The effect of genetic selection for socially affected traits on the rate of inbreeding: A simulation study

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INTRODUCTION

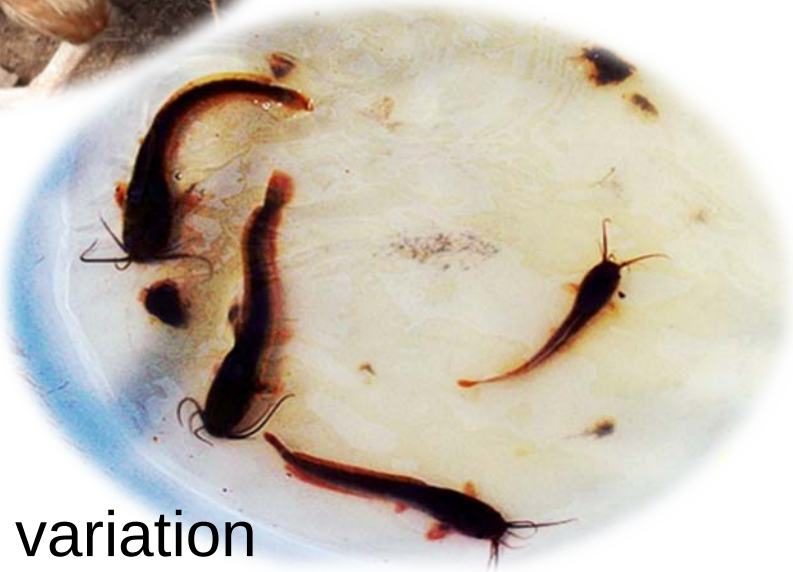
Animal welfare

- An important issue in animal breeding industries
- Social interaction:
  - Any behavior that affects or takes into account each other's physical conditions
- Welfare problems for livestock housed in group
  - Social interaction among group mates

Animal welfare (cont.)

Feather pecking

Tail biting



Size variation

Animal breeding

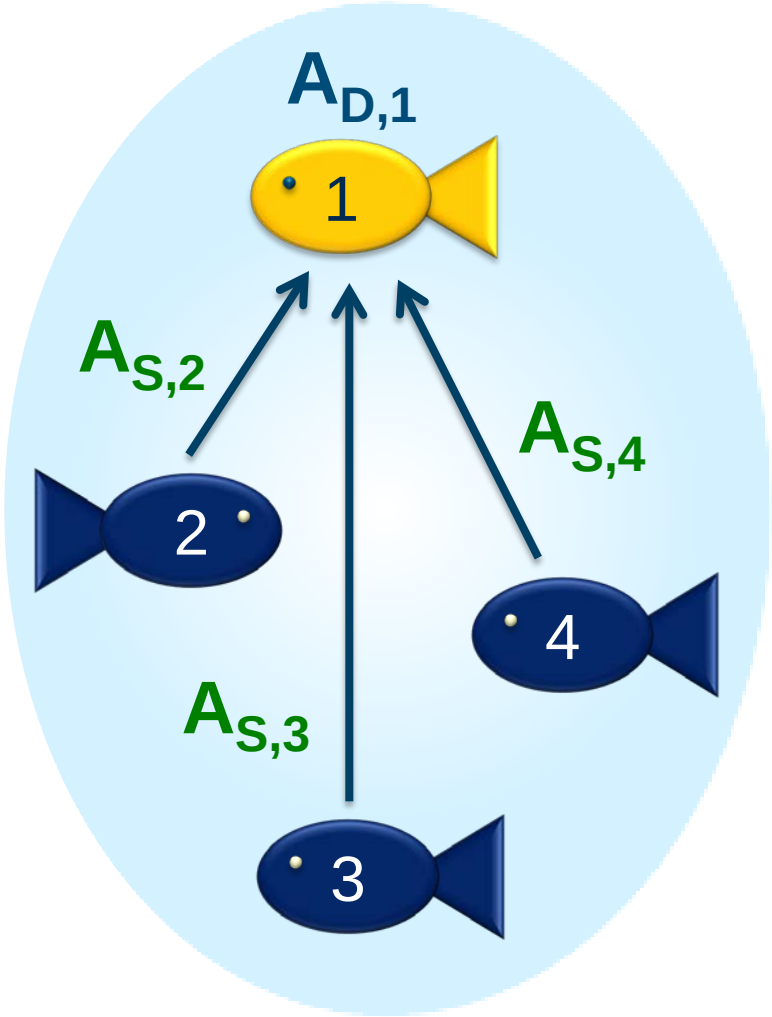
- Classical quantitative genetic model:

