by rearing individual families in the lab.
- Of 21 mothers, 9 produced significantly female-dominated clutches, whereas 4 produced mostly male offspring.
- Because mortality was low for all copepod stages, we infer that adult sex-ratios were determined mostly at birth.
- Therefore, female-biased sex-ratios at birth may explain some of the adult sex-ratio skew present in the field.

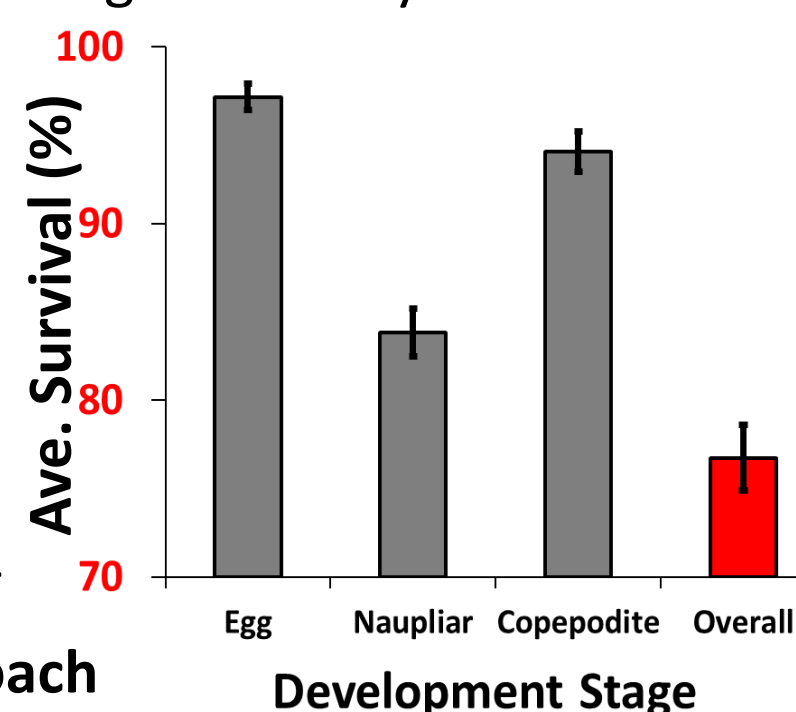
## INTRODUCTION

- Field and laboratory populations of calanoid copepods tend to be female-dominated, which may impact population growth by decreasing mate-encounter rates.<sup>1</sup>
- These skews may result from higher male mortality rates, environmental sex-determination, or biased ratios at birth.<sup>2,3</sup>
- There is little information on copepod sex-ratios at birth, making it difficult to draw conclusions about their importance in determining adult ratios.
- This study aimed to determine if females of the abundant coastal copepod, *Acartia tonsa*, produce skewed sex-ratios of offspring at birth.
- HYPOTHESIS:** Birth ratios of *A. tonsa* are female-biased at the family level and result in a female-skewed adult population.



