(Darwin as edited by Suzy)

"Sexual selection depends on the success of certain individuals over others of the same sex, in the arena of competition for reproduction; while natural selection depends on the success of individuals of either sex, at all ages, in all arenas of competition for general conditions of life. "

Sexual selection is a special case or a subset of Natural Selection

"The sexual struggle is of two kinds:
-- in the one it is between the individuals of the same sex, generally the males, in order to drive away or kill their rivals, the females remaining passive;
-- while in the other, the struggle is likewise between the individuals of the same sex, in order to excite or charm those of the opposite sex, generally the females, which no longer remain passive, but select the more agreeable partners."

"The sexual struggle is of two kinds:

-- in the one it is between the individuals of the same sex, generally the males, in order to drive away or kill their rivals, the females remaining passive;

Competition

Intra-sexual selection

-- while in the other, the struggle is likewise between the individuals of the same sex, in order to excite or charm those of the opposite sex, generally the females, which no longer remain passive, but select the more agreeable partners."

Choice

Inter-sexual selection

Polygamy

Polygyny -

Polyandry -

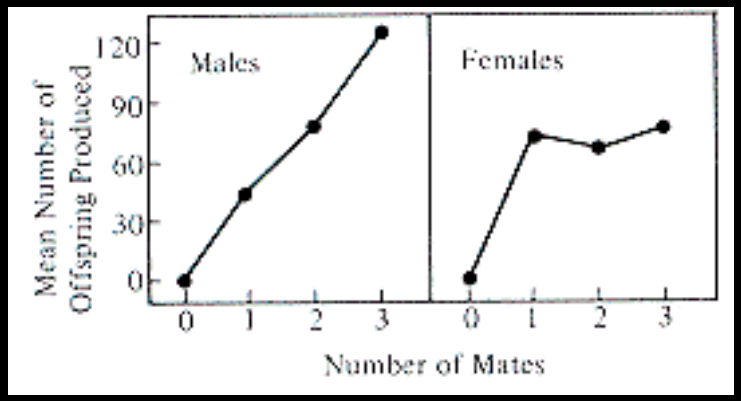
Polygynandry -

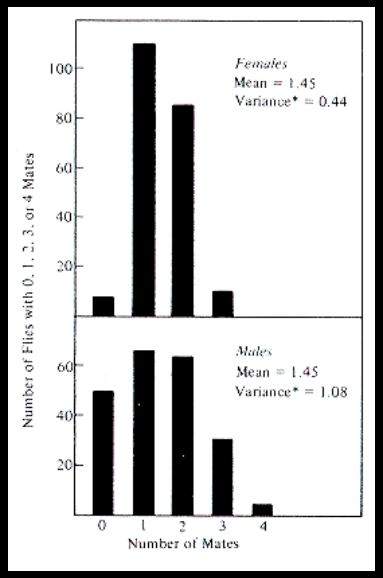
Polyandragyny -

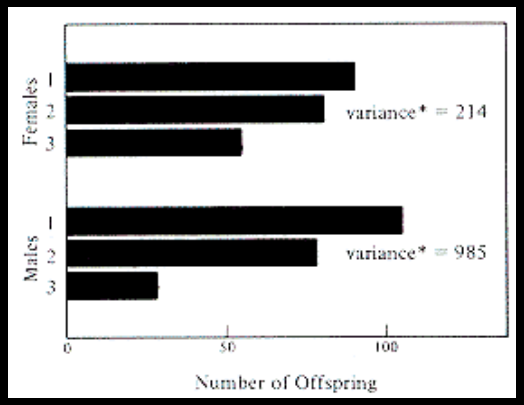
Promiscuous -

Monogamous -

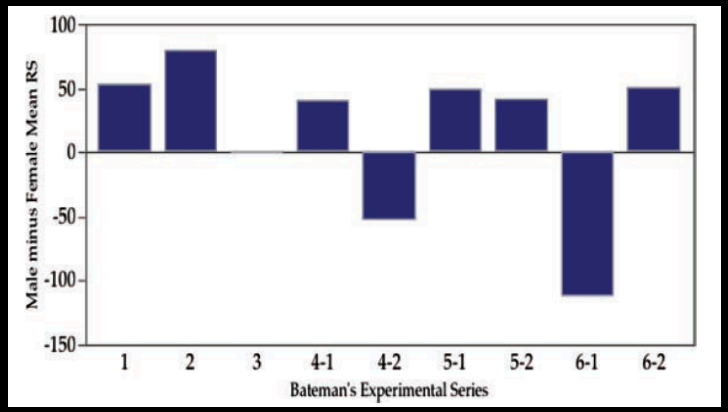
Bateman's Gradient

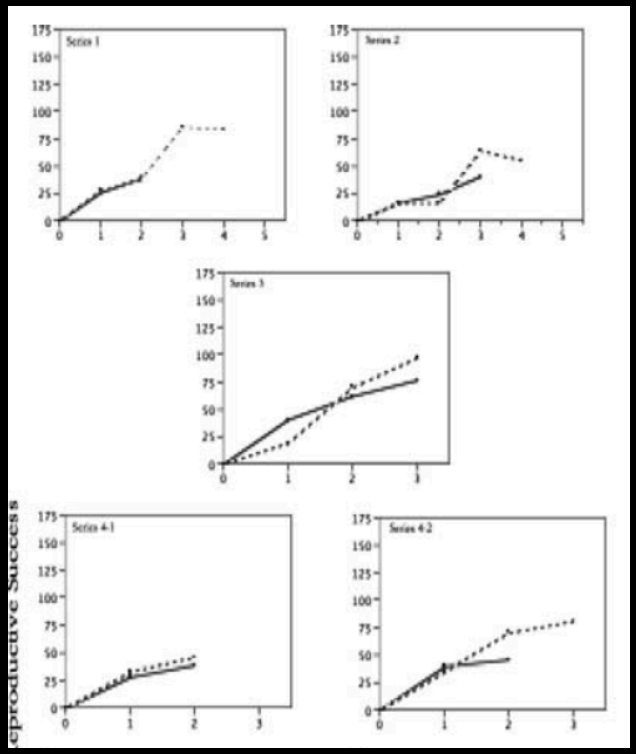




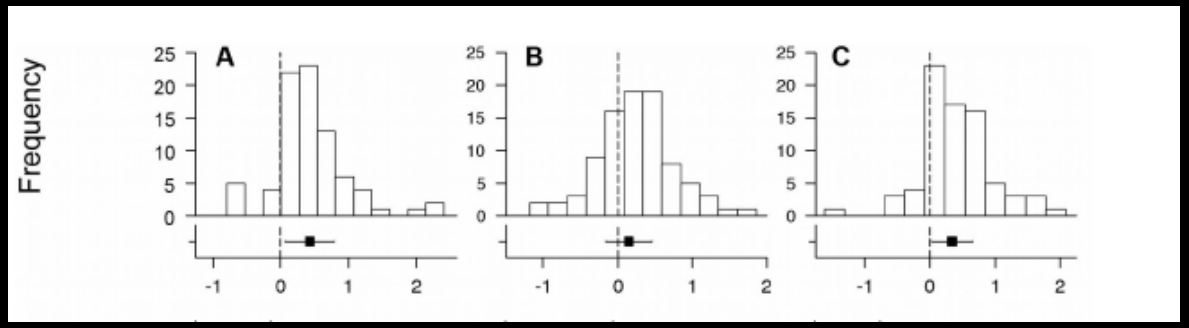


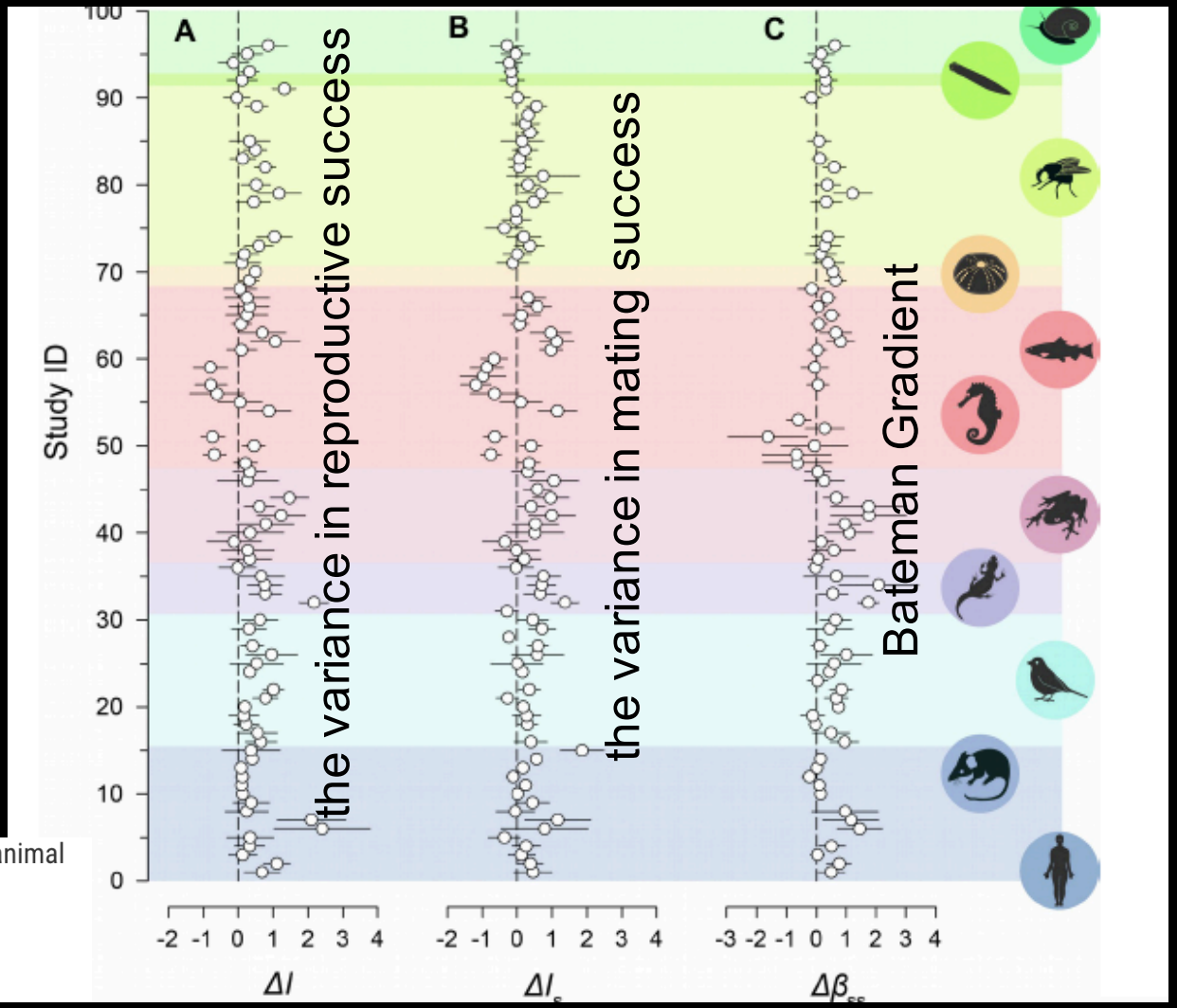
	D_m* Males	W_m
D_f* Females	D_f*D_m*	D_f*W_m
W_f	$W_f D_m$*	$W_f W_m$





some of the mutations inhibited mating
some of the mutation combinations were lethal
he should only have counted DfDm (not and WildType)
He assigned more fathers than mothers which is impossible
He had small sample size
He counted each fly as a “sample” not vial, thus inflated sample size (pseudoreplication)
only two of his 9(?) experiments showed the trend
there were some issues with his stats
He (or we) interpreted results as behavior without observing behavior