  Phenotype = Genetic + Environment

- Individual with best phenotypes => positive selection response is expected
  - Traits related to behaviour => selection response not as expected

- Existence of social genetic effects

Animal breeding - social genetic effects



$$P_i = A_{D,i} + \sum_{i \neq j}^{n-1} A_{S,j} + E$$

Social genetic effect of mates

Heritable effect of an individual on the phenotype of another individual

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Animal breeding - social genetic effects

- Selection for socially affected traits: accounting for direct and social effects may increase selection response

- It may also affect rate of inbreeding

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Objective

To examine the effect of **BLUP selection** for **socially** affected traits on **rate of inbreeding**

BLUP = Best Linear Unbiased Prediction

METHODS

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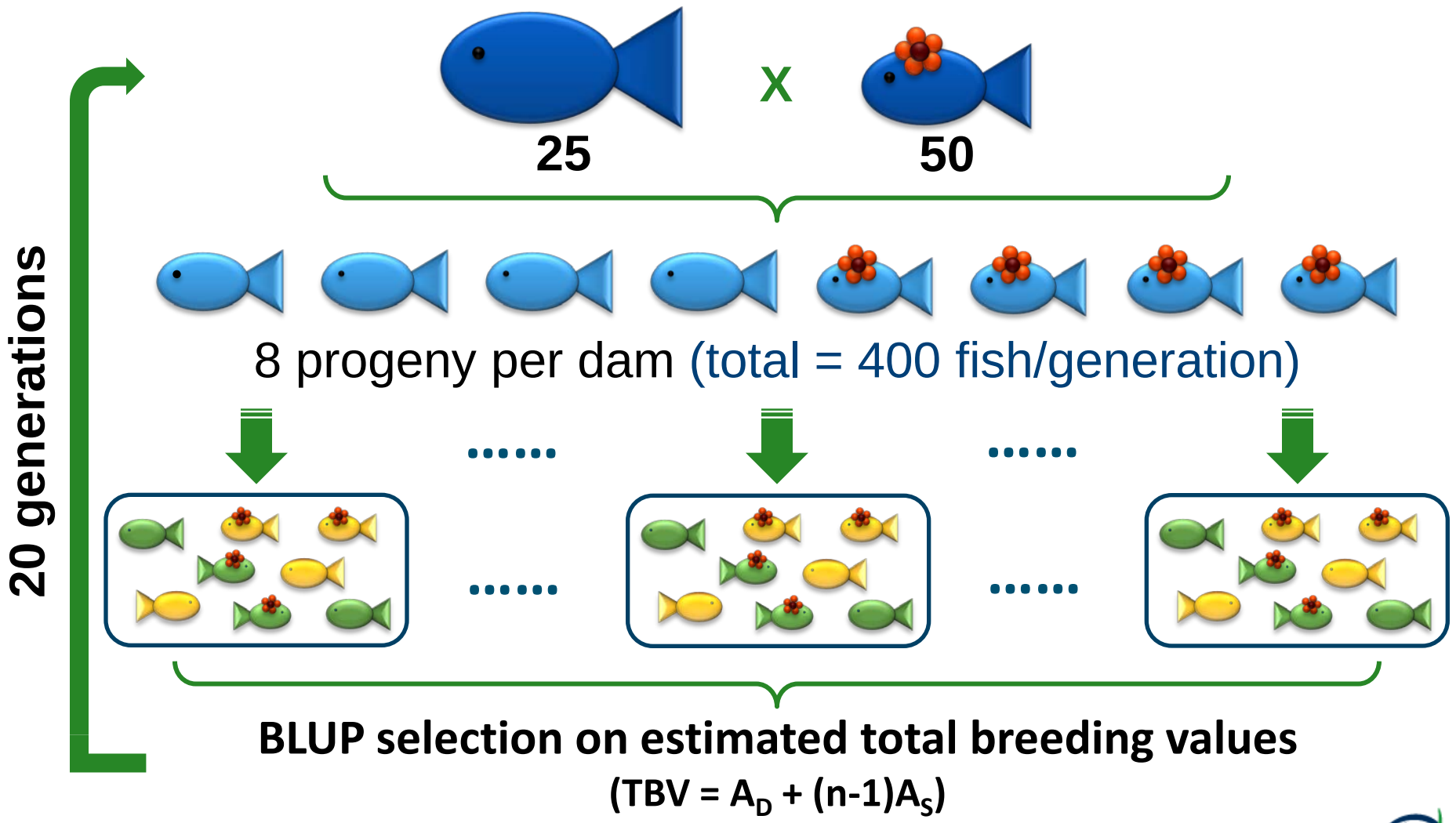
The simulation

