

Sexual Selection

Chapter 10

What is Sexual Selection

Fitness is closely related to the number of offspring produced

In sexual species this is related to the number of matings you obtain

In most species this is more true for males than females

Obtaining matings becomes a major component of fitness!

To get matings you must:

Convince other sex to mate with you (female choice)

Prevent other males from getting access to potential mates
(male-male competition)

Male - Male competition

Males fight for access to females

Females may not be innocent bystanders!

Promotes larger males, with more aggressive ornamentation.



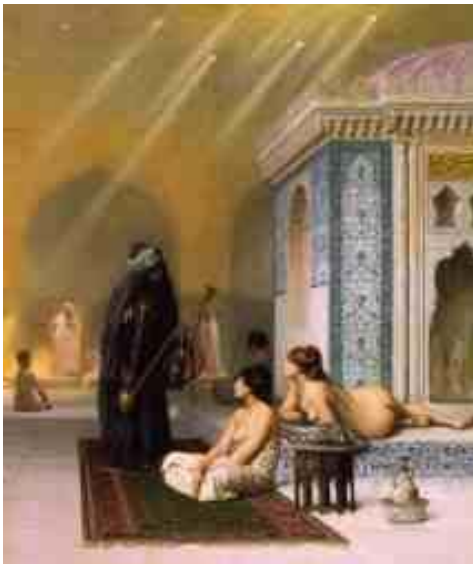
Mate Guarding



Titi monkey male showing mate guarding by preventing female partner from visiting male neighbor.

Humans have male-male competition

Topkapi Harem then and now



Mean number of offspring for males and females must be equal

Each offspring has one mother and one father.

One male can father many offspring

For every male that sires two offspring, another male fails to sire an offspring.

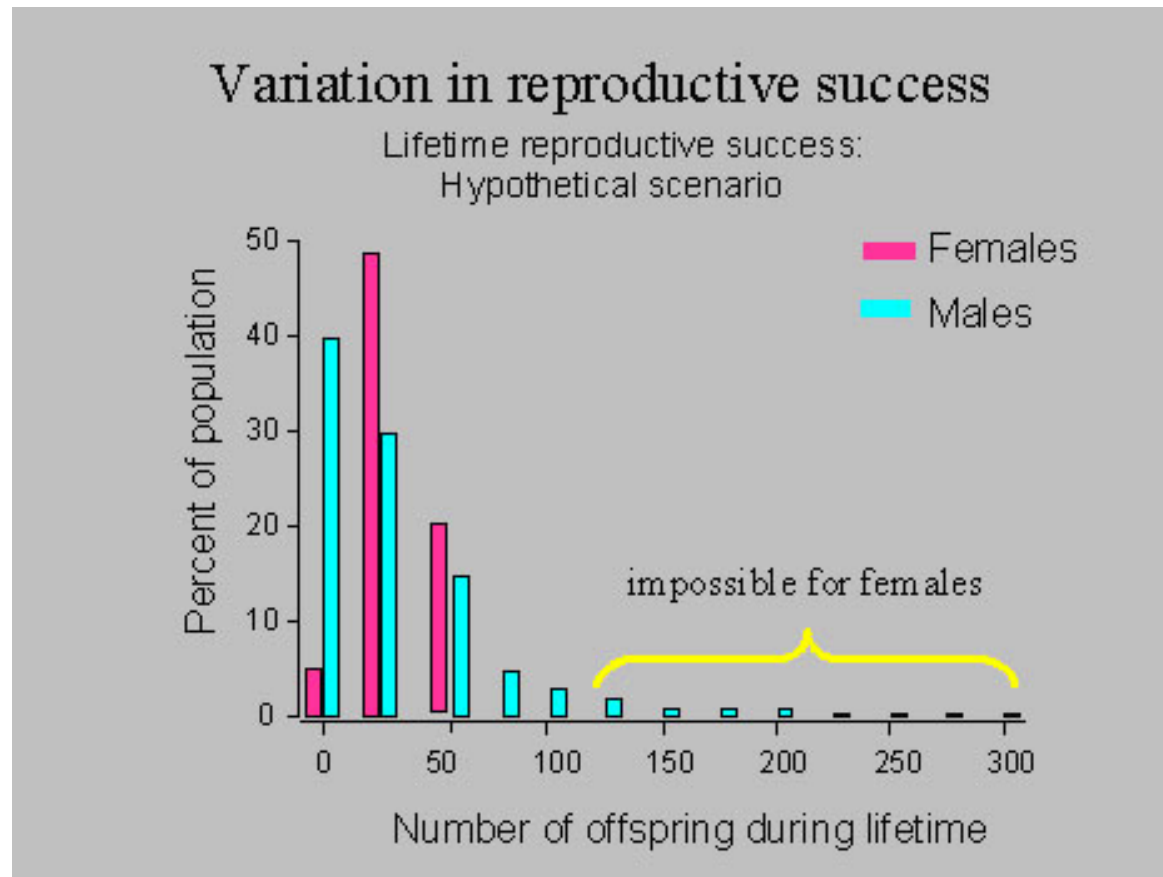
Important point:

Males tend to be limited by the number of matings

Females tend to be limited by fertility.

Variance in reproductive success tends to be greater for males than females.

Variance in Reproductive Success



Facts about Humans

Most children born to a woman

The most prolific mother in history was a Russian peasant who had 69 children in the 18th century, 67 of which survived infancy.

Between 1725 and 1765, she endured 27 multiple births, which included 16 pairs of twins, seven sets of triplets, and four sets of quadruplets.

The modern world record for giving birth is held by Leontina Albina from San Antonio, Chile. Now in her mid-sixties, she claims to be the mother of 64 children. Of these, 55 are documented, birth certificates apparently being something of a less-than-serious concern in Chile.

Most children fathered

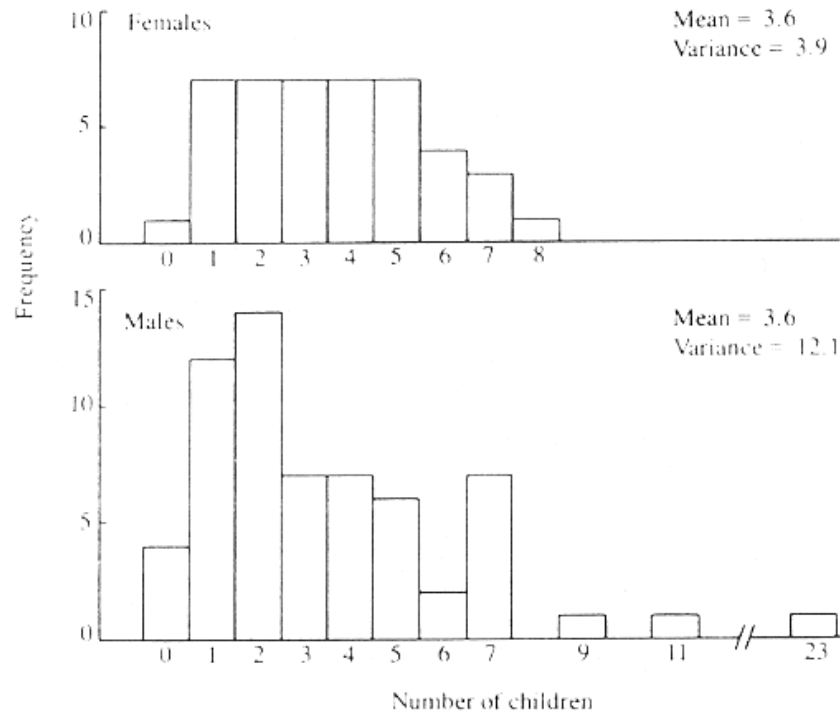
The most prolific father of all time is believed to be the last Sharifian Emperor of Morocco, Mulai Ismail (1646-1727).

In 1703 he had at least 342 daughters and 525 sons and by 1721 he was reputed to have 700 male descendents.

There is more variance in male reproduction than female reproduction!

