

ULTIMATE EXPLANATIONS FOR PRIMATE SOCIALITY



HEB 1330: Primate Social Behavior
10 September 2020

TODAY

- Revisit Tinbergen's 4 questions
- Ultimate explanations for primate sociality?
 - Group size
 - Female-female relationships
- Write quiz questions
- *Bonus video, if time allows

TINBERGEN'S FOUR QUESTIONS

Table 1. Tinbergen's four questions, organized.

| FOUR AREAS OF BIOLOGY: FOUR QUESTIONS | | Two objects of explanation | |
|--|---|---|---|
| | | <u>Developmental/historical</u> A sequence that results in the trait | <u>Single form</u> The trait at one slice in time |
| Two kinds of explanations | <u>Proximate</u> Explains how organisms work by describing their mechanisms and their ontogeny | <u>Ontogeny</u> Q: How does the trait develop in individuals? A: Description of the trait's forms at sequential life stages, and the mechanisms that control development. | <u>Mechanism</u> Q: What is the structure of the trait; how does it work? A: Description of the trait's anatomy, physiology, regulation, and how the trait works to accomplish a function. |
| | <u>Evolutionary</u> Explains how a species came to its current form by describing a sequence of forms, and how they were influenced by selection and other evolutionary factors. | <u>Phylogeny</u> Q: What is the phylogenetic history of the trait? A: Description of the history of the trait as reconstructed from its phenotype and genotype precursors | <u>Adaptive significance</u> Q: How have variations in the trait interacted with environments to influence fitness in ways that help to explain the trait's form? A: Description of how variations in the trait have influenced fitness |

TINBERGEN'S FOUR QUESTIONS

Opinions

Trump's unhinged tweets are an attempt to divert attention away from a historic fiasco

- How can Tinbergen help us understand Trump??

TINBERGEN'S FOUR QUESTIONS

Is Donald Trump an impulsive narcissist or a strategic genius?



Scott Limbrick [Follow](#)

Nov 29, 2016 · 4 min read



Flickr/Gage Skidmore

- How can Tinbergen help us understand Trump??

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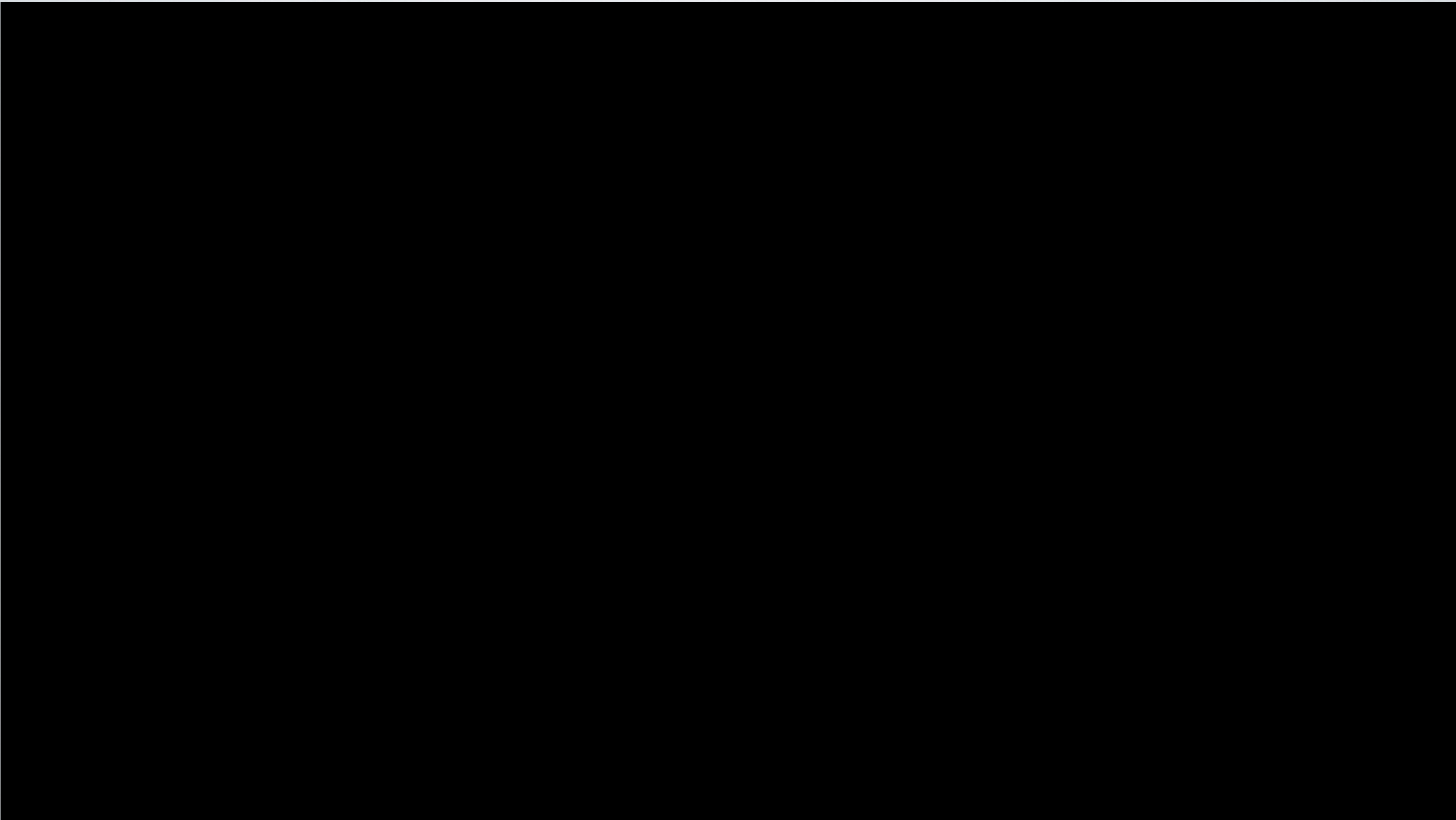
Common Mistakes