- Statistical computing program => ***R***
- Four scenarios:

Parameters	Basic	Scenario 1	Scenario 2	Scenario 3
Social phenotypic variance	Null	Mild	Intermediate	Strong
Heritabilities (Direct = Social)	0.1, 0.3, 0.5			
Correlation between direct and social (Genetic = Environment)	Null	Competitive … Cooperative -0.8, -0.4, 0, 0.4, 0.8		

Population structure



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The simulation (cont.)

- ASReml-R:

y = mean + direct genetic effect + social genetic effect + random group effect + residual

- 100 replicates for each scenario and parameters combinations

- Rate of inbreeding was averaged over 100 replicates

RESULTS AND DISCUSSION

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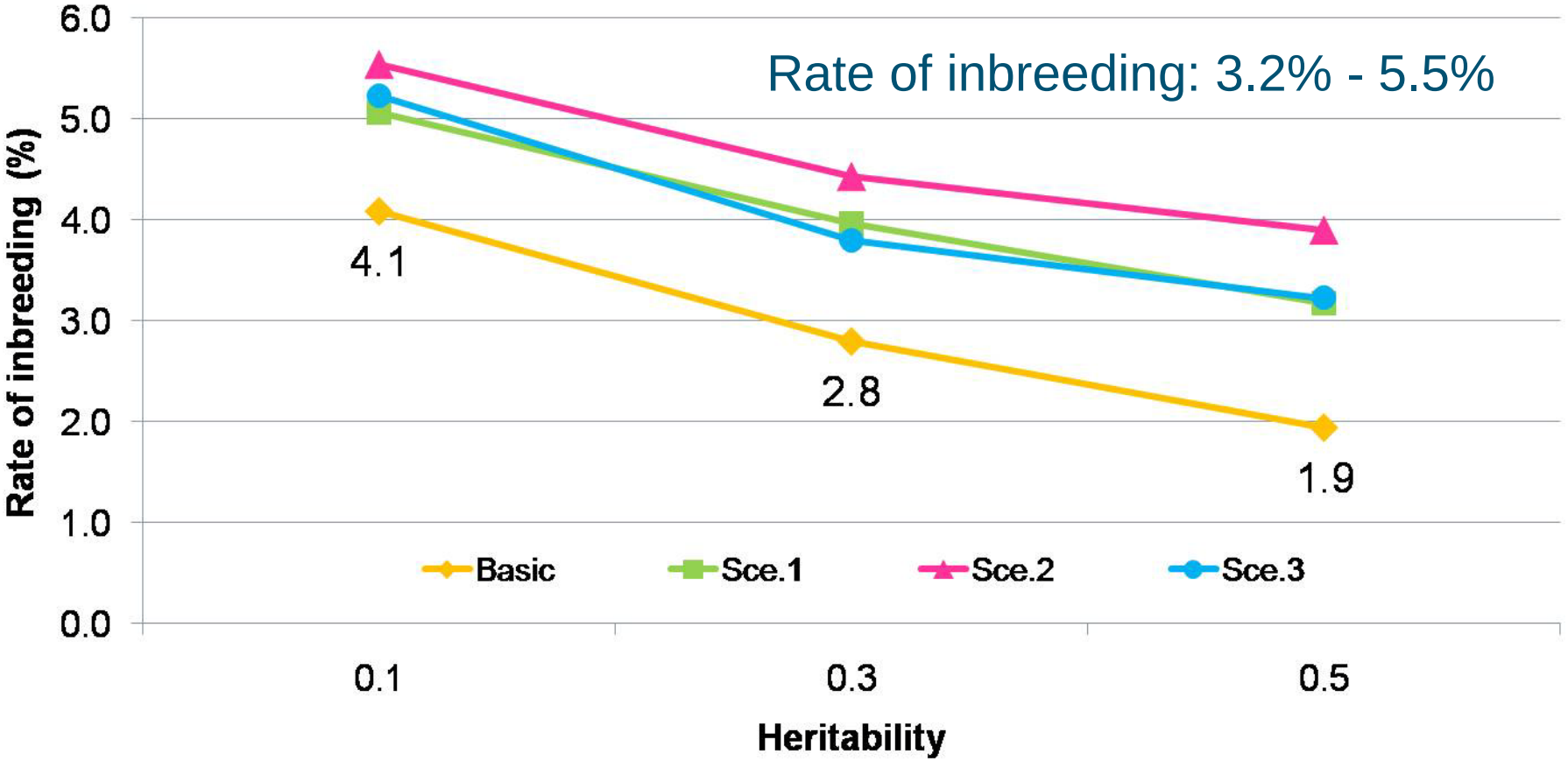
Results

