

Sexual selection *is* selection

How selection theory clarified the cause of sexual selection
and the Darwin-Bateman paradigm

Sexual selection arises from competition *within a sex* for access to mates and fertilisations



MATE CHOICE



THE EVOLUTION OF
SEXUAL
DECISION MAKING
FROM
MICROBES
TO
HUMANS



GIL G. ROSENTHAL

An abstract painting featuring a complex composition of overlapping, curved shapes in vibrant colors. The palette is dominated by deep blues, bright greens, and sunny yellows, with some white and light beige tones. The brushstrokes are visible, creating a sense of movement and depth. The overall effect is a dynamic and somewhat chaotic visual field.

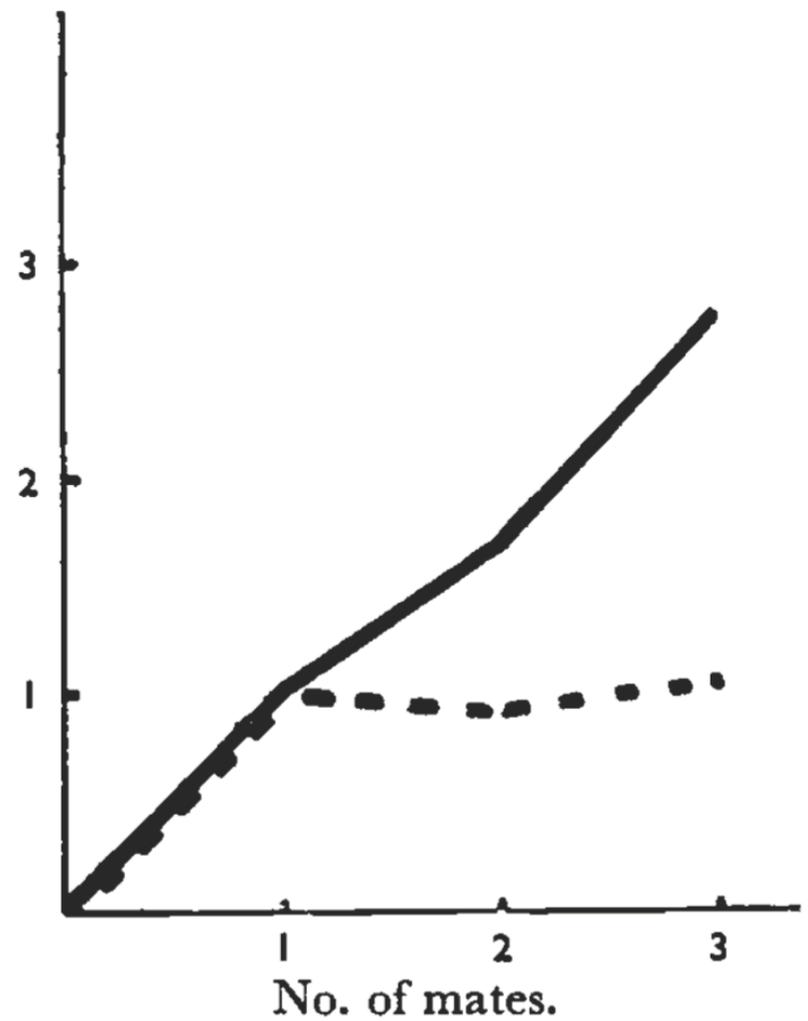
OXFORD

EVOLUTIONARY
QUANTITATIVE GENETICS

STEVAN J. ARNOLD

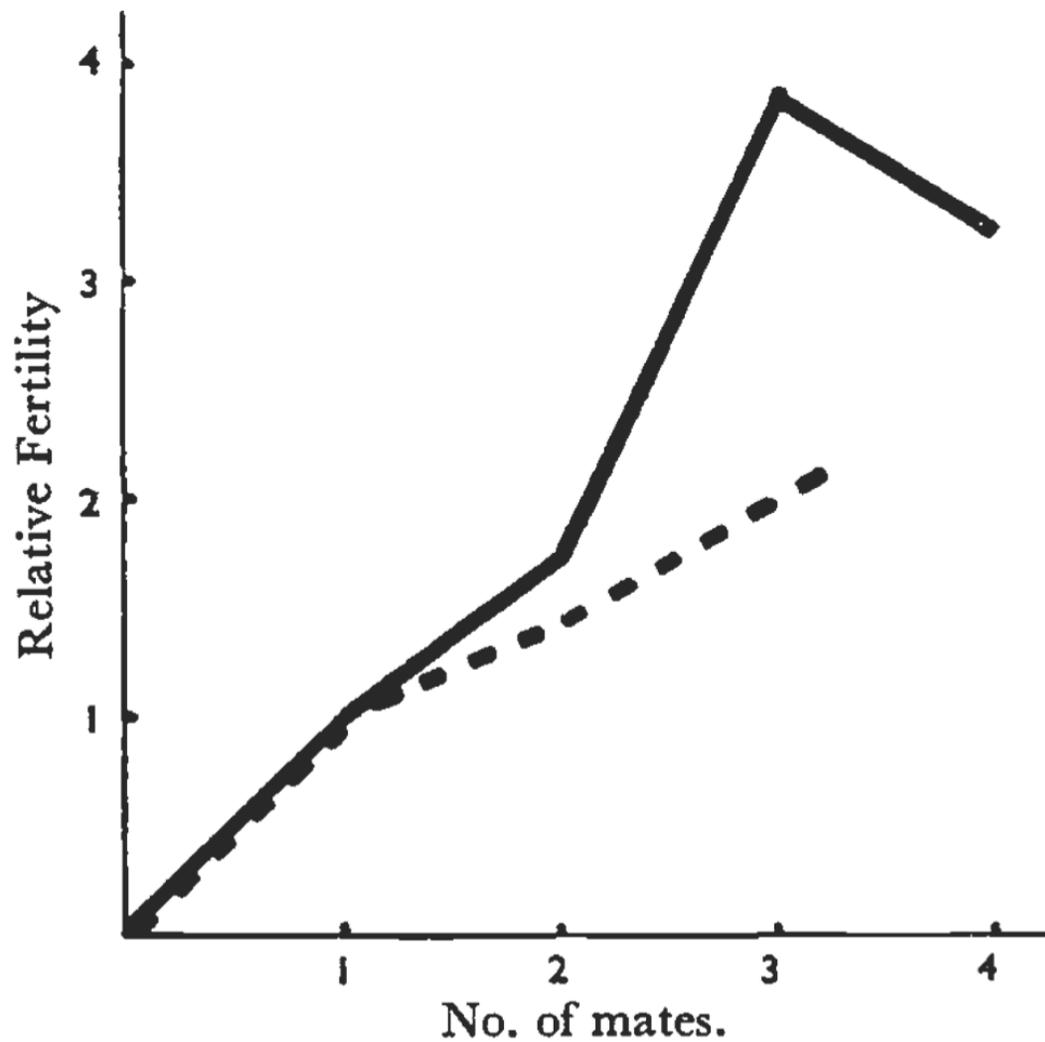
- Sexual selection *is* selection
- Selection theory offered a framework to formalise verbal models of sexual selection
 - Focusing on the *cause* of sexual selection