- **Mechanism/Function**
- **Phylogeny/Function**

TINBERGEN'S FOUR QUESTIONS



BROOD PARASITISM



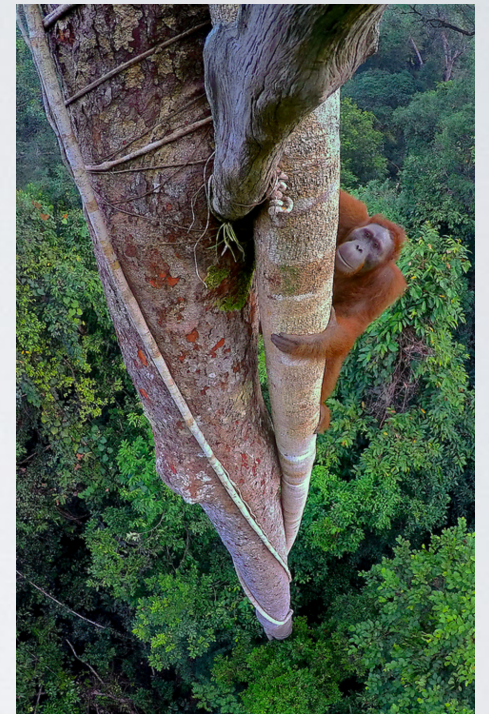
TINBERGEN'S FOUR QUESTIONS

Brood parasitism

- How does Tinbergen help us understand brood parasitism?
- What is the adaptive significance of the reed warbler feeding the cuckoo

QUESTIONS ABOUT THE FOUR QUESTIONS?

WHAT ACCOUNTS FOR DIVERSITY OF PRIMATE SOCIALITY?



COSTS AND BENEFITS OF SOCIALITY



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COSTS AND BENEFITS OF SOCIALITY

I need more friends who understand that I still want to be invited but I'm not going



thefatjewish • Follow



thefatjewish GET THE FUCK AWAY FROM ME BUT ALSO PLEASE NEVER LEAVE ME

134w



ashlee.oc @maree.marvelli



90w 1 like Reply

View replies (1)



erinranks @kayleecranstonmalooof



89w Reply



brokerbyron @leomattthew



251,261 likes

JULY 5, 2017

NATURAL SELECTION'S CURRENCIES



Deaths

How to decrease risk
of death of self and kin?



Births

How to increase
of lifetime offspring?

#FITNESSGOALS

- Long life
- Access to high-quality food
- Access to mates



#FITNESSGOALS

- Long life
- Access to high-quality food
- Access to mates



BENEFITS TO GROUP LIVING?

PREDATION

- 0-15% annual predation rate across primates
- Chacma baboons in Okavango: ~95% adult female deaths due to predation
- Extremely important selection pressure for most species

GROUP SIZE: AN ADAPTATION AGAINST PREDATION?