Correlation between direct and social = 0



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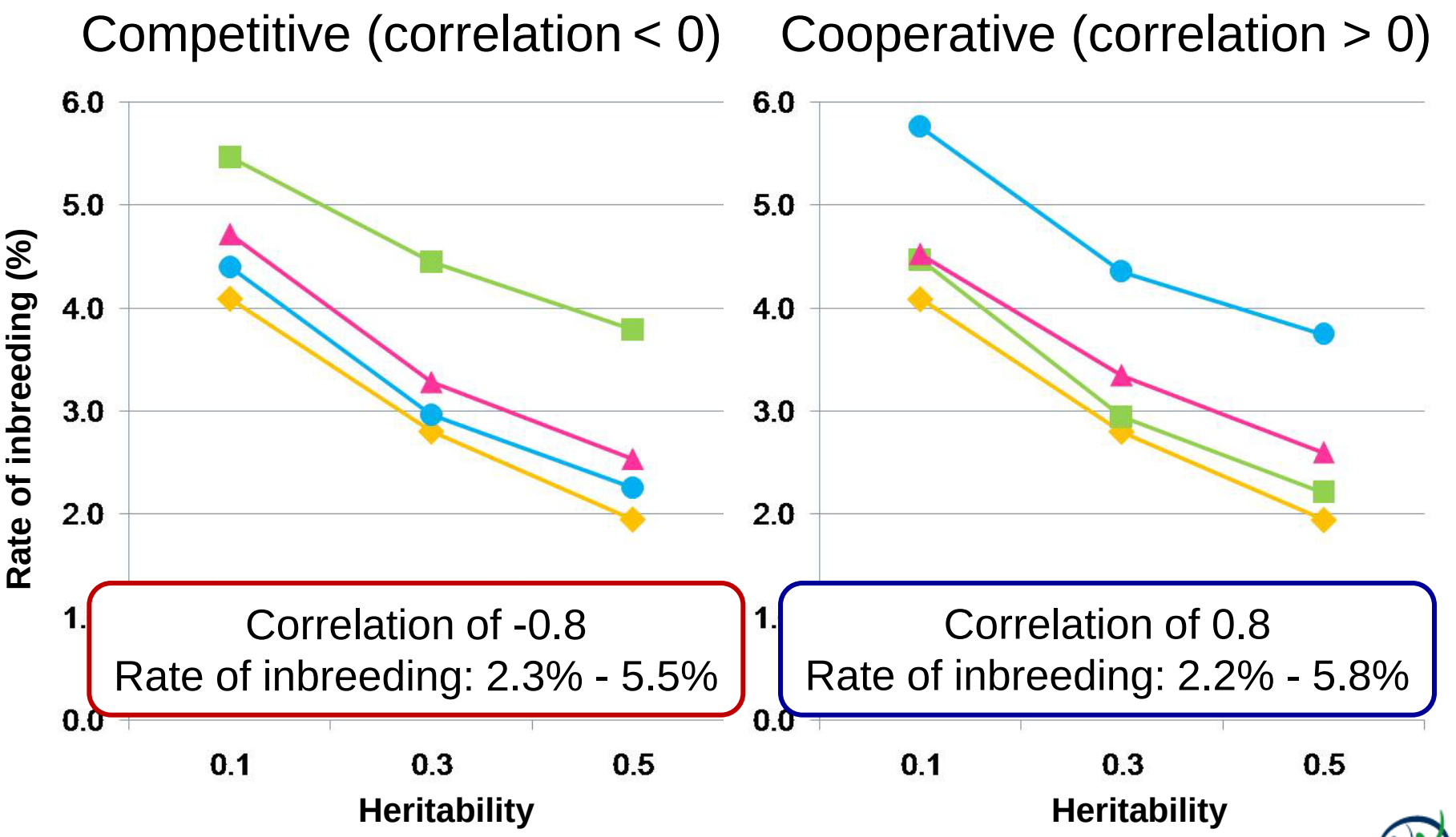
Results (cont.)



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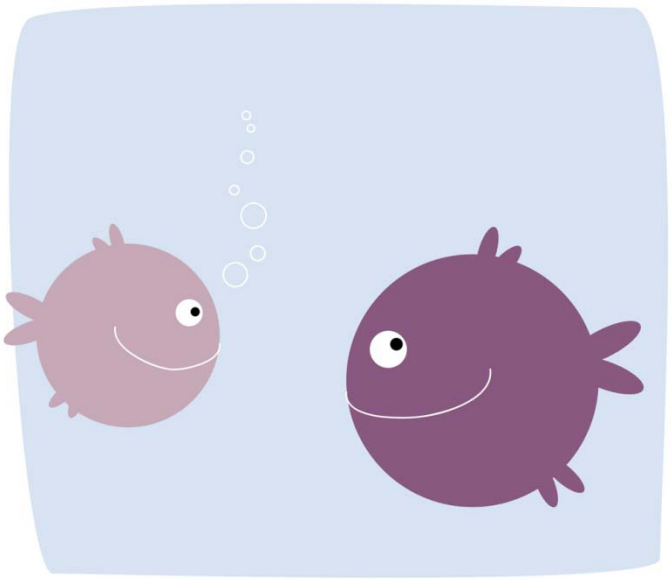
Discussion

- In scenarios with social effects, the rate of inbreeding was greater
- At low heritability, BLUP selection favors the choice of family members which increases inbreeding
  - More weight on relatives' record => high correlation of estimated breeding values within family
- Social interactions with groups of two families increased the resemblance between relatives

Conclusion

BLUP selection for socially affected traits may increase rate of inbreeding



Take home message~

To **limit inbreeding**, especially when taking into account **social effects**, we should apply a selection algorithm, such as

optimum contribution selection

Thank you

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