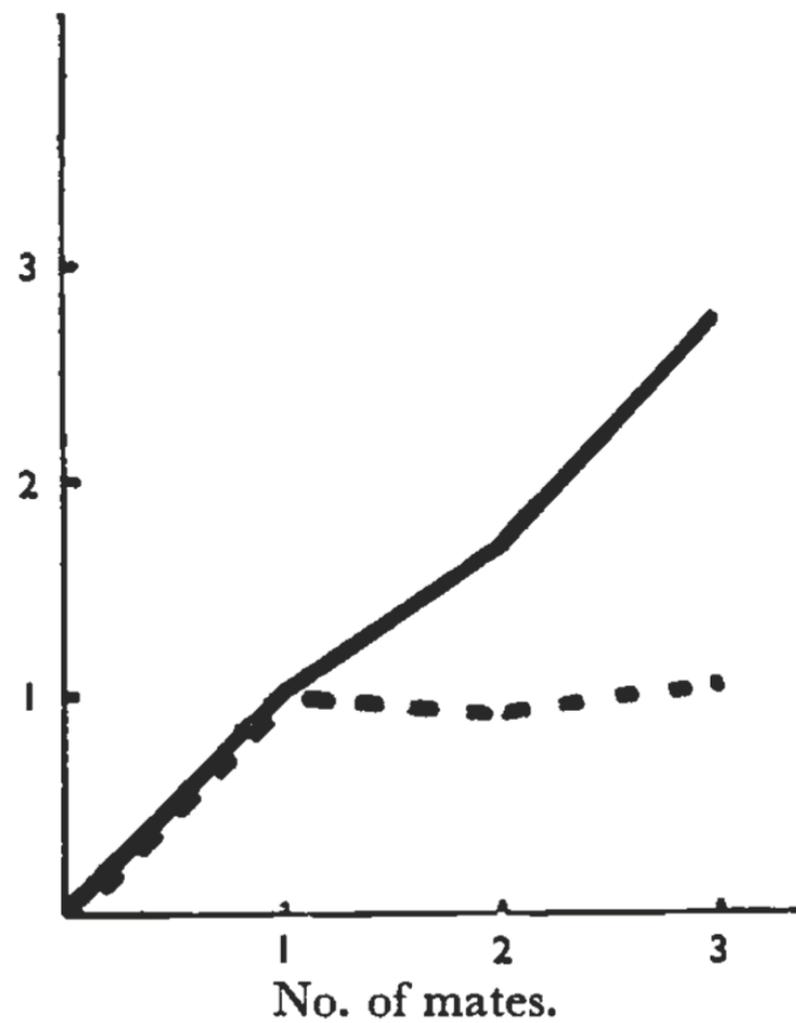


Series 5 and 6 combined.

FIG. 1.—The relation between number of mates and fertility relative to that with one mate.
Solid line, males : Broken line, females.