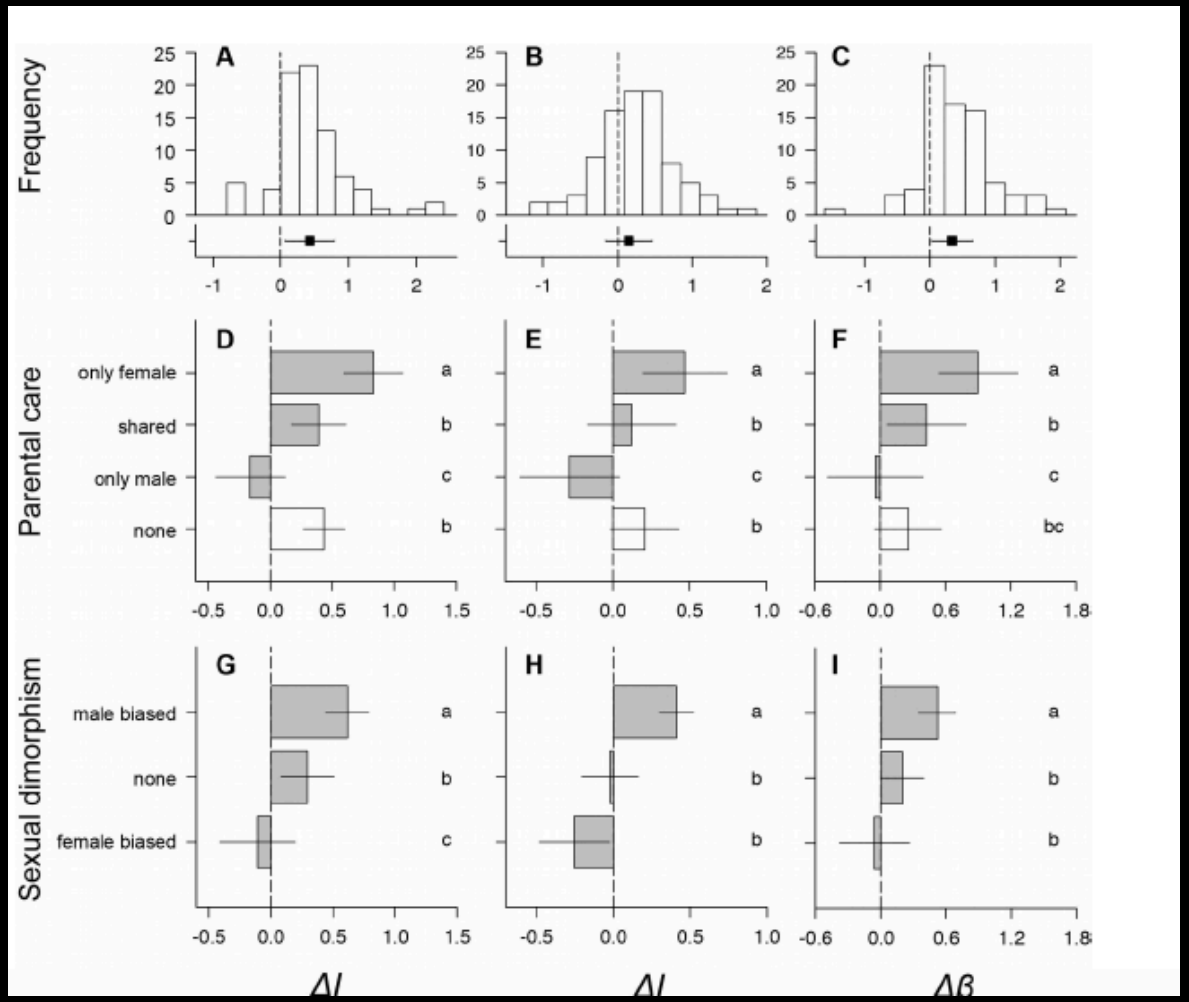




Darwinian sex roles confirmed across the animal kingdom

Tim Janicke[1,*], Ines K. Häderer[2], Marc J. Lajeunesse[3] and Nils Anthes[2]
+ See all authors and affiliations

Science Advances 12 Feb 2016:
Vol. 2, no. 2, e1500983
DOI: 10.1126/sciadv.1500983



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Sexual Selection & Male Competition In Red Deer

- Strong variation in male mating success

- Males vary in body size, body mass and age

- Males compete for positions in the dominance hierarchies in prerut

(McElligot et al. 2001, *Behav. Ecol Sociobiol*)

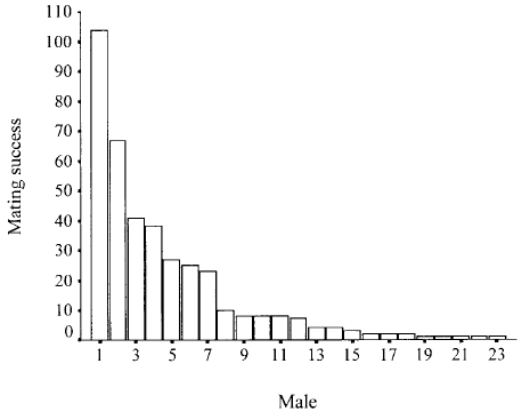


Fig. 1 Mating success of the males that gained matings (n=23). The males that gained no matings (n=15) are not represented in this figure

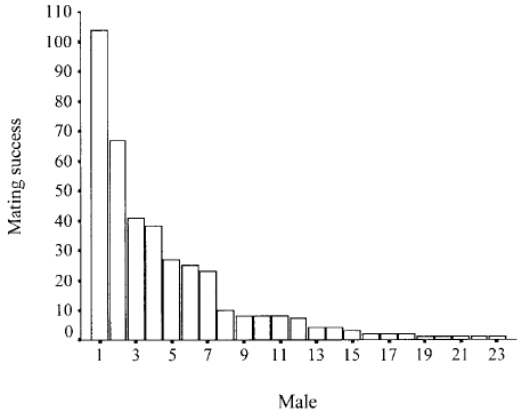


Fig. 1 Mating success of the males that gained matings (n=23). The males that gained no matings (n=15) are not represented in this figure

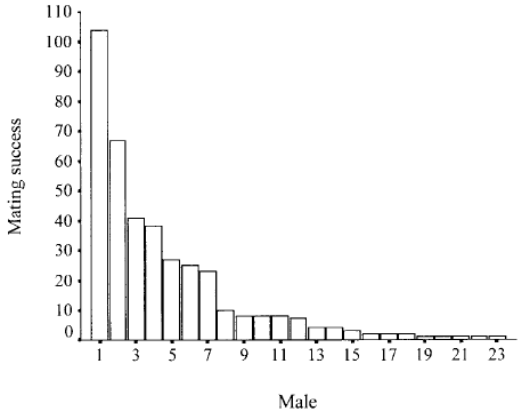
Table 4 Kendall rank-order correlation coefficients, with mating success as the dependent variable (n=38)

	Mating Success		
	Simple τ	Partial τ[a]	Partial τ[b]
Age	0.065		
Body mass	0.128		
Body size	0.451***	0.318**	–
Prerut rank	0.369**	0.070	
Rut rank	0.652***	–	0.593***

**P<0.01; ***P<0.001

[a] Controlled for rut rank; age and body mass excluded

[b] Controlled for body size; age, body mass and prerut rank excluded



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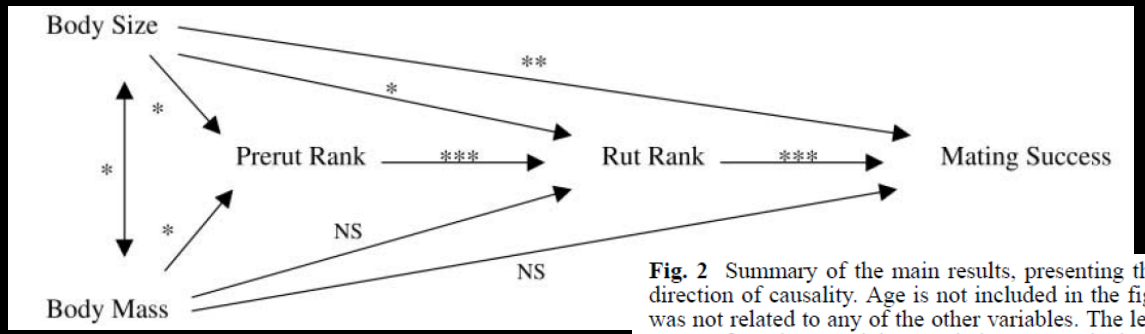
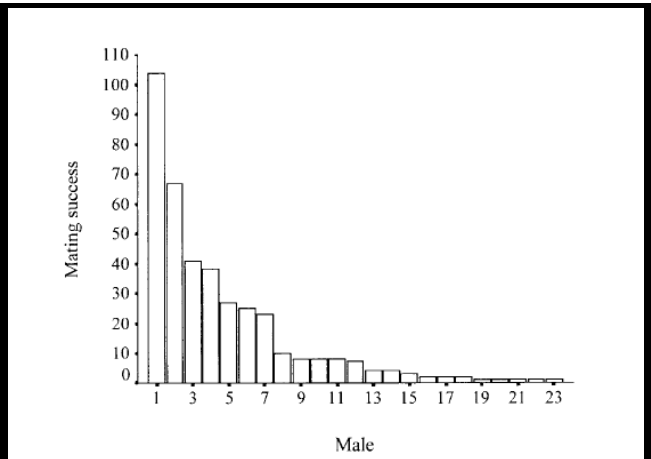


Fig. 2 Summary of the main results, presenting the hypothetical direction of causality. Age is not included in the figure because it was not related to any of the other variables. The levels of significance for the partial correlations are included (*P<0.05, **P<0.01, ***P<0.001, *NS* non-significant). For additional details, see Tables 2, 3 and 4