- No predators=smaller groups
- Island vs mainland populations



Long-tailed macaque

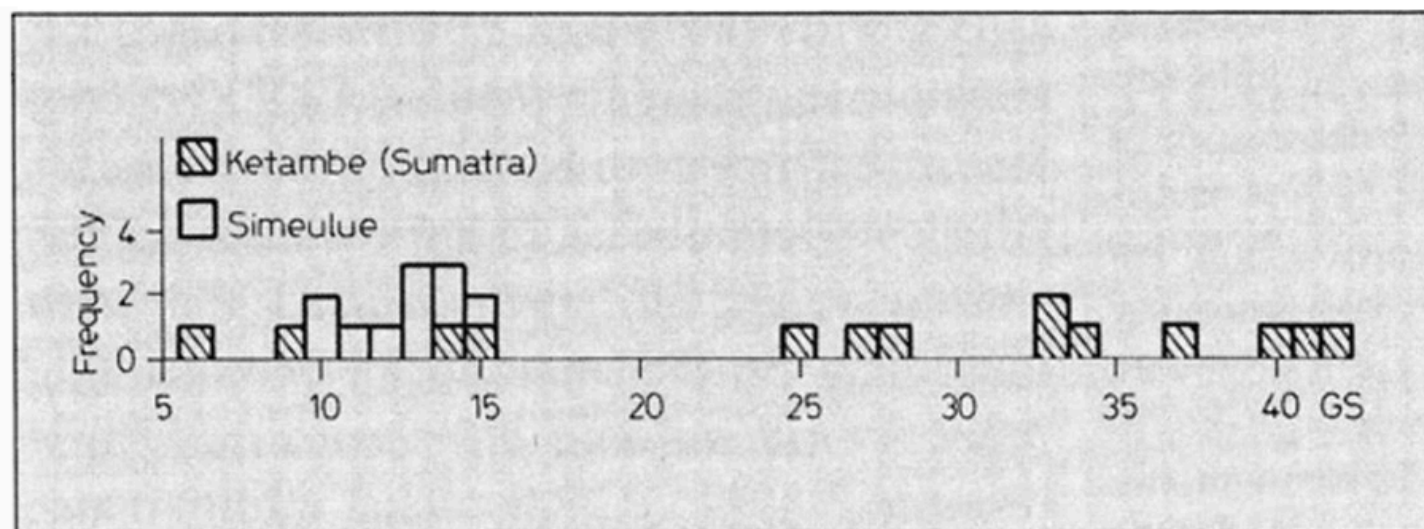
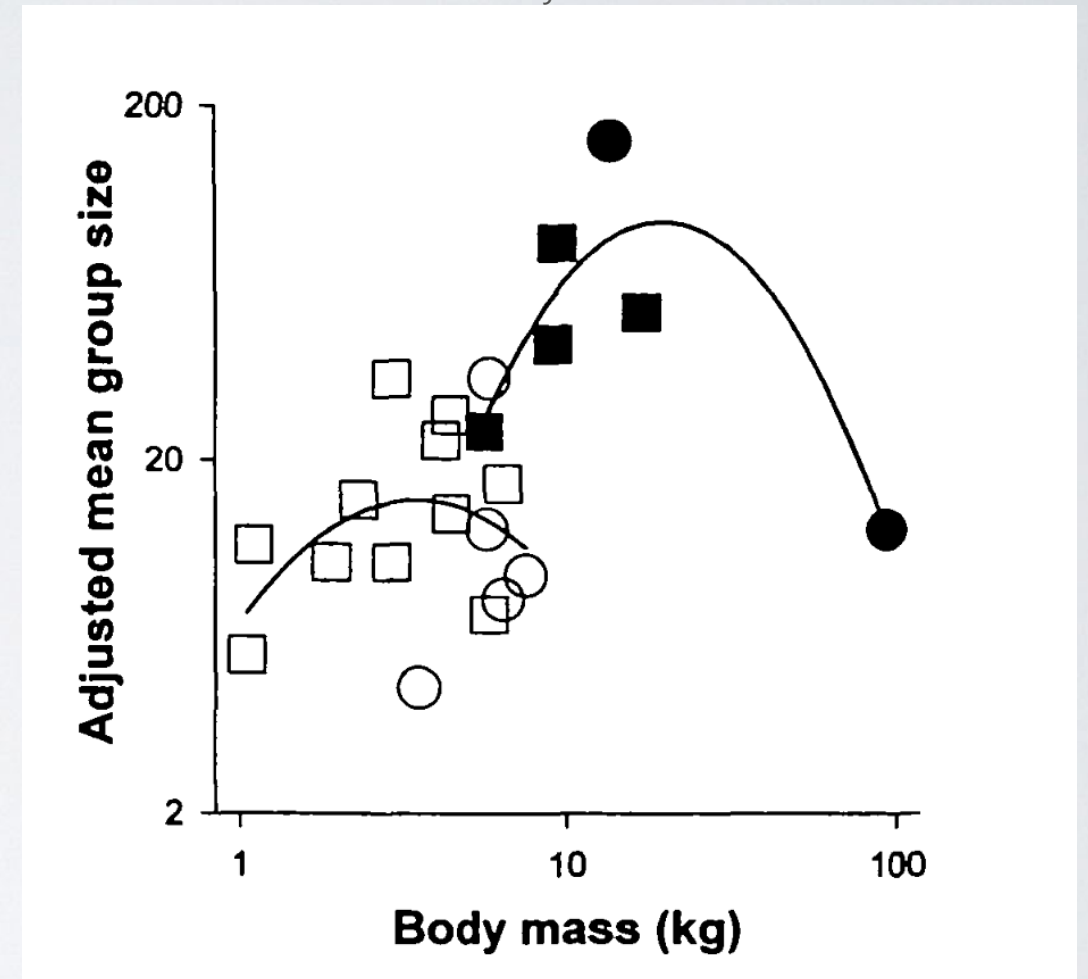


Fig. 1. Comparison of the size distribution of long-tailed macaque groups on Simeulue and at Ketambe (Sumatra).

GROUP SIZE: AN ADAPTATION AGAINST PREDATION?

- Terrestrial species live in larger groups

Janson and Goldsmith 1995



Black symbols=terrestrial species
White symbols=arboreal species

GROUP SIZE: AN ADAPTATION AGAINST PREDATION?

- Groups at higher risk of predation live in larger groups
- 121 groups of cercopithecoid primates, from 39 species