## METHODS

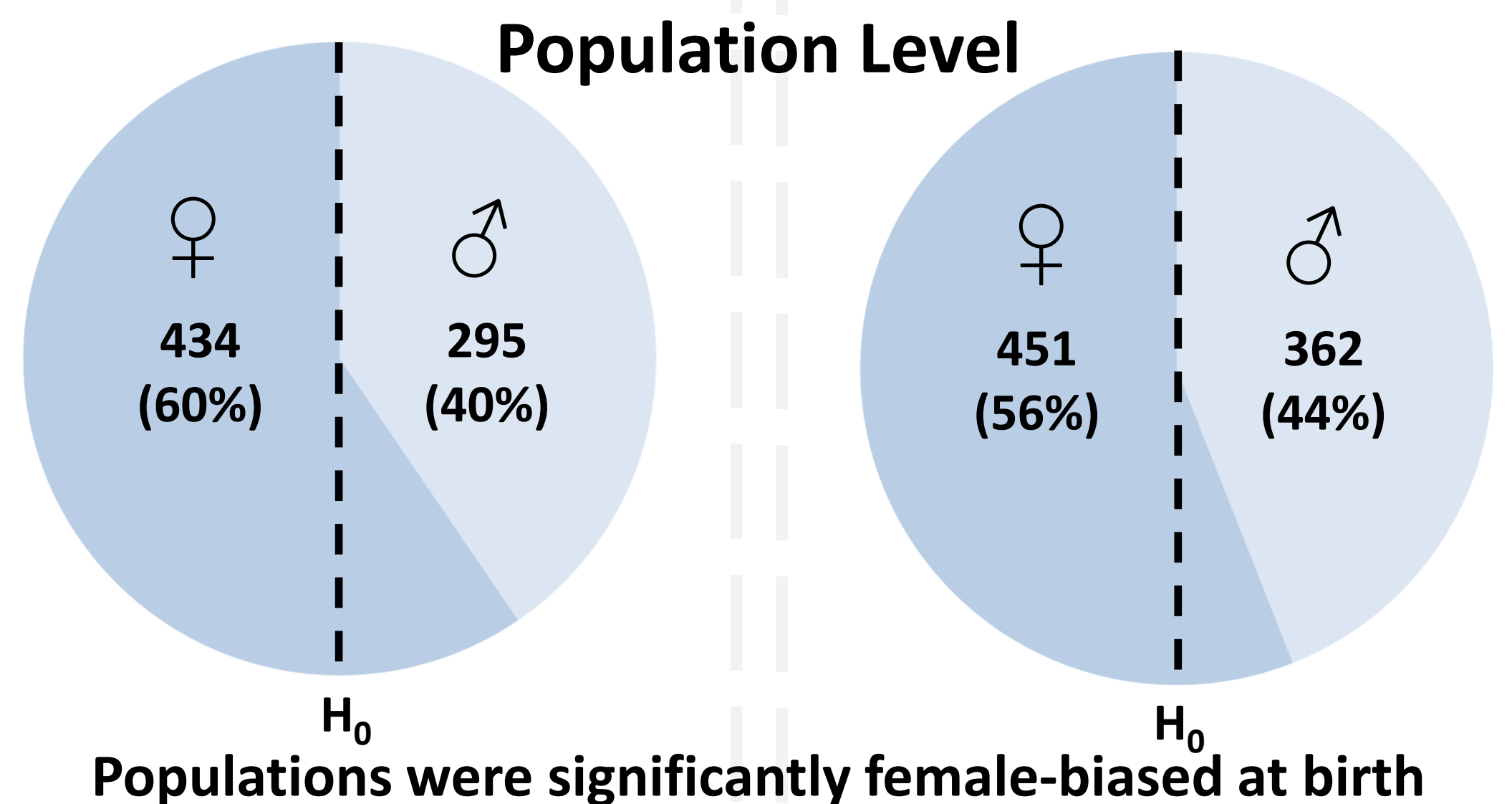
- 30 field-fertilized females were fed for 4 days on a standard diet. Eggs produced on the 4<sup>th</sup> day were used in the study. Families averaged ~44 offspring.
- Survival was recorded for individuals at all life stages; sex was noted at stages C5 and adult.
- 9 families were excluded because they produced few eggs, the eggs did not hatch, or the family had high mortality.
- Adult sex-ratios were used as a proxy for ratios at birth since mortality was low (inset).
- The null hypothesis ( $\text{♂}:\text{♀} = 1$ ) was tested against the observed sex-ratio for each family using a  $\chi^2$ .
- To test that sex-ratio skews were not due to differential mortality of the rarer sex, a **conservative approach** was applied in which dead individuals were scored as the rarer sex. Statistics were then rerun on these new sex-ratios.



