

Sexual Selection

Alan R. Rogers

March 14, 2011



- ▶ In general, males are big, gaudy, and mean
- ▶ Why?

Outline

- ▶ Puzzle: why are males big, mean, and gaudy?
- ▶ Theory of sexual selection
- ▶ Big males, Sperm competition, Female choice
- ▶ Big, mean, gaudy females: the Wattled Jacana
- ▶ Summary

Males are often colorful (Painted Bunting)



Why is the male Painted Bunting so colorful?

- ▶ Makes male easy for predator to see.
- ▶ Reduces survival.
- ▶ How could this evolve by natural selection?

Antlers (Elk)



Why do male elk have antlers?

- ▶ Not predator defense.
(Otherwise females would have them too.)
- ▶ Expensive to grow.
- ▶ Heavy and cumbersome.
- ▶ Poor weapons
- ▶ How do they evolve?



Male widowbirds and bishops (East Africa)



Female widowbirds and bishops (East Africa)

Why do male widowbirds have long tails?

- ▶ Make it hard to fly.
- ▶ Expensive to grow.
- ▶ How do they evolve?



Males are often larger.

Orangutan

| Sex | Weight (lb) |
|--------|-------------|
| Male | 200 |
| Female | 110 |
| M/F | 1.8 |

Southern Elephant Seal



| Sex | Weight (kg) |
|--------|-------------|
| Male | 3000 |
| Female | 900 |
| M/F | 3.3 |

Why are male orangutans and elephant seals so large?

- ▶ It takes resources to grow.
- ▶ It takes resources to maintain a large body.
- ▶ Large size helps defend against predators.
- ▶ But if that were the explanation, females would be just as large.

Males tend to be aggressive (Gnu)



Males Take Risks



and more risks.

In many species,
▶ males have higher mortality,
▶ and shorter life spans.

Puzzle

- ▶ Why should these characters evolve at all?
- ▶ Why are they limited to males?

Outline

- Puzzle: why are males big, mean, and gaudy?
- ▶ Theory of sexual selection
- ▶ Big males, Sperm competition, Female choice
- ▶ Big, mean, gaudy females: the Wattled Jacana
- ▶ Summary

Theory of sexual selection (Darwin 1871)

- ▶ Darwin: these characters help males get mates.
- ▶ But how do they help?
- ▶ And why just males?

The potential rate of reproduction

- ▶ In some species, the two sexes reproduce at the same rate.
- ▶ In others, one sex has an advantage.

Consider deer

- ▶ Male can copulate many times a day.
- ▶ After being fertilized, female is not fertile for a year.
- ▶ Potential rate of reproduction higher for males than for females.

Mating pool

- ▶ Consists of those individuals available to mate
- ▶ At any given time, nearly all males are available.
- ▶ Many females, however, are not: (pregnant or nursing)
- ▶ Mating pool contains more males than females.
- ▶ Receptive females have few competitors.
- ▶ Receptive males have many.

Selection for mating success

- ▶ strong in males.
- ▶ weak in females.

In most species, females invest more in each offspring

- ▶ Larger gametes
- ▶ Eggs (fish, birds, reptiles, etc)
- ▶ Gestation (mammals)
- ▶ Parental care (mammals, birds)

The more you invest per offspring, the fewer you can produce

- ▶ Since females usually invest more, their rate of reproduction is usually lower.
- ▶ Result: less competition for mates.
- ▶ Sexual selection is weak in females.

Traits favored by sexual selection

| In sex where potential rate of reproduction is | We expect |
|--|---|
| high | traits that increase number of matings |
| low | traits that increase quality of matings |

Usual case: ardent males and choosy females

Ways to increase number of matings

- ▶ Either exclude other males (be big; be mean),
- ▶ or else be sneaky (some fish),
- ▶ exclude other males' sperm (make lots),
- ▶ attract females (be beautiful).

