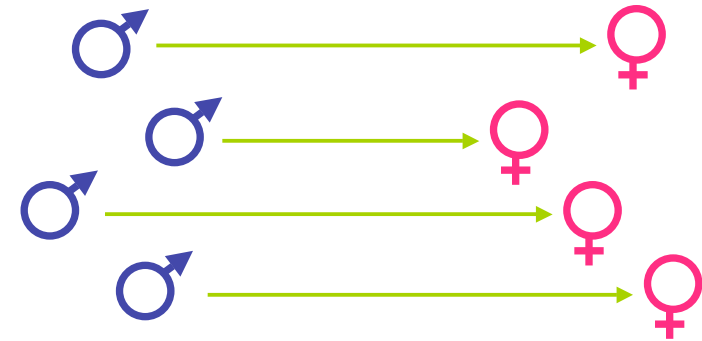


Sex ratio theory

I formerly thought that when a tendency to produce the two sexes in equal numbers was advantageous to the species it would follow from natural selection, but I now see that the whole problem is so intricate that it is safer to leave its solution to the future.

- Darwin
'The Descent of Man',
1871

Why is the sex ratio 1:1?

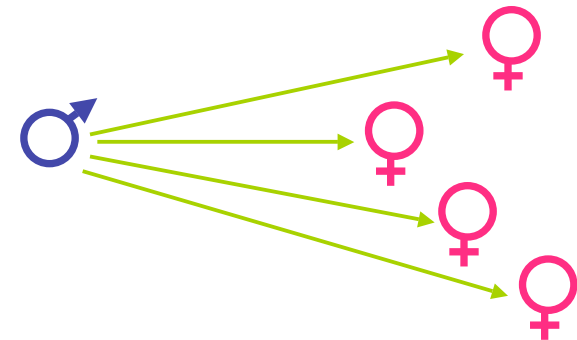


(Fisher, 1930)

“The total reproductive value of the males [in a population] is exactly equal to the total value of all the females, because each sex must supply half the ancestry of all future generations of the species...The sex ratio will so adjust itself, under the influence of Natural Selection, that the total parental expenditure incurred in respect of children of each sex, shall be equal.”

Fisher 1930.

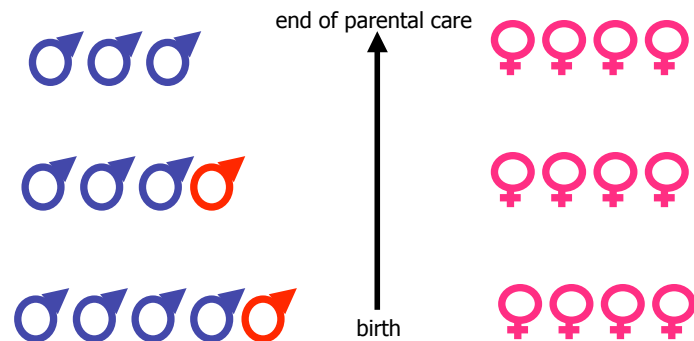
Why is the sex ratio 1:1?



(Fisher, 1930)

Why is the Canadian sex ratio at birth 1.06:1 (M:F)?

Sex *allocation* between the sexes should be equal



Local Mate Competition (LMC)

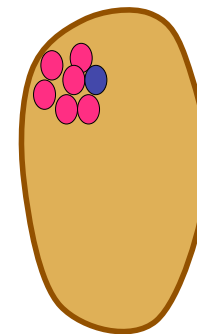
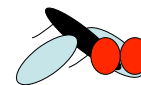
If one sex has reduced fitness due to competition *with siblings of the same sex*, it is advantageous to skew the sex ratio towards the *opposite sex*

Prediction: where inbreeding is common, the sex ratio should be skewed towards the choosy sex (usually females)