- Male mating success related to body size and not body mass



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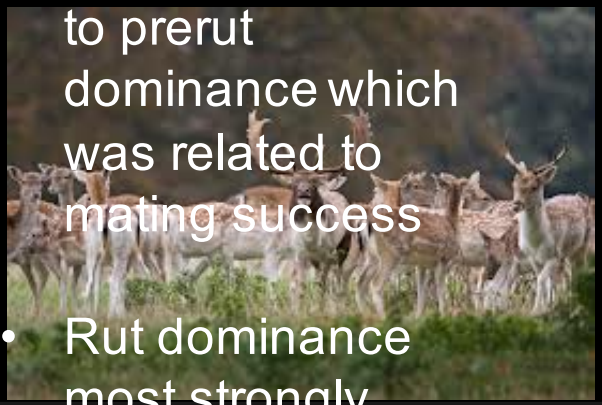
- Body mass related to prerut dominance which was related to mating success



- Rut dominance most strongly related to mating success

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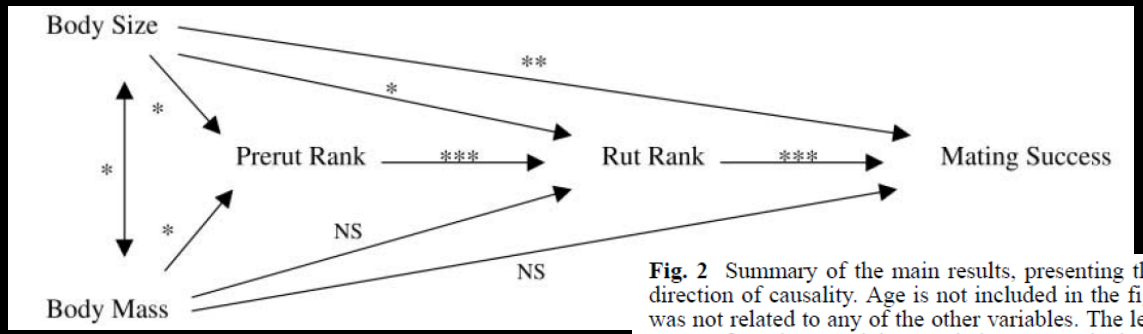
**P<0.01; ***P<0.001
[a] Controlled for rut rank; age and body mass excluded
[b] Controlled for body size; age, body mass and prerut rank excluded

- Mating success unrelated to age



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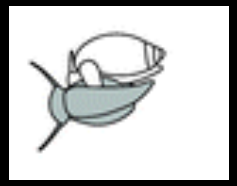
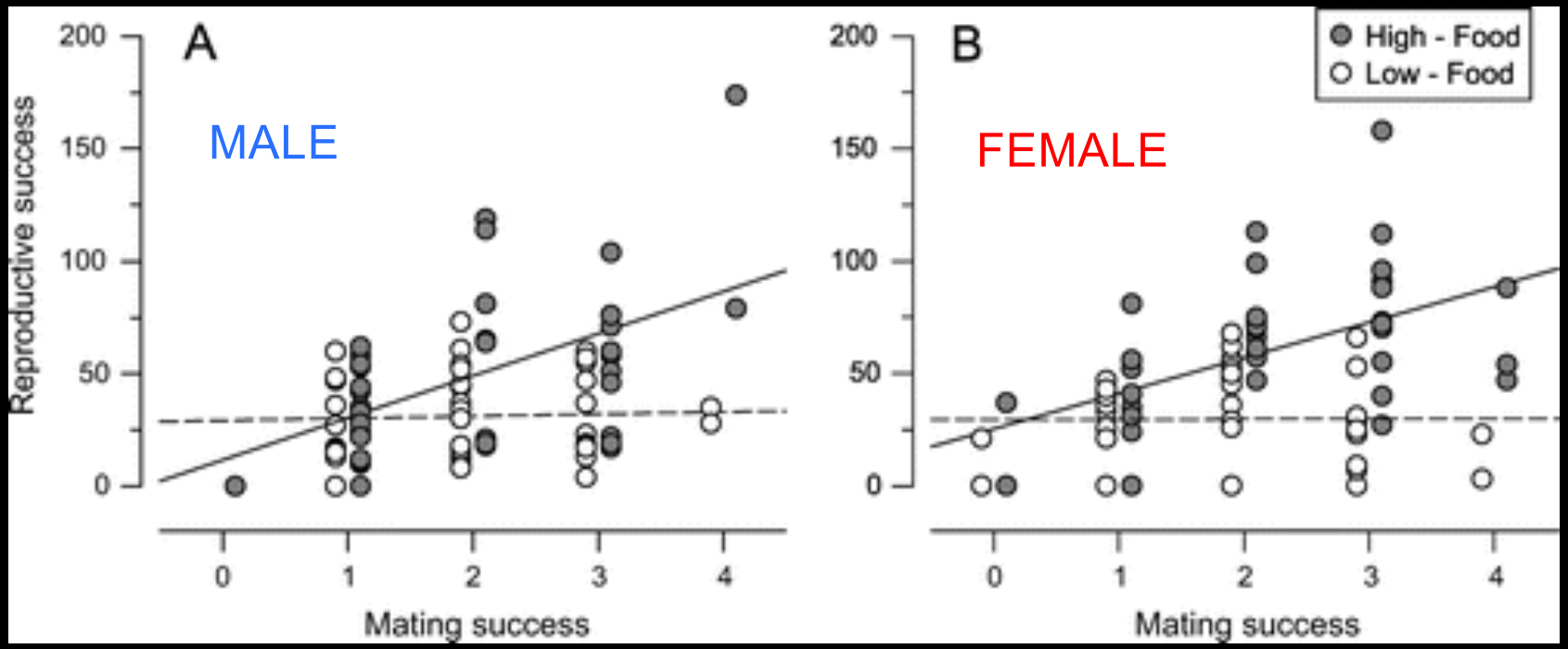
- Strong variation in male mating success
- Males vary in body size, body mass and age

