

The Genetics of Aggression in Unique Three-Spined Stickleback Populations

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What is the genetic basis of behavior?

- Aggression is important for territory defense.
- The underlying genetic basis of aggression is likely to be complex.
- We study two different ecotypes ("whites" and "commons") of three-spined stickleback (*Gasterosteus aculeatus*).
- The white ecotype is more aggressive. [1]

Genetic Mapping

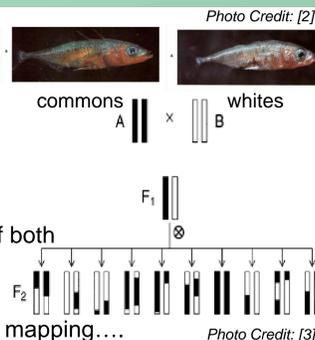
What we did:

1. Commons x Whites = F1
2. F1 x F1 = F2

Individual F2s (mapping population) have a mix of both ecotype's genomes

Why we did it:

quantitative trait locus (QTL) mapping....



For a trait to be amenable to QTL mapping it must be:

1. Repeatable
2. Highly variable in the F2 mapping population

Questions

1. Is aggression repeatable?
2. How does aggression vary in the F2s?

Behavioral Assay

Each male was confronted with a territorial intruder in a flask; no fish were harmed during these trials.



For five minutes the number of times the male bit at the intruder was recorded.

Each male was observed in two trials separated by ≥ 1 day.