(a) Series 1-4 combined.



(b) Series 5 and 6 combined.

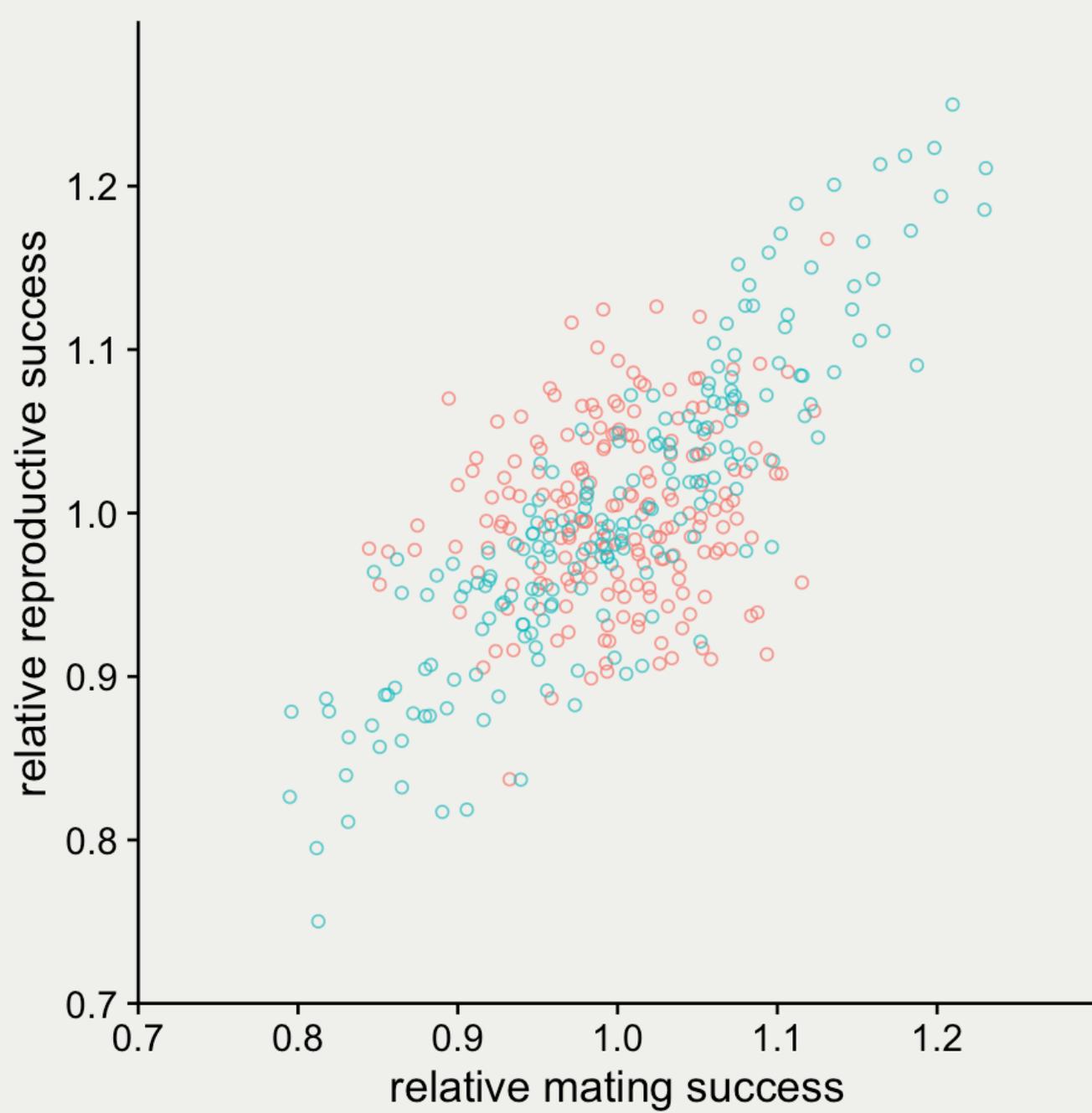
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Solid line, males : Broken line, females.