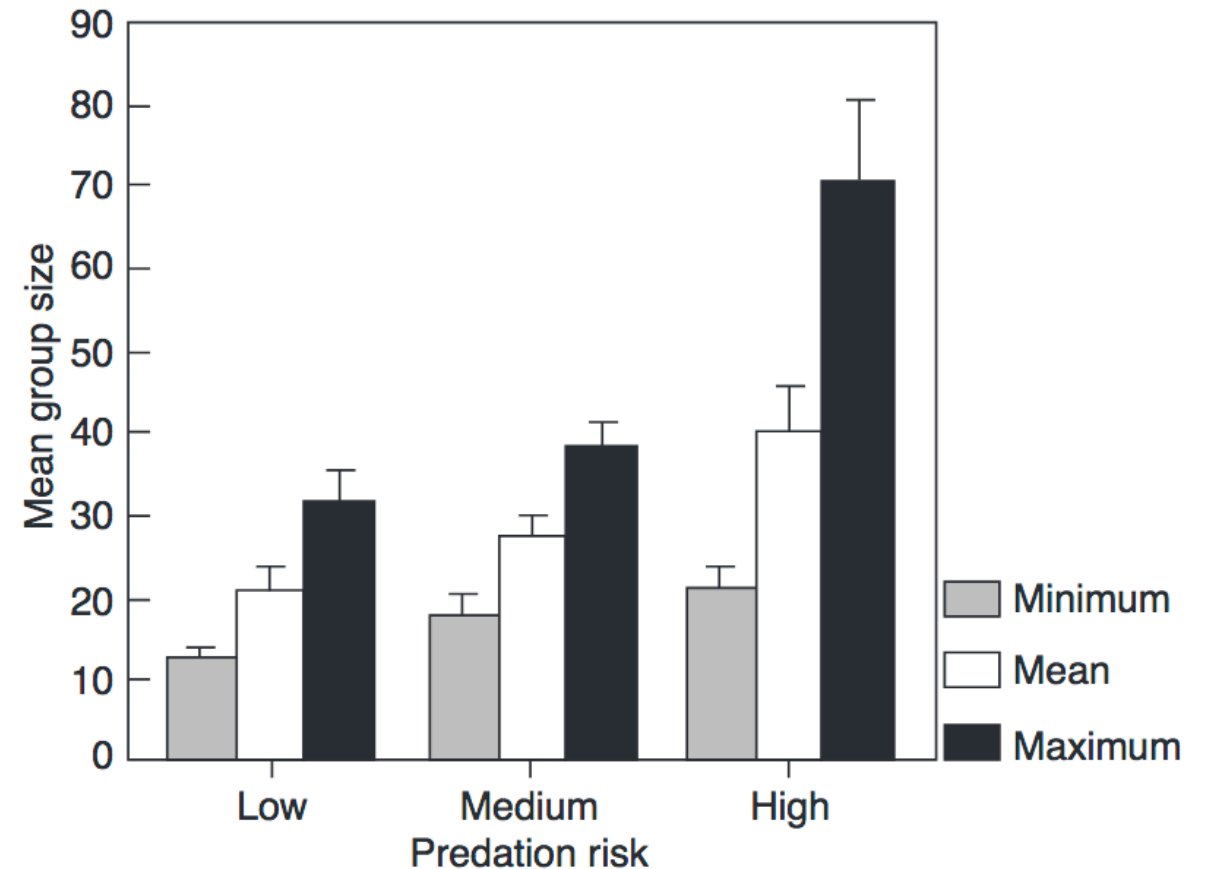


Fig. 1. Mean and standard error for the minimum, mean and maximum group sizes of populations under low, medium and high predation risk.

Hill and Lee 1998

MECHANISMS OF PREDATOR AVOIDANCE?

MECHANISMS OF PREDATOR AVOIDANCE?