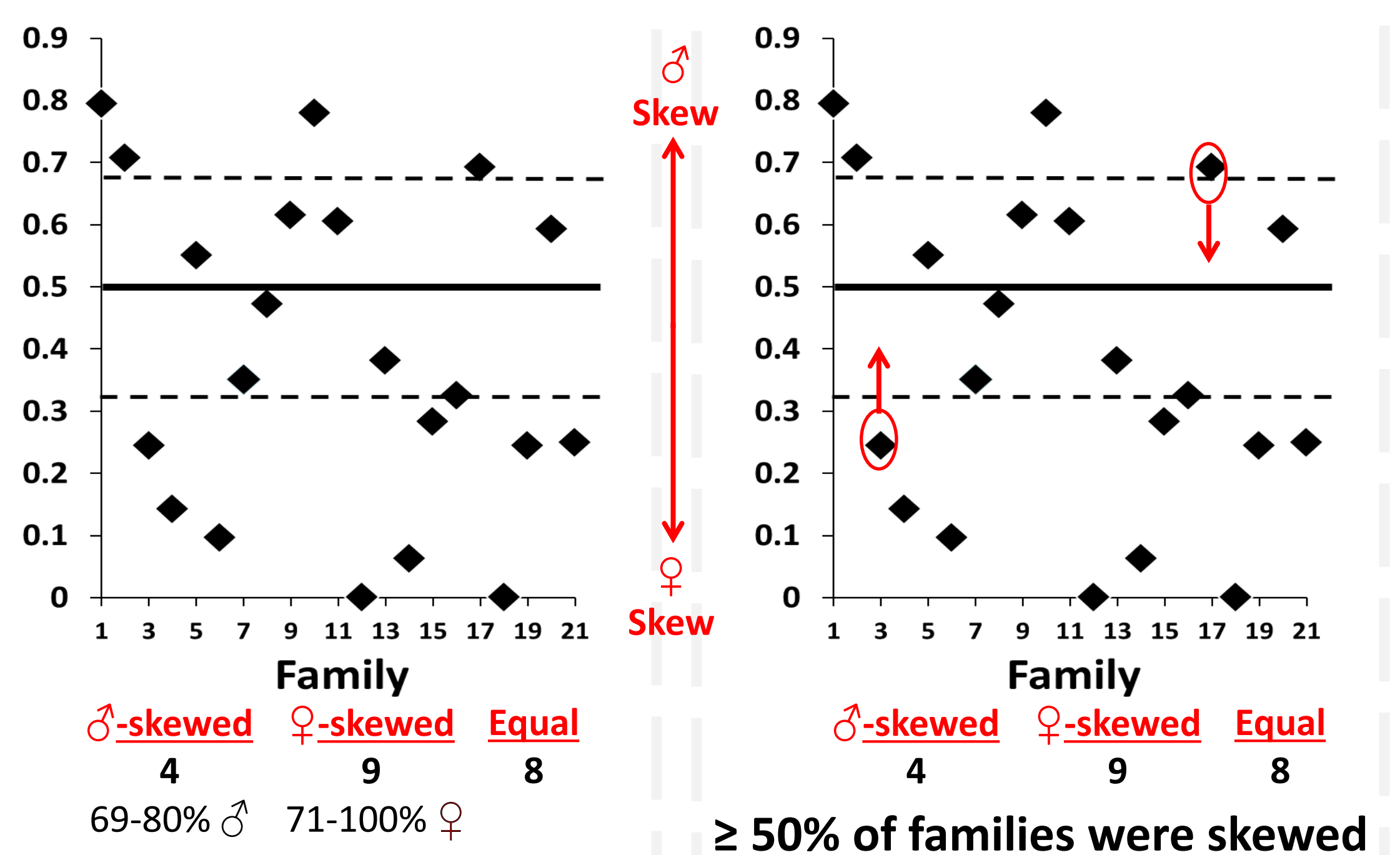
## RESULTS

### Non-conservative approach

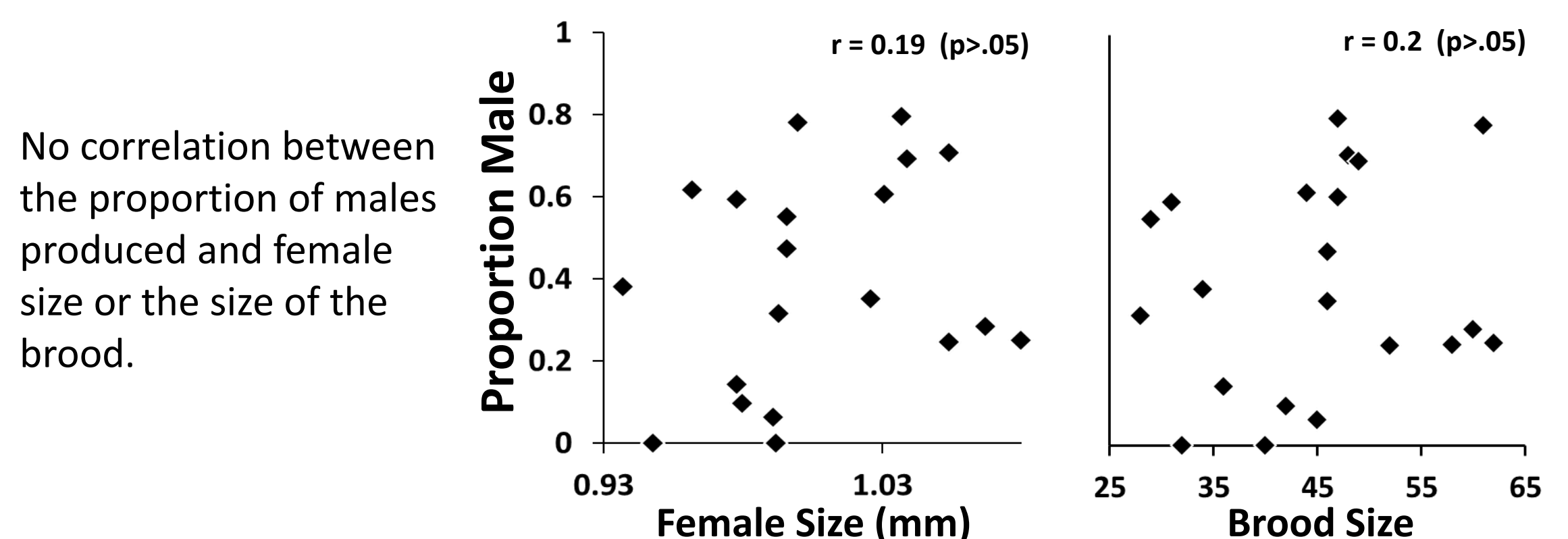
### Conservative approach



### Family Sex-Ratios



### What other factors may explain the sex-ratio bias?



## DISCUSSION

- ≥ 50% of *Acartia tonsa* mothers produced skewed sex-ratios (male-skewed: 4; female-skewed: 9).
- The female-biased population resulted from a preponderance of female biased families.
- The variability in sex-ratios among families was not due to differential mortality of the sexes, the size of the female, or her brood size.
- The biased sex-ratios at birth may explain some of the skew in adult field ratios.
- Future work will determine if sex-ratios are heritable or if they change depending on age or condition.

**ACKNOWLEDGMENTS:** Research funded by NSF. Travel Support from University of Connecticut.

## REFERENCES

- Kjørboe, T. 2006. Sex, sex-ratios, and the dynamics of pelagic copepod populations. *Oecologia*. 148:40-50.
- Hirst, AG, Bonnet, D, Conway, DVP, Kjørboe, T. 2010. Does predation control adult sex-ratios and longevities in marine pelagic copepods? *Limnology and Oceanography*. 55:2193-2206.
- Gusmao, LFM and AD McKinnon. 2009. Sex ratios, intersexuality and sex change in copepods. *Journal of Plankton Research*. 31: 1101-1117.