Bateman's principles

1. variance in reproductive success (number of offspring)
greater in males
2. variance in mating success (number of sexual partners)
greater in males
3. an increase in mating success provides an increase in reproductive success for males, but not always for females

Anisogamy

Darwin-Bateman paradigm



1

variance in reproductive success (number of offspring)
greater in males.

Opportunity for selection (I)



2

variance in mating success (number of sexual partners)
greater in males.

Opportunity for *sexual* selection (
 I_s)

Variance based metric paint an imperfect picture.

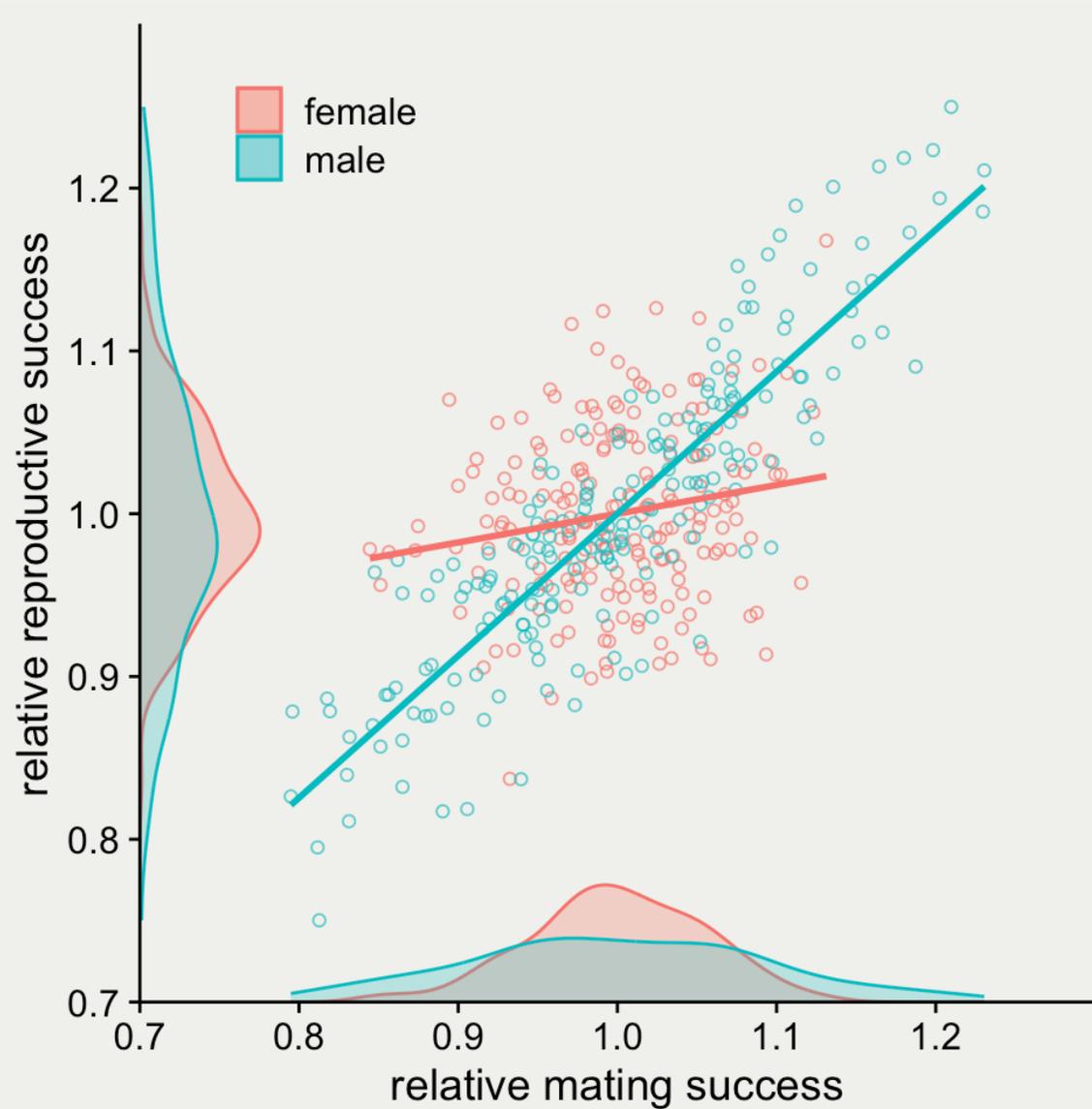
3

an increase in mating success provides an increase in reproductive success for males, but not always for females

Sexual selection gradient (β_{SS})



Bateman gradient (β_{SS})