- Mobbing
- Increased vigilance
- Dilution effect

VIGILANCE

- Predators spotted at greater distance in larger groups



Long-tailed macaque

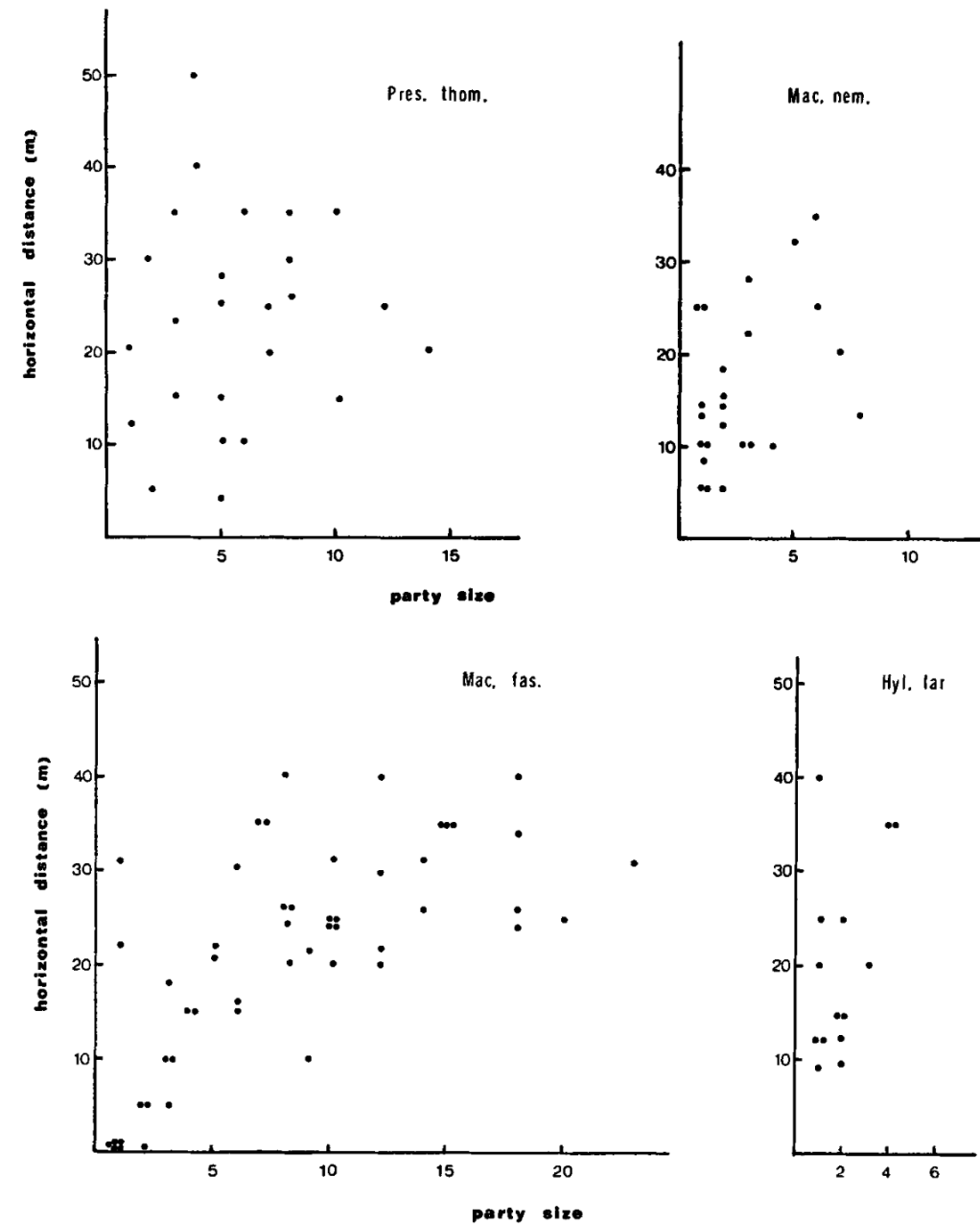


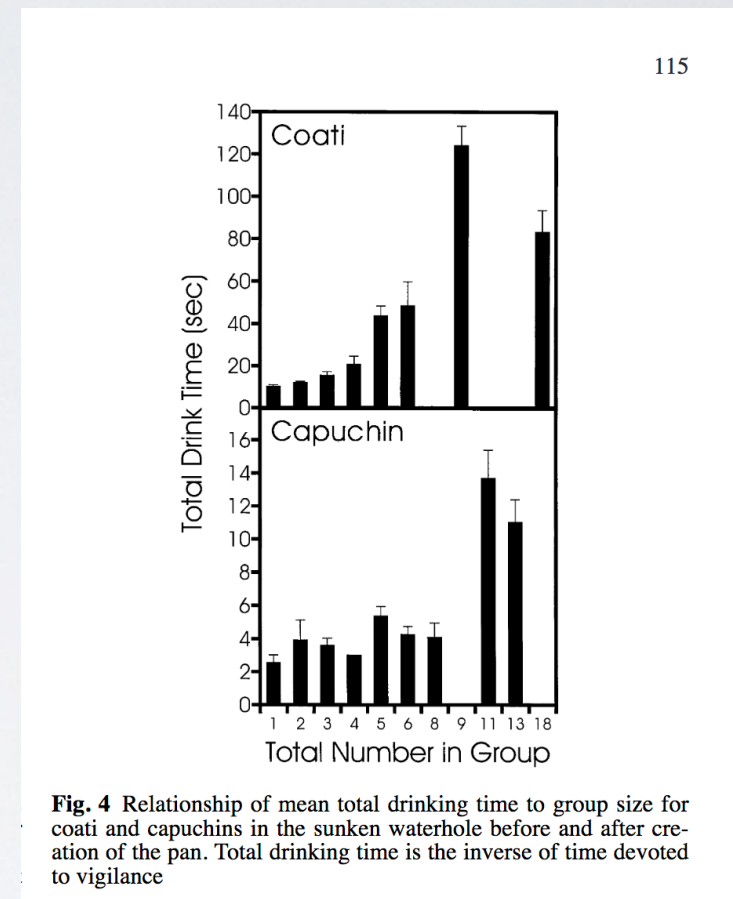
Fig. 1a. The observed relationship between estimated party size of four species of primate and horizontal detection distance.

VIGILANCE



VIGILANCE

- Coatis and capuchins in larger groups were able to spend more time drinking
- Extra eyes allow you to eat



Burger 2001



DILUTION EFFECT

- An individual's probability of being killed decreases as group size increases



Fanshawe & FitzGibbon: Hunting success of wild dogs

483

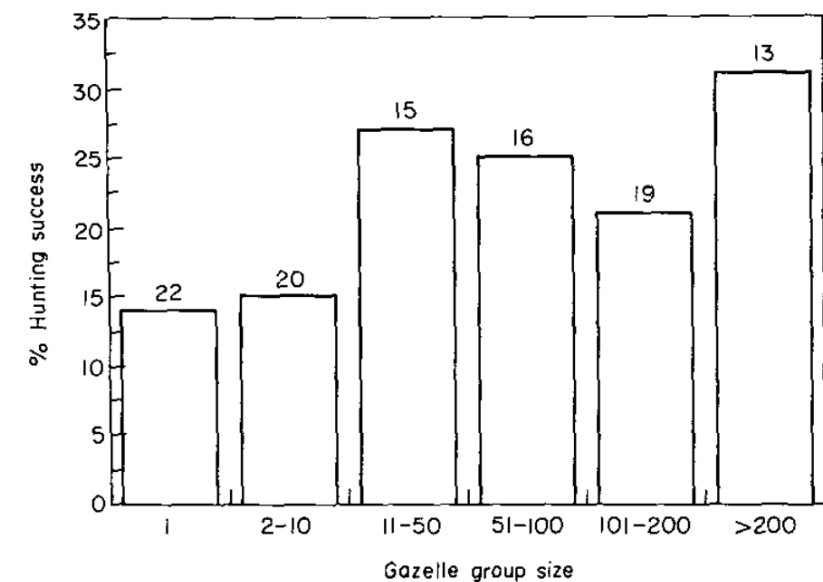


Figure 2. The effect of gazelle group size on wild dog hunting success. The number of hunts is shown above each histogram.

COSTS OF SOCIALITY?