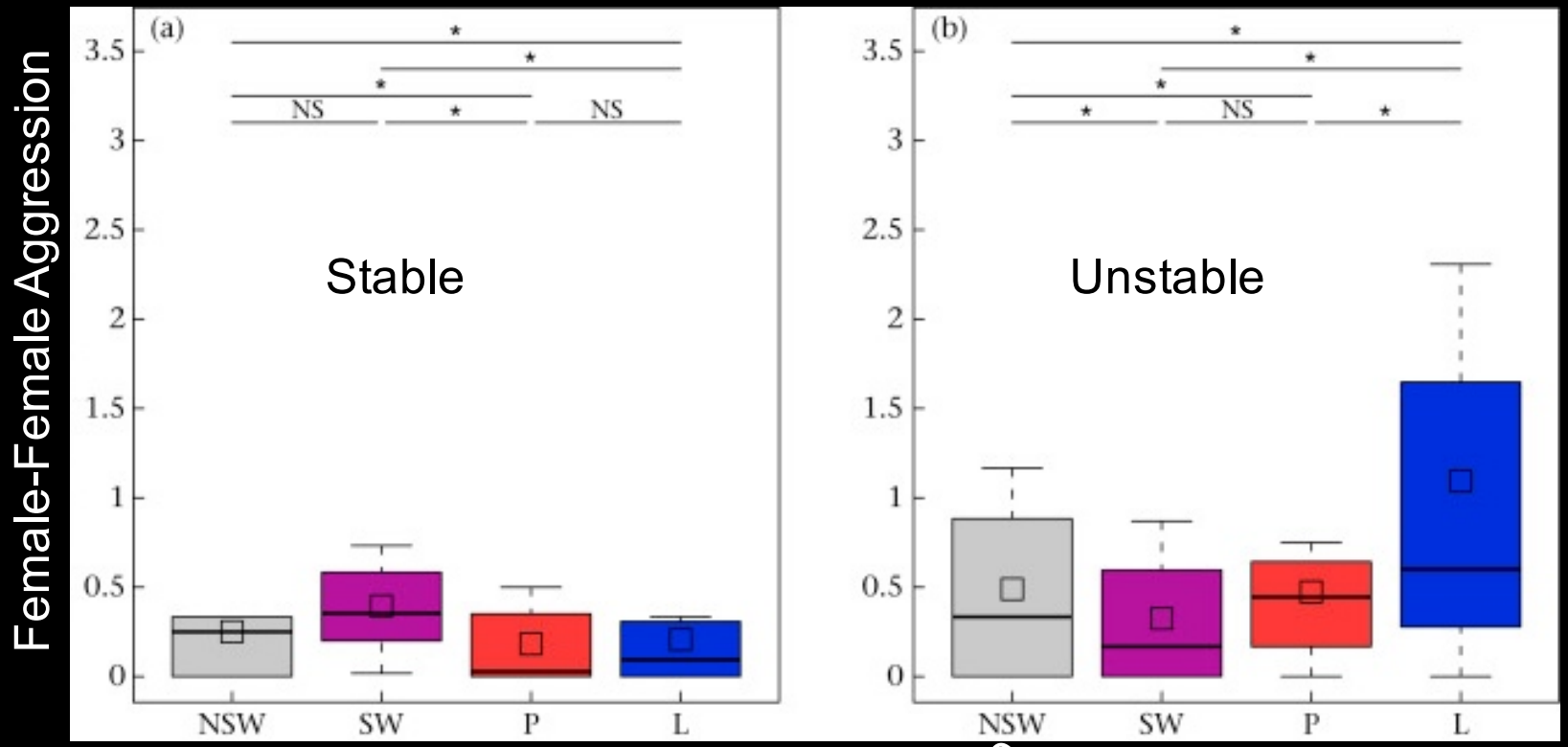
Males compete for positions in prerut dominance





Ecological factors influence the strength of sexual selection

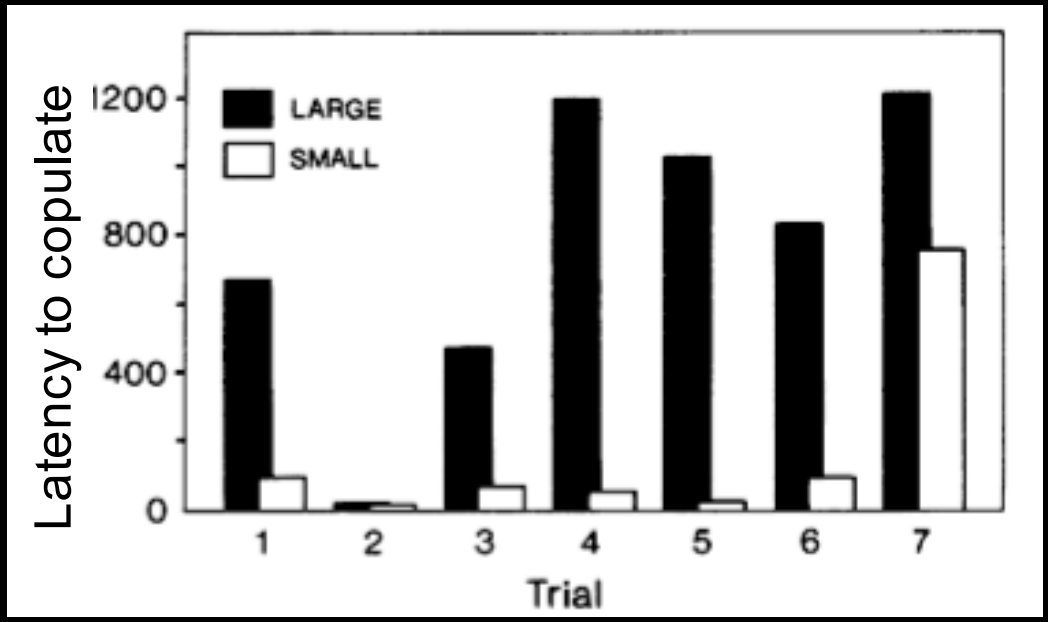
Environment-Dependent Sexual Selection: Bateman's Parameters under Varying Levels of Food Availability
Tim Janicke, Patrice David, and Elodie Chapuis The American Naturalist 2015 185:6, 756-768



Chacma Baboon

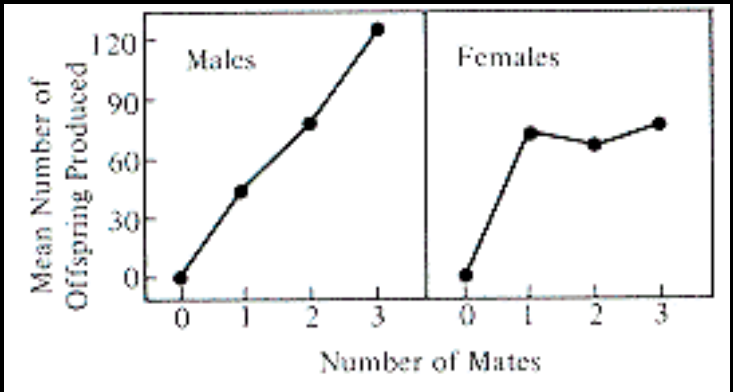
Additional factors influence mating/reproductive behavior

Context dependence of female reproductive competition in wild chacma baboons
Alice Baniel;Guy Cowlishaw;Elise Huchard
Animal behaviour. , 2018, Vol.139, p.37-49