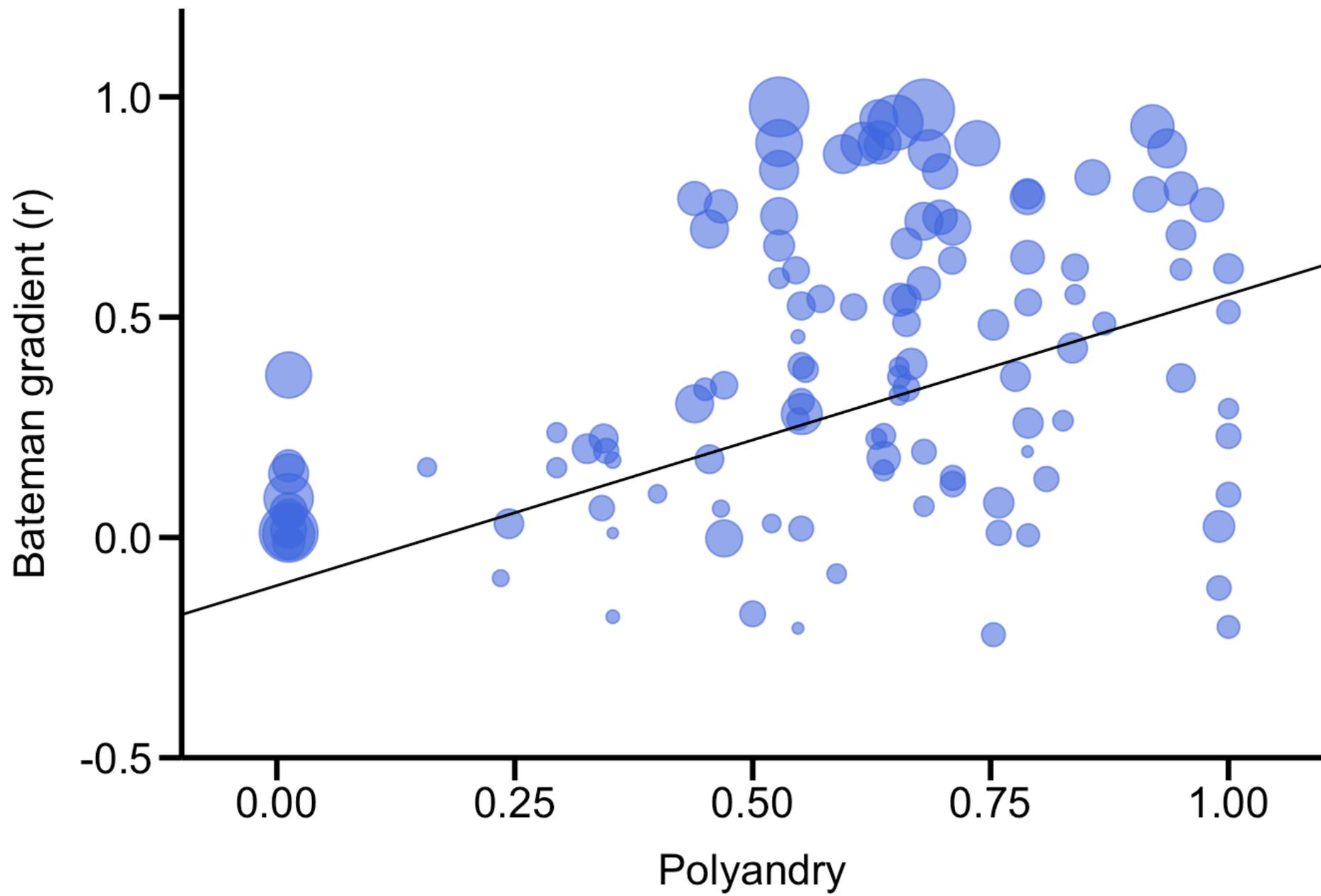


Mating success as a trait

- outcome of an individual's (relative) competitive ability
- the ecological setting in which the competition takes place
- the social environment
- poorly predicted by e.g. the breeder's equation

Bateman metrics

- Opportunity for selection (I)
- Opportunity for *sexual* selection (I_s)
- Bateman gradient (β_{ss})
- Jones Index ($s'_{\max} = \beta_{ss} \sqrt{I_s}$)



Andersson, M. 1994. Sexual selection.

Arnold, S. J. 1994. Bateman's Principles and the Measurement of Sexual Selection in Plants and Animals. *The American Naturalist* 144:S126–S149.

———. 2023. *Evolutionary Quantitative Genetics*. Oxford University Press.

Arnold, S. J., and M. J. Wade. 1984. On the Measurement of Natural and Sexual Selection: Applications. *Evolution* 38:720–734.

Bateman, A. J. 1948. Intra-sexual selection in *Drosophila*. *Heredity* 2:349–368.

Crow, J. F. 1958. Some Possibilities For Measuring Selection Intensities In Man. *Human Biology* 30:1–13.

Darwin, C. 1871. *The descent of man, and selection in relation to sex*. International science library. Murray.

Dewsbury, D. A. 2005. The Darwin-Bateman Paradigm in Historical Context. *Integrative and Comparative Biology* 45:831–837.

Emlen, S. T., and L. W. Oring. 1977. Ecology, Sexual Selection, and the Evolution of Mating Systems. *Science* 197:215–223.

Fromonteil, S., L. Marie-Orleach, L. Winkler, and T. Janicke. 2023. Sexual selection in females and the evolution of polyandry. *PLOS Biology* 21:e3001916.

Jones, A. G., N. L. Ratterman, and K. A. Paczolt. 2013. The Adaptive Landscape in Sexual Selection Research. Pages 110–125 *in* E. Svensson and R. Calsbeek, eds. *The*

Adaptive Landscape in Evolutionary Biology. Oxford University Press.

Lorch, P. D. 2005. Using Upper Limits of “Bateman Gradients” to Estimate the Opportunity for Sexual Selection¹. *Integrative and Comparative Biology* 45:924–930.

Rosenthal, G. G. 2017. *Mate Choice*.

Tang-Martínez, Z., and T. B. Ryder. 2005. The Problem with Paradigms: Bateman’s Worldview as a Case Study. *Integrative and Comparative Biology* 45:821–830.

Wade, M. J. 1979. Sexual Selection and Variance in Reproductive Success. *The American Naturalist* 114:742–747.

Wade, M. J., and S. J. Arnold. 1980. The intensity of sexual selection in relation to male sexual behaviour, female choice, and sperm precedence. *Animal Behaviour* 28:446–461.