COSTS OF SOCIALITY

- Larger groups:
 - spend more time foraging

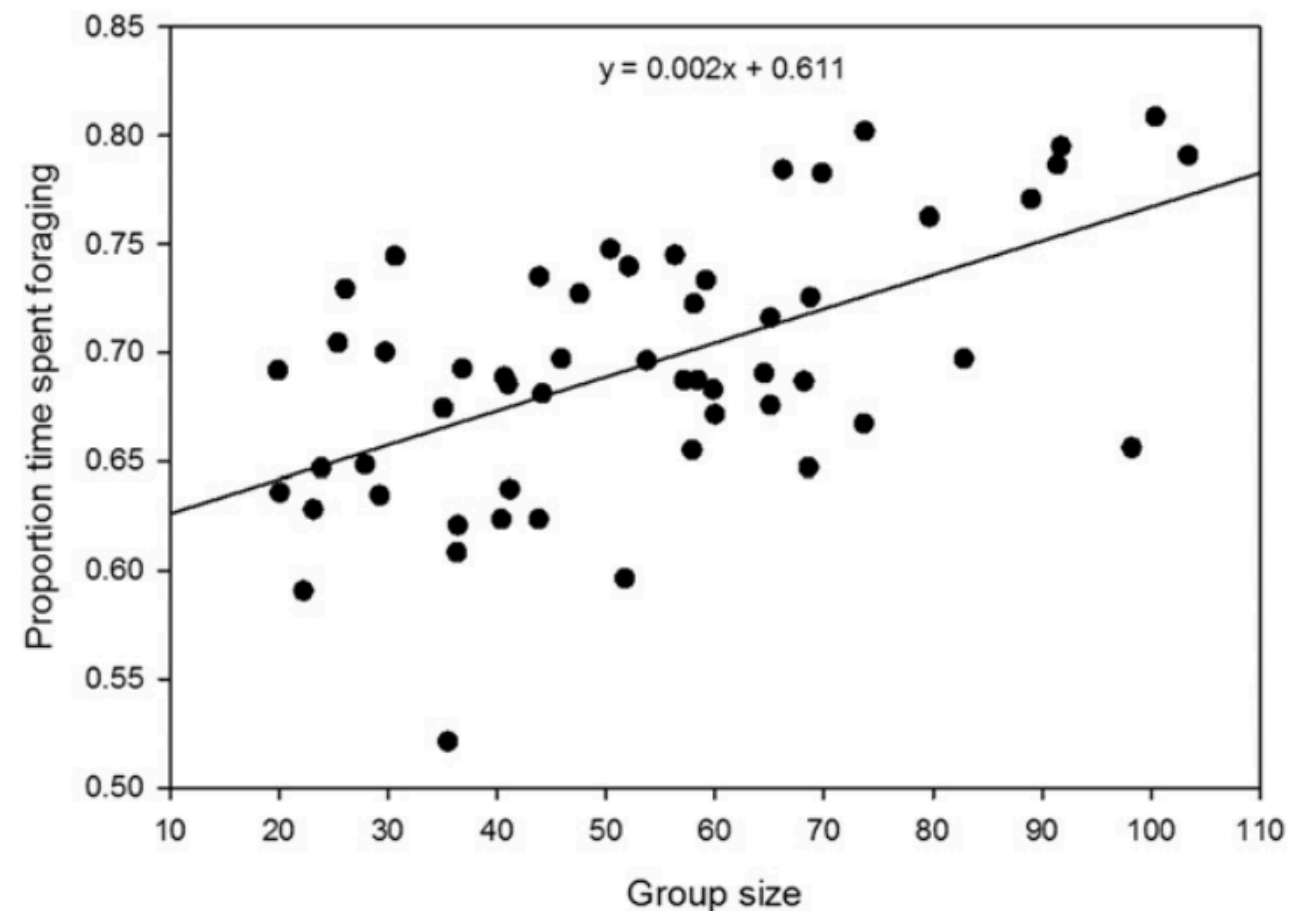
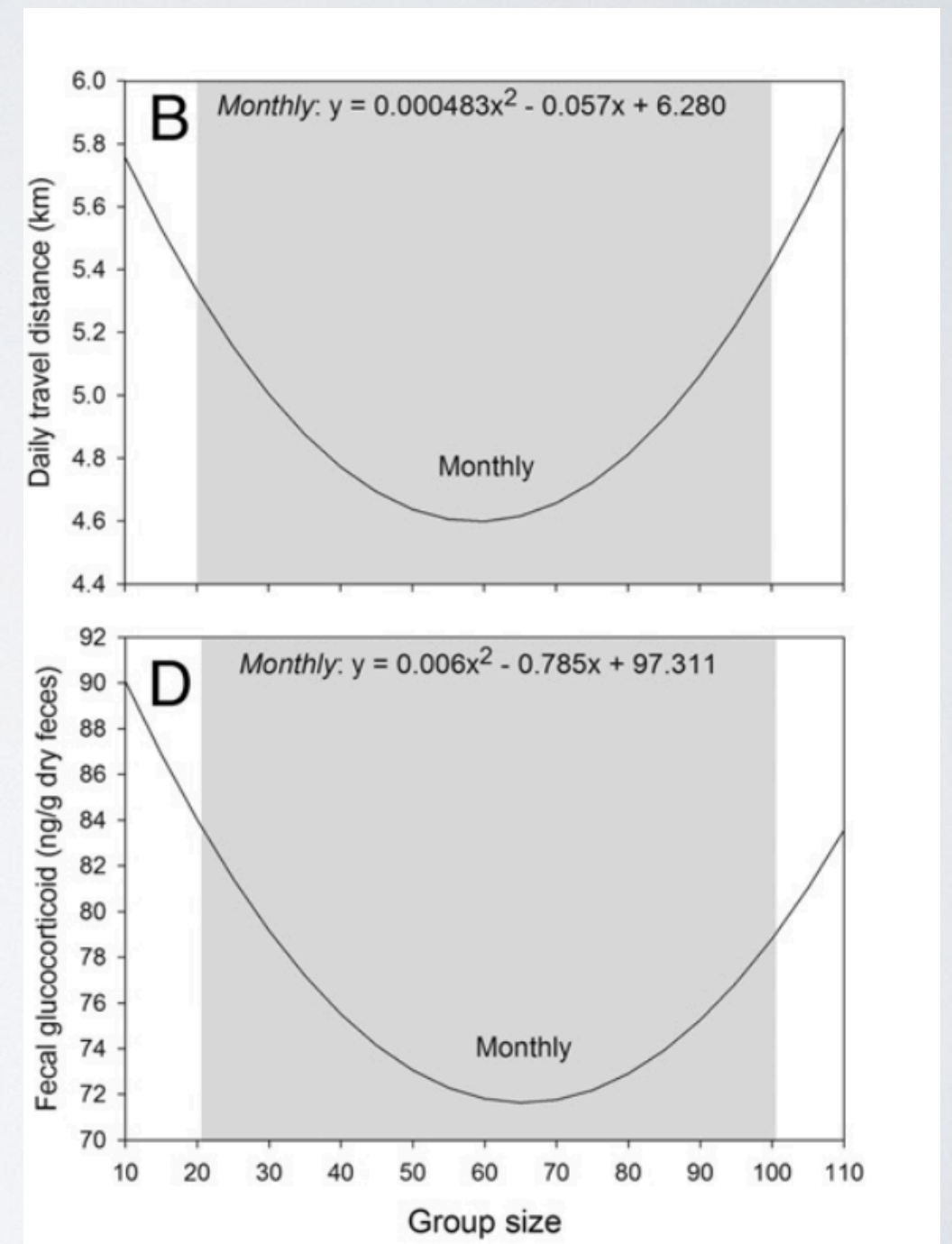


Fig. 3. Group size predicts annual proportion of time spent foraging for five baboon social groups. Data collected in hydrological years 2000–2010. Each point represents a single group-hydrological year, which begins in November each year and extends through the following October ($n = 55$ group years). See [Fig. S2](#) for a color version of this figure.