Photo Credit: Bell Lab

1. Is aggression repeatable?

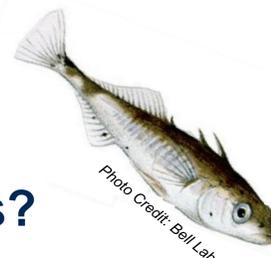
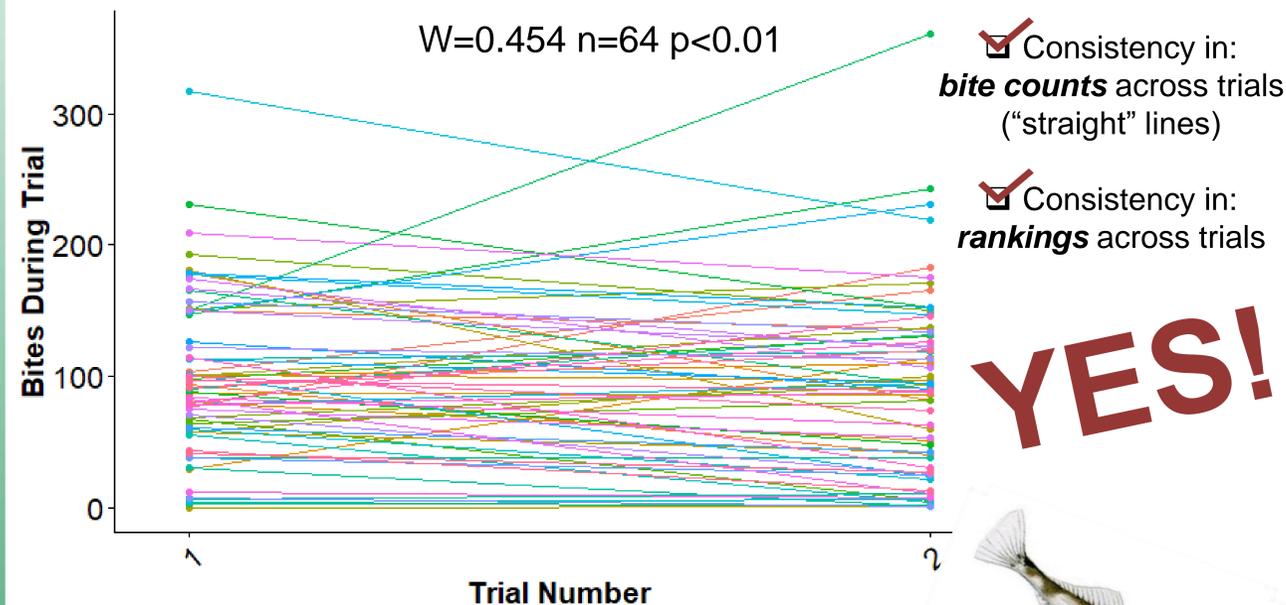
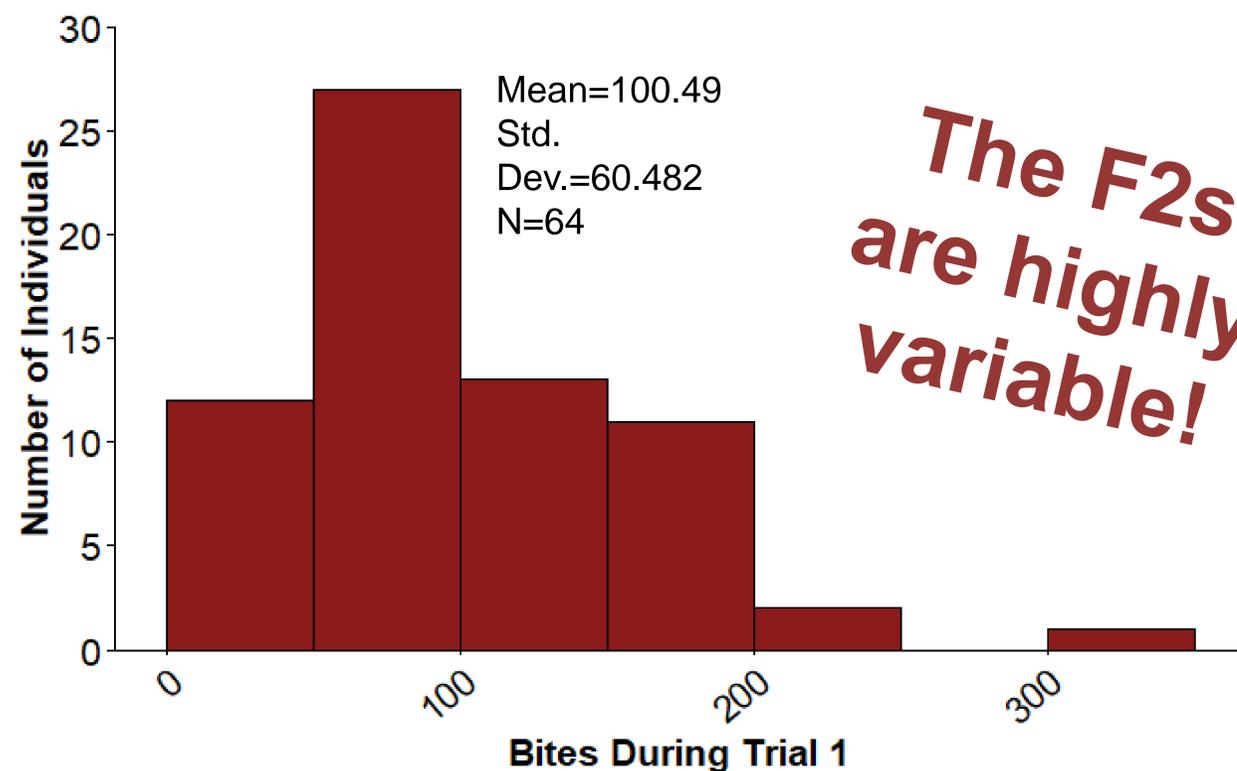


Photo Credit: Bell Lab

2. How does aggression vary in the F2s?



Conclusions & Future Work

- ❖ Some individual male F2s are consistently more aggressive than others.
- ❖ Levels of aggression are highly variable among the F2s.
- ❖ These results suggest that this trait is amenable to QTL mapping.
- ❖ We are currently phenotyping additional F2s to increase the sample size.
- ❖ Future studies will genotype the F2s at marker loci distributed throughout the genome to identify loci which contribute to aggressive behavior.
- ❖ This study highlights the advantages of studying natural variation in order to understand the genetic basis of complex traits such as behavior.

References

- [1] Haley, A. L. (2018). Nuptial colouration and breeding behaviour in the white Threespine Stickleback (*Gasterosteus aculeatus*). Honors Thesis, St. Mary's University
- [2] Blouw, D. M., & Hagen, D. W. (1990). Breeding ecology and evidence of reproductive isolation of a widespread stickleback fish (*Gasterosteidae*) in Nova Scotia, Canada. *Biological Journal of the Linnean Society*, 39(3), 195–217. <https://doi.org/10.1111/j.1095-8312.1990.tb00512.x>
- [3] Zhang, Yuan-Ming. (2012). F2 designs for QTL analysis. *Methods in molecular biology* (Clifton, N.J.). 871. 17-29. 10.1007/978-1-61779-785-9_2.

Acknowledgments



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