Outline

- Puzzle: why are males big, mean, and gaudy?
- Theory of sexual selection
- ▶ Big males, Sperm competition, Female choice
- ▶ Big, mean, gaudy females: the Wattled Jacana
- ▶ Summary

We've already talked about species with large males. What about aggressive ones?

The Yanomamo

- ▶ human population, S Venezuela
- ▶ rain forest agriculture
- ▶ frequent warfare & violence
- ▶ those who have killed are called *unokais*

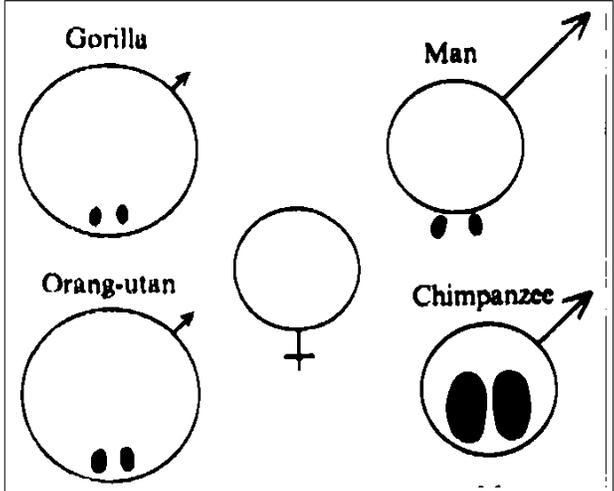
Children born to *unokais* and non-*unokais*

| Ages | Offspring | |
|-------|----------------|---------------------|
| | <i>Unokais</i> | Non- <i>Unokais</i> |
| 20-24 | 1.00 | 0.18 |
| 25-30 | 1.57 | 0.86 |
| 31-40 | 2.83 | 2.02 |
| > 41 | 6.99 | 4.19 |
| Total | 4.91 | 1.59 |

Sperm competition

- ▶ In some species, each female mates several males.
- ▶ Sperm of different males compete for ovum.
- ▶ One way to win: make lots of sperm.
- ▶ Prediction: promiscuous species should have large testes

Chimps are promiscuous, have large testes



- Chimps**
 - ▶ multi-male troop
 - ▶ receptive females mate many times
 - ▶ Lots of sperm competition
 - ▶ Large testes
- Other species**
 - ▶ males monopolize females
 - ▶ Less sperm competition
 - ▶ Small testes

Rapid evolution of sperm proteins

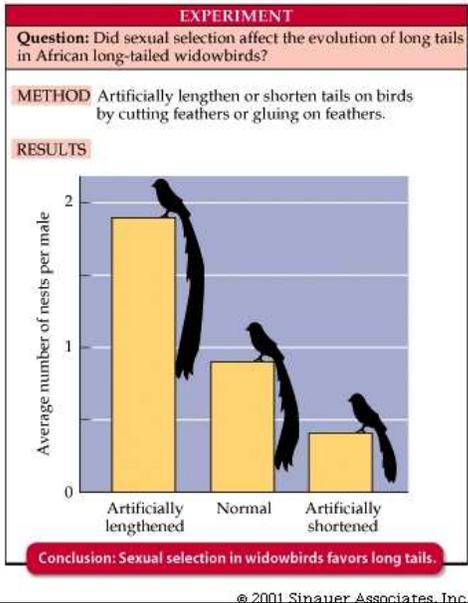
- ▶ Some proteins are expressed only in sperm.
- ▶ In primates, these proteins evolve rapidly.
- ▶ Especially in lines leading to humans and chimps.
- ▶ Suggests lots of sperm competition in human ancestors.

Why are males beautiful?

Do beautiful males get more mates?



- ▶ Do males with long tails get more mates?
- ▶ Experiment (Andersson 1982): shorten tails of some males, lengthen tails of others, and leave others alone.



Longtailed Widowbird

Females prefer males with long tails.

But why do females prefer beautiful males?

One potential answer: the "sexy son" hypothesis.