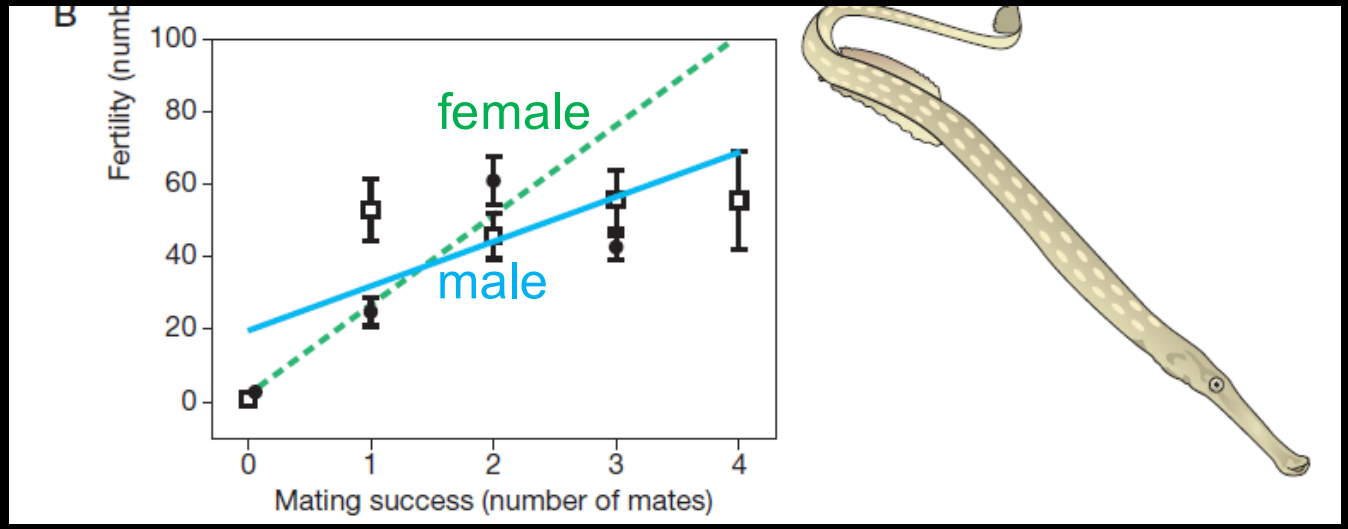


Berglund (1991) Evolution 45:770-774.

Bateman's Gradient



Is isogamy enough to drive all of this?
Is sexual selection always stronger in males?



- In pipefish, males incubate the young. Both sexes show a non-zero slope but females are steeper than males. (Jones et al. *Proc. R. Soc. Lond.* B (2000) 267, 6770)

When Sex Selection is “reversed” sex-roles will be “reversed”

1) Stronger female-female intrasexual competition and aggression.

2) More critical choice of mates by males

3) Higher variance in female mating success

4) More pronounced female secondary sexual traits

The Strength of Sexual Selection Affects Sex-role Behaviors

	Conventional
Investment in gamete	F>M
Mate choice	F>M
Controlled fertilization	F>M
Offspring investment	F>M
Transfer of resources during copulation	M>F
Competition for mate	M>F
Courtship effort	M>F
Sexual Coercion	M>F
Infanticide	M>F
Post-copulatory competition	M>F
Post-copulatory choice	F>M

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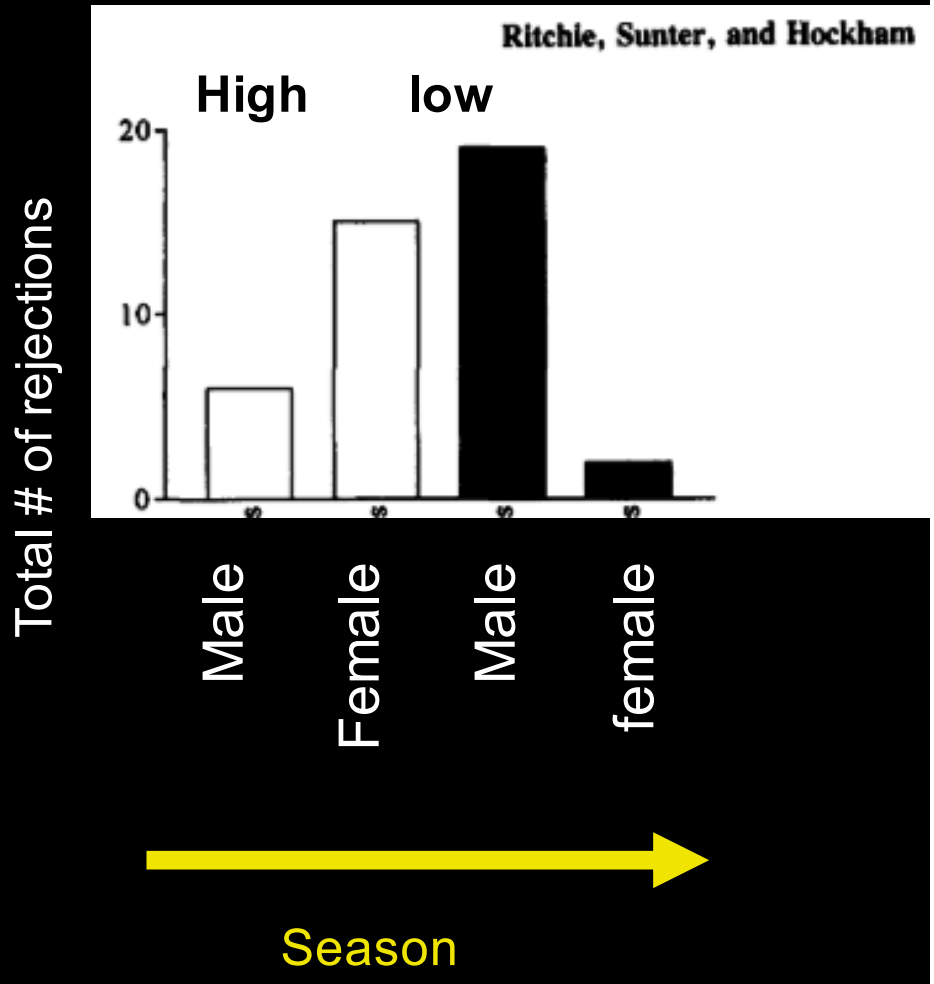
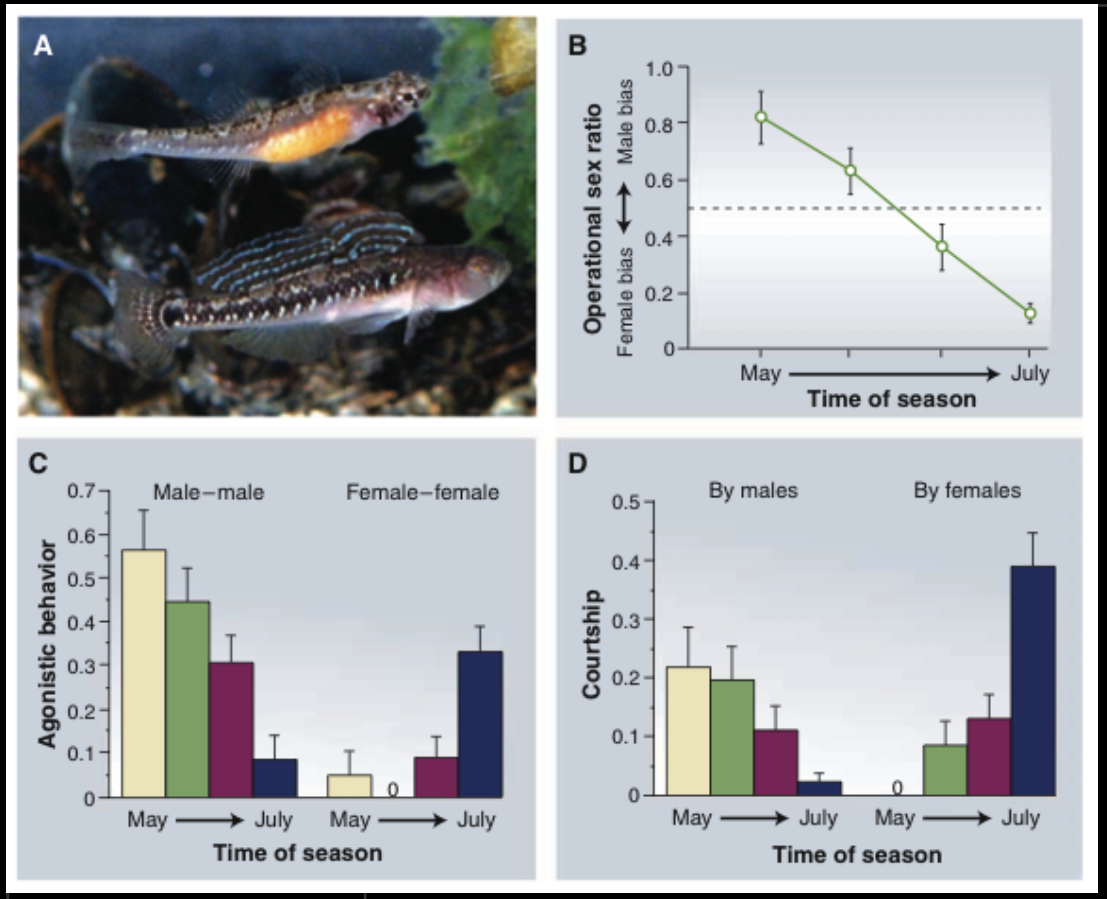
Foto: Víctor Ciscar