Deviations from 1:1

1. Local Mate Competition theory (LMC) (Hamilton, 1967)
2. Trivers-Willard model (TWM) (Trivers and Willard, 1973)

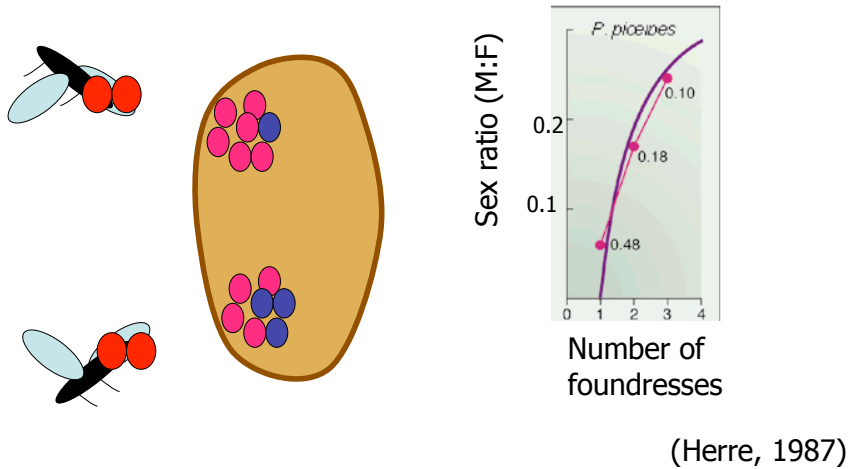
LMC: fig wasp example



5%-10% of offspring are male

(Herre, 1987)

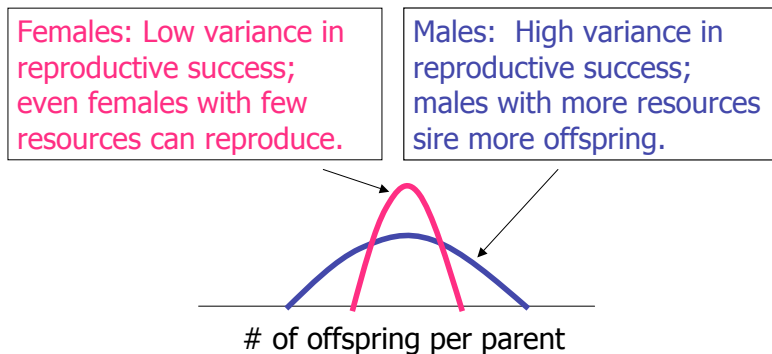
LMC: fig wasp example



Deviations from 1:1

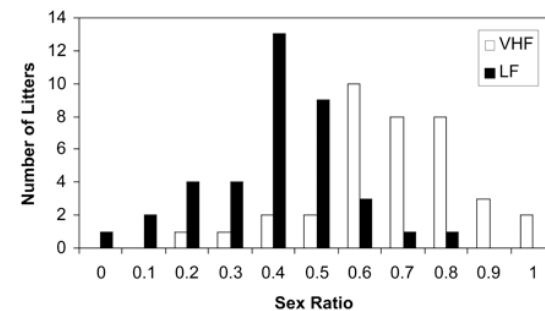
1. Local Mate Competition theory (LMC) (Hamilton, 1967)
2. Trivers-Willard model (TWM) (Trivers and Willard, 1973)

Trivers-Willard model (TWM)

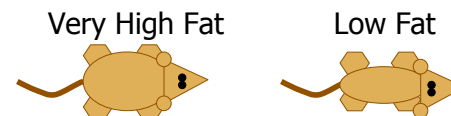


Prediction: High fitness mothers should produce more sons and low fitness mothers should produce more daughters

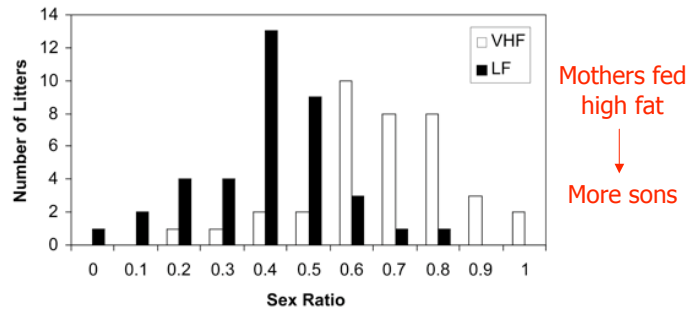
TWM: mice example



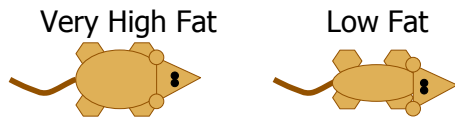
(Rosenfeld *et al.*, 2003)



TWM: mice example



(Rosenfeld *et al.*, 2003)



Conclusion

- Sex ratio theory provides some of the most testable hypotheses in evolution
- Why? (a) Easily measured trait, (b) Strong frequency-dependent selection, (c) Clear cut predictions about the factors that alter sex ratio