COSTS OF SOCIALITY

- Larger groups:
 - spend more time foraging
 - Walk more each day
 - Have higher stress levels



COSTS OF SOCIALITY

- Larger groups:
 - Delay weaning
 - Increase inter-birth interval (i.e., decrease lifetime reproductive success)



Phayre's leaf monkeys

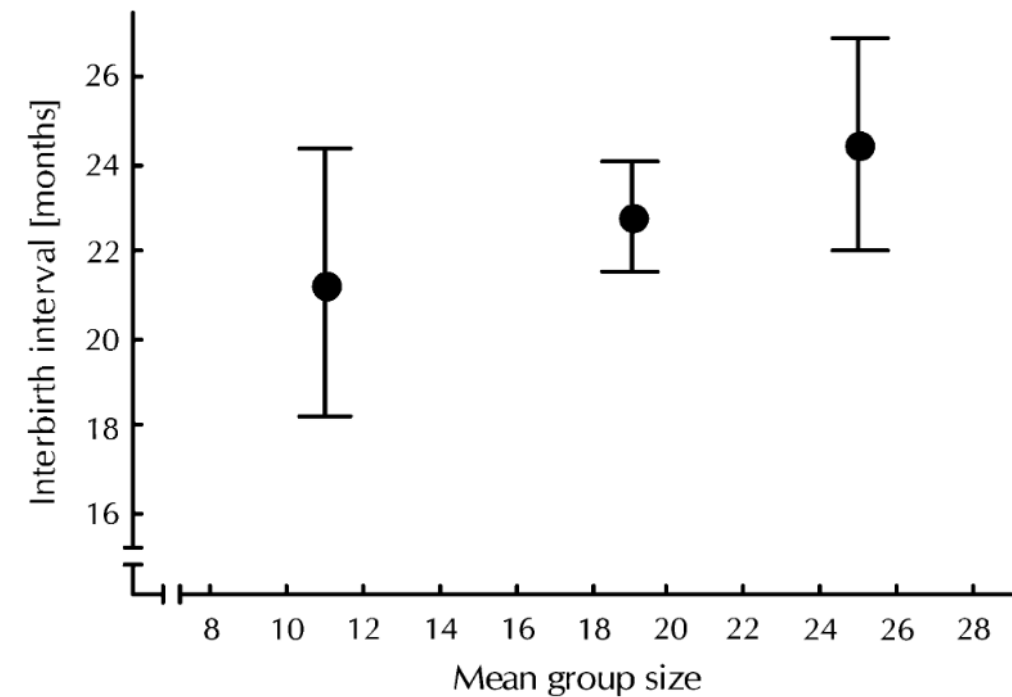


Figure 3

Interbirth interval after a surviving infant ($n = 32$) increased with group size. Circles represent mean values, whiskers the 95% confidence limits.

Borries et al. (2008)

SELECTION PRESSURES ON GROUP SIZE

- Predation risk favors larger groups
- Feeding competition favors smaller groups
- Actual group size is tradeoff between the two

QUESTIONS?

SELECTION PRESSURES SHAPING FEMALE-FEMALE RELATIONSHIPS?

NATURAL SELECTION'S CURRENCIES



Deaths

How to decrease risk
of death of self and kin?



Births

How to increase
of lifetime offspring?

DETERMINANTS OF REPRODUCTIVE SUCCESS

Females

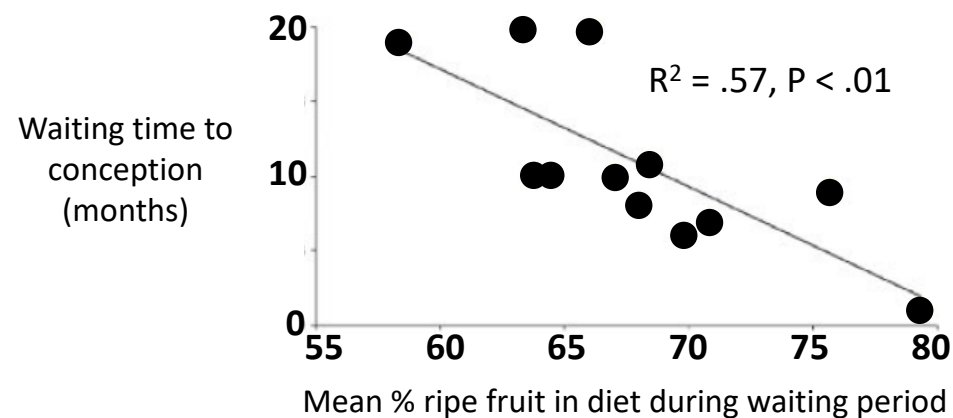
- Reproduction costly (eggs, gestation)
- Determined by access to food

Males

- Reproduction cheap (sperm, no gestation)
- Determined by access to fertile females

FOOD AND REPRODUCTION

- More fruit=short inter-birth interval



Chimpanzees: 5% more ripe fruit --> 4 months quicker to conceive

**Primates are always on a nutritional edge:
more food → higher fitness**

FOOD AND REPRODUCTION

- How to maximize caloric intake? It depends...