Xavante Indians

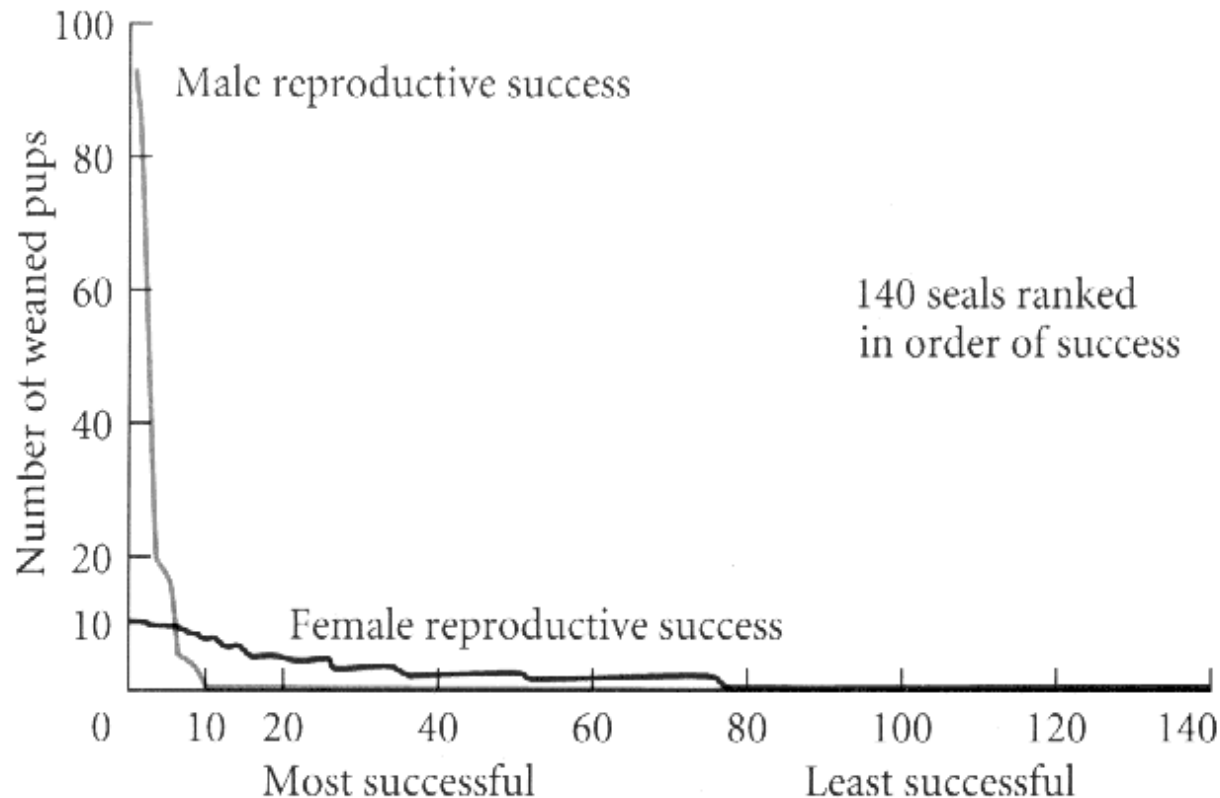
Variance in reproductive success among Xavante Indians



Total children produced by living adults at least forty years old plus recently deceased, in two villages in the Mato Grosso, Brazil.

Because of polygynous marriage a few men have more children than any one woman could bear.

Elephant Seals



Reproductive success of male elephant seals is highly biased: the "alpha male" sires >90% of pups, the large majority of males none. Most females had at least one pup. (from Futuyma 1998)

What Causes Asymmetries in reproduction?

Generally females “invest” more than males.

Eggs are much larger than sperm

Females are generally “saddled” with offspring

Males can (theoretically) inseminate and run

Females are physiologically limited by fertility rates

Males are limited by mating rates.

Females tend to be “choosy”, males tend to be more promiscuous

Exceptions that prove the rule



Rednecked Phalarope



“pregnant” male seahorse

In some species males provide the bulk of effort to rear offspring. In these species often the males are “choosy”

Consequences of female choice

Males spend considerable effort attracting mates.

Females do not have this issue.

Males often deviate wildly from the natural selection “optimum” solely because it is attractive to females!





What Should Females Choose?

Females are choosy, but what are they choosing?

Good genes?

How do you know who has good genes?

Males lie!

Immediate advantage

Disease free males

Males that will provide resources

Males that are sexy.

Who cares what they provide other than sperm?

Which explain a peacocks tail?

Good Genes

Females choose mates because they will provide good genes for their offspring.

The problem: Females can choose phenotypes, not genes.

The solution: Home in on traits that are good indicators of genetic quality.

“expensive” traits: Only a male with good genes can “afford” to maintain bright colors, large antlers etc.

Males should “lie”. That is evolution will favor males that overemphasize the trait females are using for mate choice.

Problems with good genes

If a gene is unequivocally “good” it should be rapidly fixed in a population. -- nothing to maintain the mating preference!

There is no reason that an extreme trait will be genetically linked to the “good” genes that a female is interested in.