Bushcricket



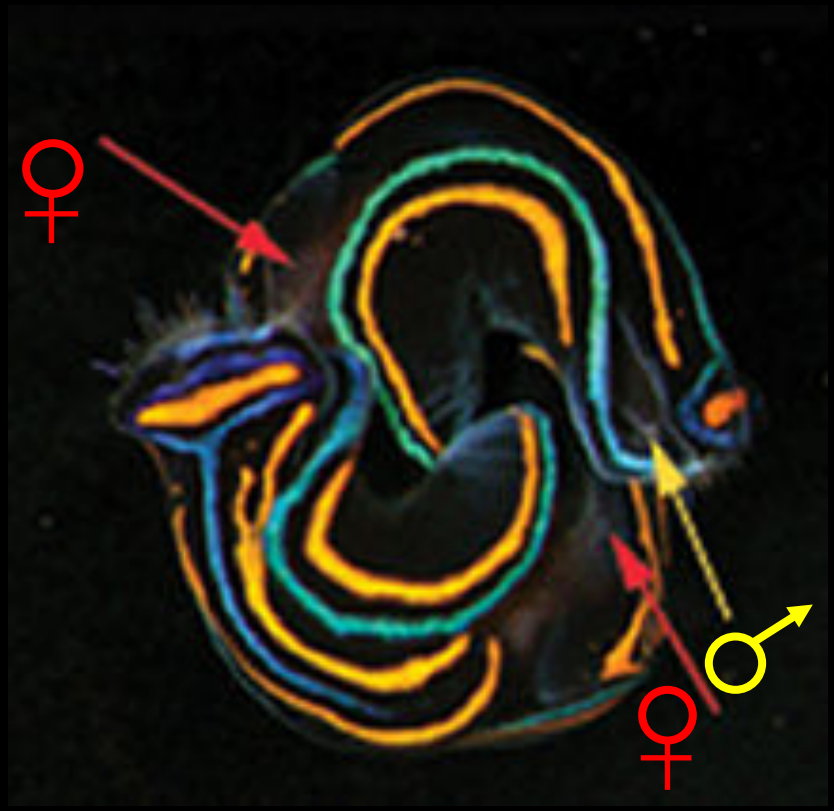
Ecological factors influence the relative strength of sexual selection



Ecological factors influence the relative strength of sexual selection

Forsgren et al., 2004

Required Reciprocity

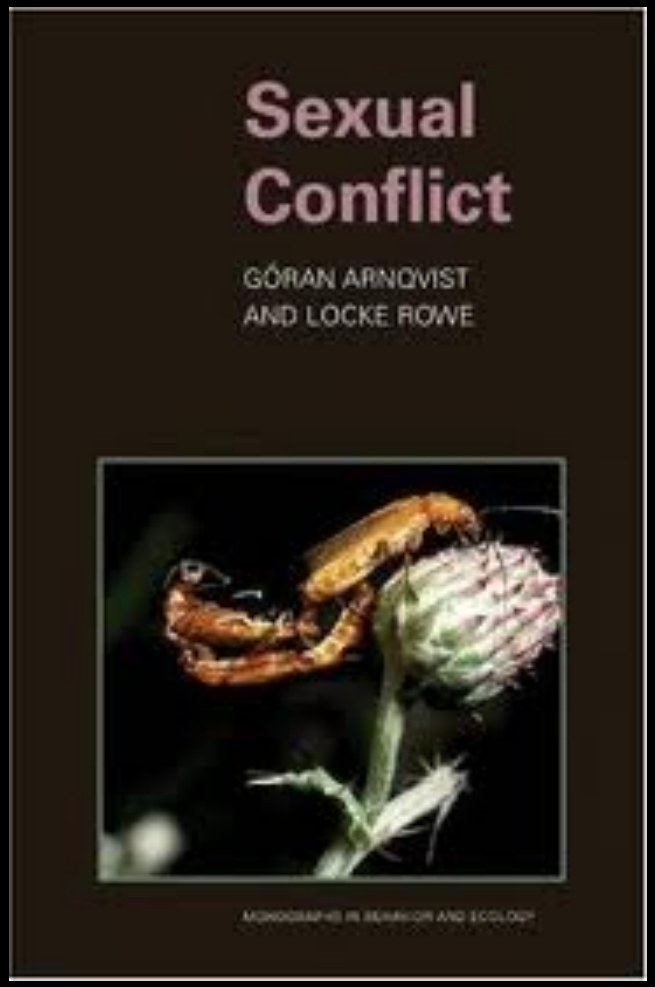


FAIR TRADE:
Chelidonura hirundinina sea slugs perform several simultaneous sperm exchanges.