Selection of foods eaten by bonobos

TYPES OF FOOD PATCHES

- High vs low quality
- Small vs intermediate vs large
- Uniform vs patchy distribution
- Scarce vs plentiful



TYPES OF FEEDING COMPETITION

Contest Competition

- Patchy distribution
- Scarce
- High quality
- Possible/advantageous to defend
- ex. Medium-sized, seasonally fruiting tree



Scramble Competition

- Uniform distribution
- Abundant
- Low quality
- Not possible/not advantageous to defend
- ex. Ground cover vegetation (THV)



TYPES OF FEEDING COMPETITION

Contest Competition

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Also: Within group vs Between group competition

TYPES OF FEEDING COMPETITION

Scramble Competition



**Contest
Competition**

**Scramble
Competition**

Within group

WGC

WGS

Between group

BGC

BGS

**Contest
Competition**

**Scramble
Competition**

Within group

WGC

WGS

Between group

BGC

~~BGS~~

WITHIN-GROUP CONTEST

- Competition over defensible resources with members of own group
- Clear linear female dominance hierarchies
- Females form coalitions with relatives to defend resources
- Female philopatry
- “Resident Nepotistic”
- ex. Most baboon species



WITHIN-GROUP SCRAMBLE

- Resources cannot be defended
- Dominance hierarchy unclear
- Feeding tolerance common
- Weak female bonds; coalitions rare
- Reduced importance of kinship
- (possible) Male philopatry
- “Dispersed egalitarian”
- ex. Gorillas

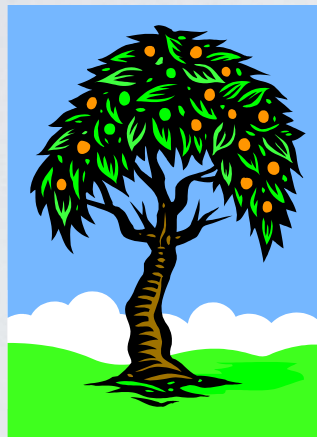


BETWEEN-GROUP CONTEST

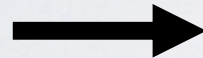
- Competition over defensible resources with outside groups
- Dominance unclear, unimportant
- Females cooperate to defend resources against other groups
- Female philopatry
- “Resident Egalitarian”
- ex. Most guenon species



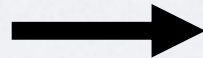
PRIMATE SOCIOECOLOGY



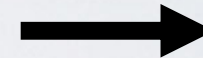
food distribution &
abundance, quality



optimal female
foraging strategy



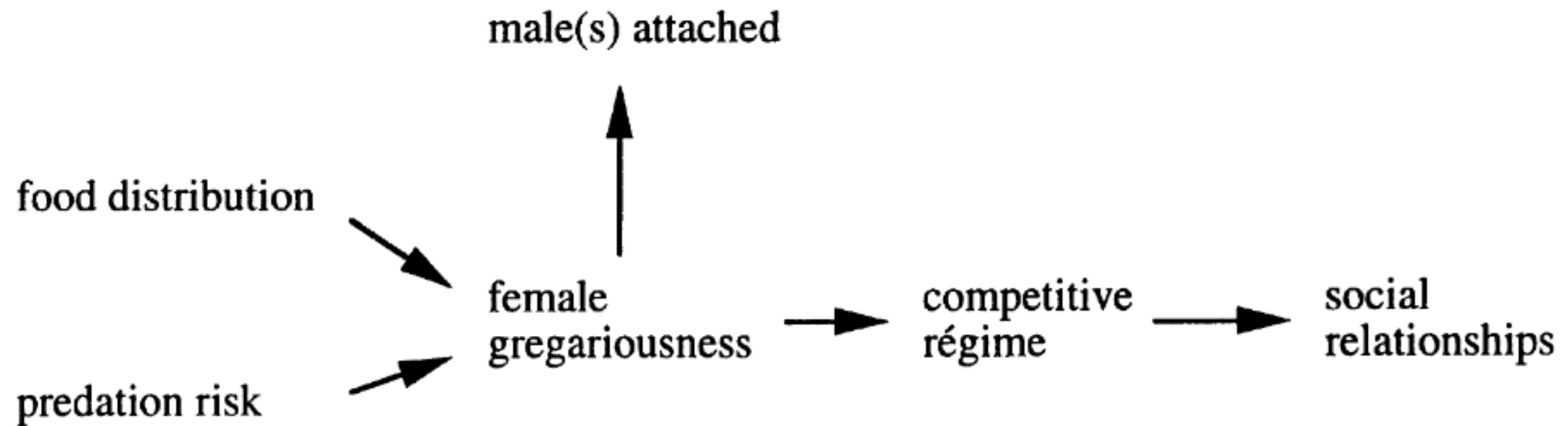
female distribution
& sociality



male distribution
& sociality

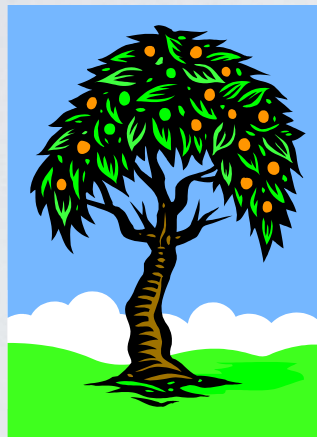
Wrangham 1980; van Schaik 1989; Sterck et al. 1997

PRIMATE SOCIOECOLOGY

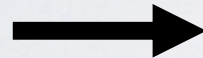


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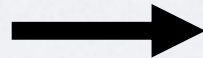
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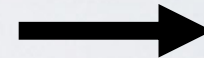
food distribution &
abundance, quality



optimal female
foraging strategy



female distribution
& sociality



male distribution
& sociality

- Many, many exceptions to these patterns
- Food competition not the only selective force shaping primate sociality
- Understand the logic between aspects of sociality and ecology

SUMMARY

- Food is limiting factor in female reproductive success
- Quality and distribution of food varies across habitats
- Female social structure shaped feeding competition (scramble vs contest)

FLY CATCHER



QUIZ QUESTIONS

- 5 minutes in break out rooms
- Google doc: https://docs.google.com/document/d/1zfKHgIIZvEJCyMya_FbEsCjdLFCWdkAuAkIRCHnIs4I/edit

QUESTIONS?