The genes causing the extreme trait cannot be “good” in and of themselves since they push the male away from the naturally selected optimum.

Immediate advantage

Interestingly, this makes some sense.

Females should avoid males with communicable diseases.

Extreme traits advertise overall health and vigor.

Birds with mites have ragged plumage

Lizards with malaria have dull dewlaps.

Males that “falsely” advertise their health should be favored by selection (females should be good at detecting false advertising!)

Females could demand lots of attention from males to have them “prove” they will be good parents.

Problems with immediate advantage

It is still hard to explain the really extreme traits that are often seen

Mating pairs are good targets for predators. Obviously it is in a females best interests to mate with a cryptic male.

Sword tail females prefer males with big tails UNLESS they sense a predation risk. Then they prefer males with shorter tails.



Females like sexy males

Incredibly this one works VERY well.

Fisher's "runaway" process:

For what ever reason some females have an underlying preference for males with an exaggerated trait.

Sons of choosy mothers have the exaggerated trait and carry the tendency to be choosy

Daughters tend to be choosy, and carry the tendency for the exaggerated male trait.

This process can "run away"

Fisher's runaway process

PHASE 1: Female preferences initially evolve because the preferred trait is favored by natural selection and hence the offspring are more likely to carry the beneficial trait.

Whenever appreciable differences exist in a species, which are in fact correlated with selective advantage, there will be a tendency to select also those individuals of the opposite sex which most clearly discriminate the difference to be observed, and which most decidedly prefer the more advantageous type.

Fisher (1930) Genetical Theory of Natural Selection (1958 ed., p. 151)

PHASE 2: Once female preferences exist, males with the trait are even more fit (both a natural and a sexual selection advantage). There will then be an ever increasing selective force favoring stronger preferences and more extreme traits (Fisher's runaway process).

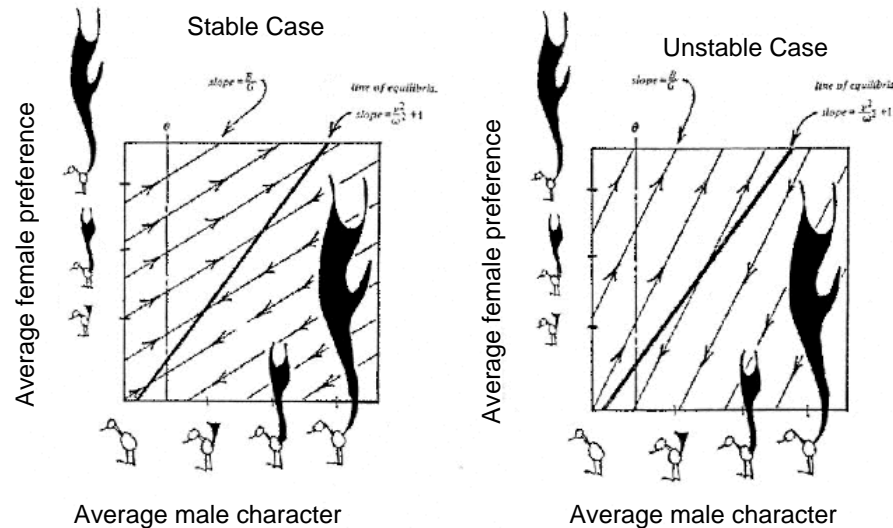
...the further development of the plumage character will still proceed, by reason of the advantage gained in sexual selection, even after it has passed the point in development at which its advantage in Natural Selection has ceased.

Fisher (1930) Genetical Theory of Natural Selection (1958 ed., p. 152)

The process stops when natural selection is eventually strong enough to counteract sexual selection

Fisher's runaway process

The Fisher Runaway process



Equilibrium line: sexual selection (female preference) exactly balances natural selection against male trait.

Genetic correlation determines whether or not the trait will “run away”

Problems with Fisher's process

From a theoretical perspective the runaway process works

There must be an underlying preference and trait variation to get the system started.

Females get nothing but low fitness sons out of it

Males get nothing but a gigantic hit to their survivorship out of it.

In general the runaway process leads to maladaptation from a survival perspective!

Summary

Males and females have different constraints on reproduction

Females tend to be limited by fertility

Males limited by mating success

This can be reversed

This disparity leads to males having a much larger variance in reproductive success.

It also tends to lead to female “choosiness”.

The bases for female choosiness is not always clear.

This choosiness leads to extreme male traits, often at odds with male viability fitness.