# (Not) Too Cool for School:
# Sibship, Starvation, and Schooling in Stickleback

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Schooling has many functions in fish communities.

- Hydrodynamic efficiency
- Improved mate finding
- Improved foraging
- Predator detection
- Predator avoidance

http://news.bbc.co.uk/earth/hi/earth_news/newsid_8772000/8772020.stm

What is schooling? Our working definition:

- Stickleback are grouped together in one area of the tank
- Fish in the group are facing in the same direction

## Questions addressed:

Does population membership influence schooling behavior?

Can an environmental stressor (food availability) influence schooling behavior?

Is there an interaction between these two factors?

# Experimental Design

| | | Population | |
|---|---|---|---|
| | | Reed Lake | Ritmanis Pond |
| Feeding Condition | Fed | Test 1<br>Test 2 | Test 1<br>Test 2 |
| | Starved | Test 1<br>Test 2 | Test 1<br>Test 2 |

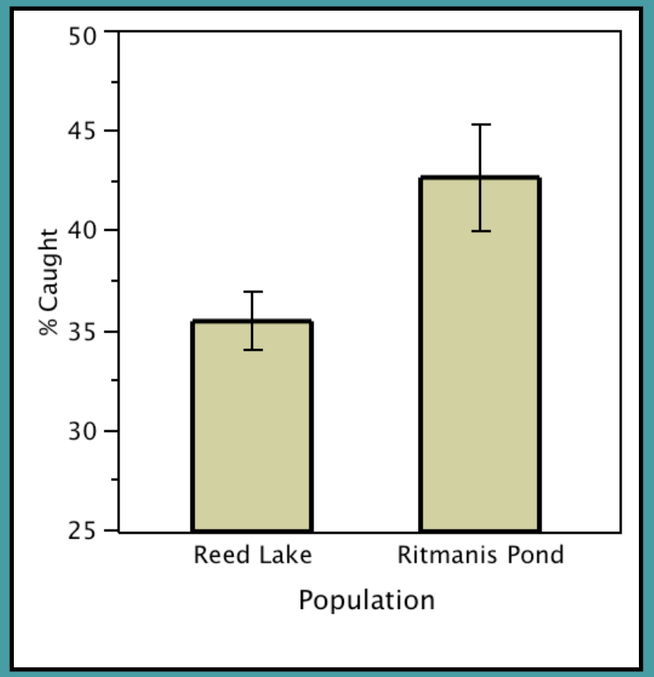
Test 1: Netting Assay
Catch, count, release

Test 2: Decoy-Induced Schooling
Scan sampling every 30 seconds

http://pond.dnr.cornell.edu/nyfish/Gasterosteidae/stickleback.html

# Results: Test 1

**Population significantly influences shoal size.**
(ANOVA, p= 0.02)

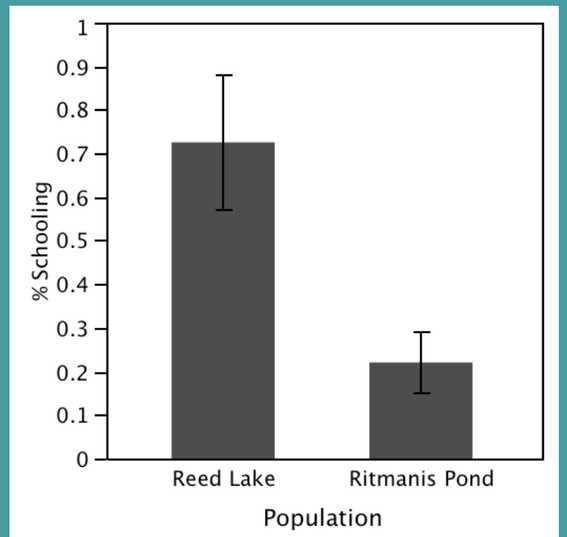



Stickleback from Ritmanis Pond school in larger groups than those from Reed Lake.

Feeding condition and population-condition interaction did NOT significantly influence shoal size.