Sexy son hypothesis (Fisher 1930)

The process starts with a slight tendency for females to prefer males with long tails.

- ▶ Females who mate with such males have sons with long tails.
- ▶ The sons get more mates.
- ▶ The female gets more grand-children.
- ▶ Females with the preference have more grand-children.
- ▶ The preference gets stronger, and tails get longer.

Outline

- Puzzle: why are males big, mean, and gaudy?
- Theory of sexual selection
- Big males, Sperm competition, Female choice
- ▶ Big, mean, gaudy females: the Wattled Jacana
- ▶ Summary

Wattled Jacana



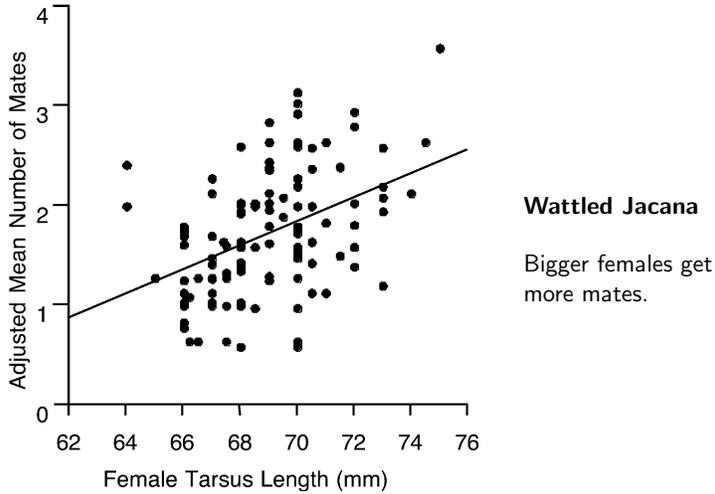
- ▶ Male sits on eggs
- ▶ Polyandrous: females have 1–4 mates
- ▶ males have 1 mate

Male Wattled Jacana on nest

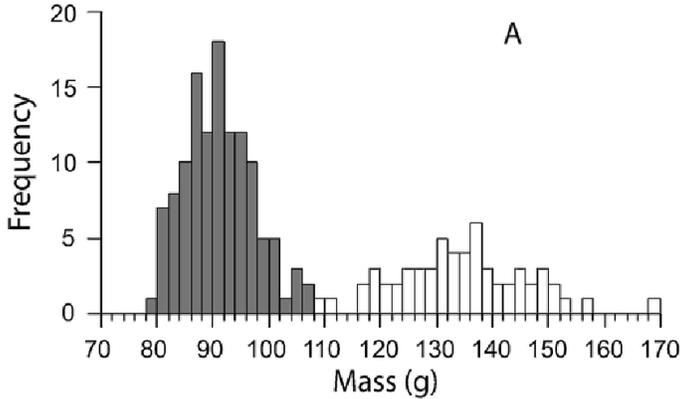


Potential reproductive rate among Wattled Jacana

| | | |
|--------|------|---------------|
| Male | 3.6 | broods per yr |
| Female | 14.4 | broods per yr |
| F/M | 2.2 | |



Weight of Wattled Jacanas



Gray: male; white: female. (Wrege & Emlen, 2005)

Sexual dimorphism in Wattled Jacana

| Sex | Weight (g) |
|--------|---------------|
| Male | 87.5 |
| Female | 129.3 |
| M/F | 0.68 |

Summary

- ▶ Males are big, gaudy, and mean because this gets them mates.
- ▶ Males invest less in each offspring, so their potential rate of reproduction higher, and they must compete for females.
- ▶ Selection favors traits that help males get mates.
- ▶ This makes them ardent, big, gaudy, and mean.
- ▶ Females do not benefit from numerous mates, they benefit from mates who will invest in offspring, and who have good genes.
- ▶ Selection favors choosy females.
- ▶ If females reproduce faster than males, then females are big, gaudy, and mean.