# Results: Test 2

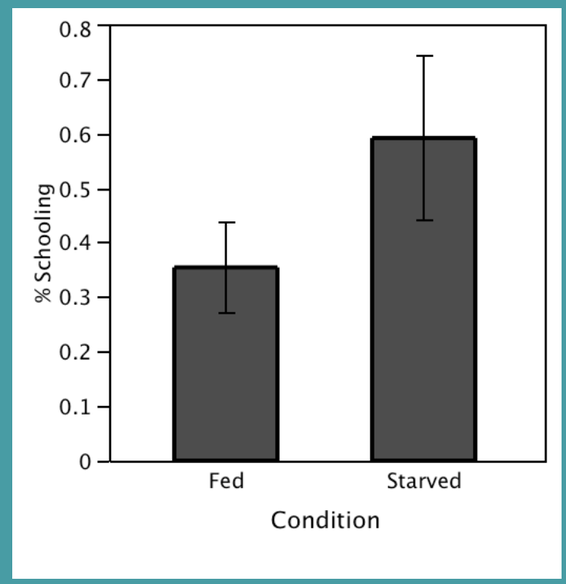
**Population influences tendency to school.**
(ANOVA, p= 0.003)



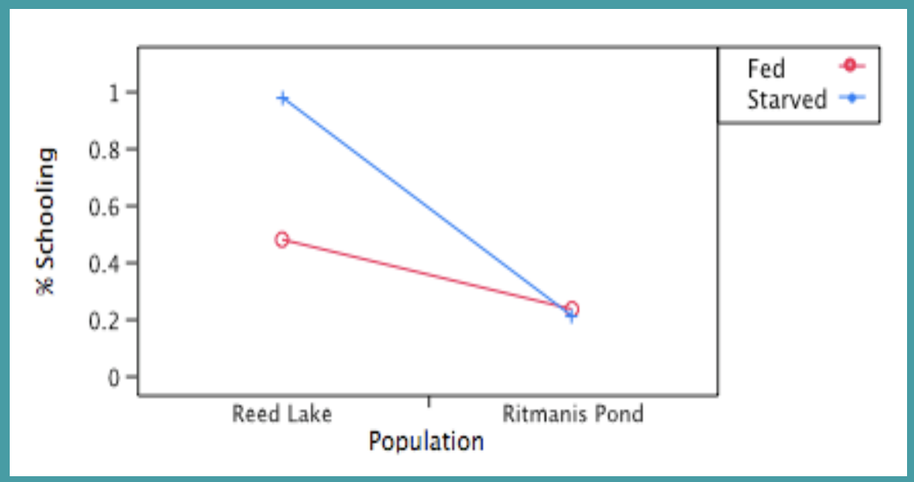

However, this time fish from Reed Lake schooled with the decoy more often than fish from Ritmanis Pond.

**The effect of feeding condition was stronger**
(ANOVA, p= 0.16)

…in test 2 than test 1, although it was still not statistically significant.




**Food stress does not alter schooling behavior equally across both populations.**
(ANOVA, p= 0.12)




While Reed Lake stickleback were much more likely to school with the decoy when starved, feeding condition did hardly influenced Ritmanis Pond stickleback schooling at all.

# Conclusions

• Because fish from Reed Lake school in smaller groups and their schooling behavior is more variable, their schools may be less permanent and effective in providing benefits. (1)

•Increased willingness to follow the decoy could reflect increased boldness in Reed Lake fish (or could be an artifact of attempted predation).

•Schooling phenotype stability (Test 2) in Ritmanis Pond fish could reflect a lower relative concentration of prey items in their environment and therefore increased tolerance to starvation because schooling behavior enhances foraging efficiency. (3)

•Depending on the genetic basis of the behavior, the differential response to starvation between the two populations may be evidence of a gene by environment interaction.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# Further Questions

• What other environmental stressors may affect schooling behavior?

• How high is the level of relatedness in each population that we studied?

•Is there a genetic basis for schooling behavior in stickleback?

## References


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