Everybody wants to be male, and nobody wants to be female

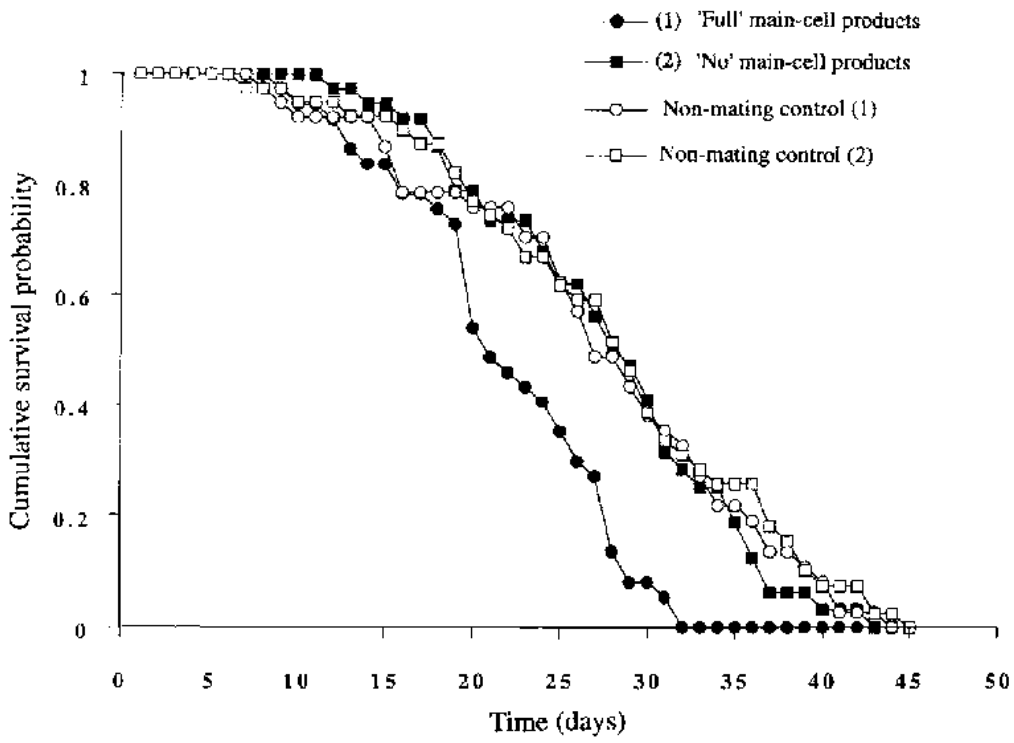
DUELING FLATWORMS:
Pseudobiceros bedfordi, each attempt to play the male role in a one sided sperm exchange.
(white paired penises)

Sexual Conflict



- There can be mutual benefits to a male and female who mate.
- This is more likely in monogamy with biparental care.
- In many mating systems it is in the Darwinian Fitness interest of males to mate often, but mating often for females is not advantageous and can be harmful.
- Thus there is a ***conflict of interests*** between the sexes.

Sexual Conflict in *Drosophila*

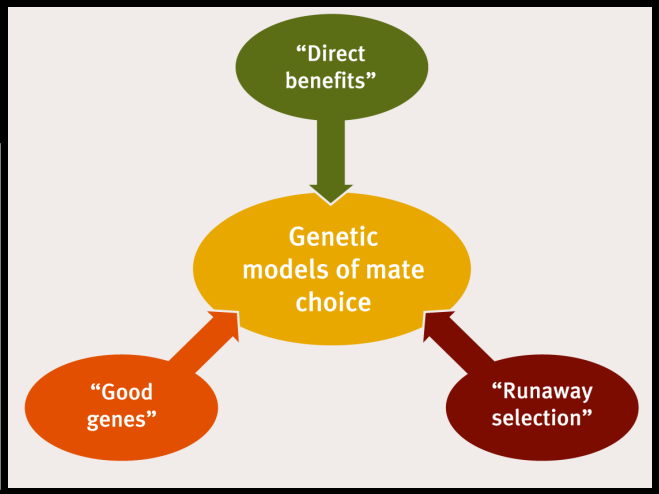


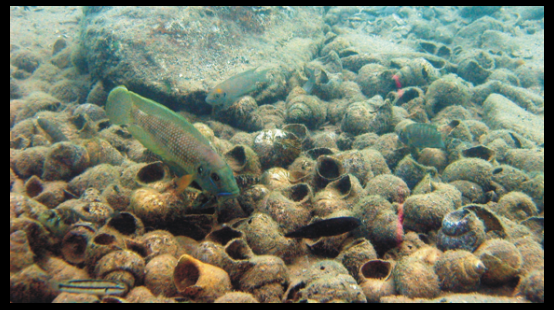
- Female survivorship decreases with number of “matings” .

- Male’s produce toxin aimed at competing sperm from other males, female mortality is an incidental consequence as far as the males are concerned, it does not decrease his reproductive success in the future.

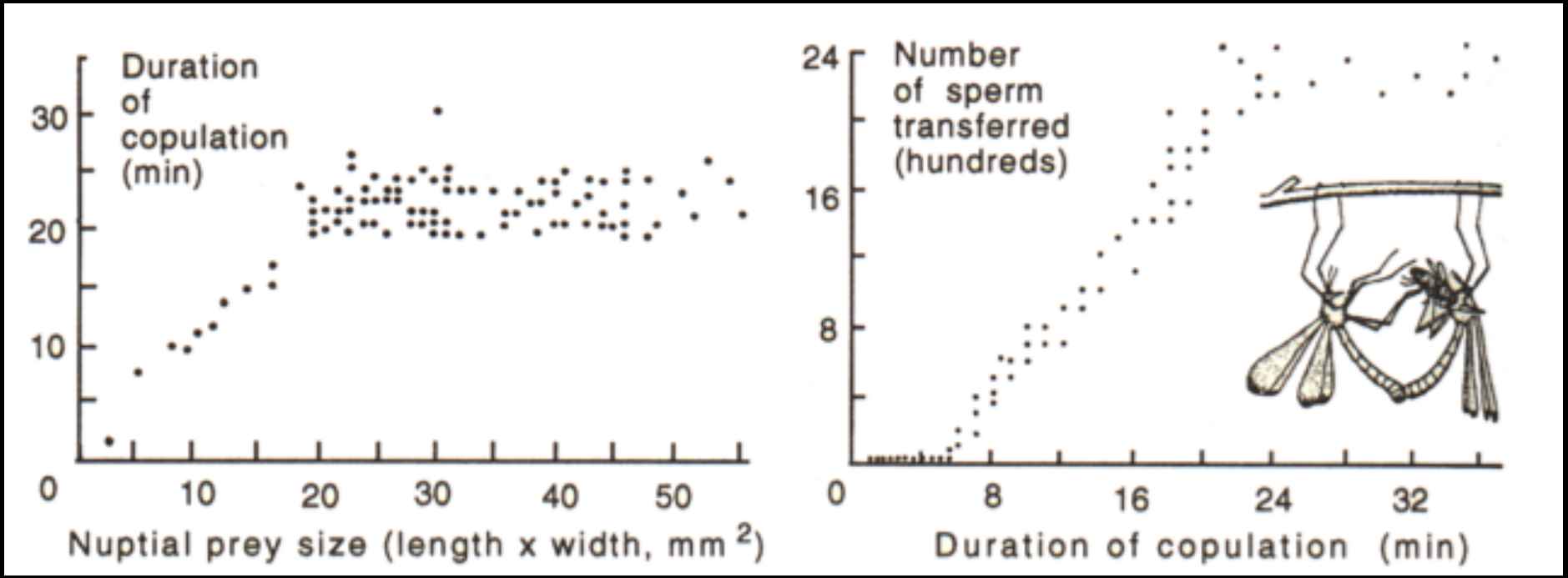
Under what situations would you expect there to be a genetic basis for the choice made by females?


Cyathopharynx furcifer
© Ad Konings, Cichlid press


"Direct benefits"
Genetic models of mate choice
"Good genes"
"Runaway selection"



Direct Benefits



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Direct Benefits


Cyathopharynx furcifer
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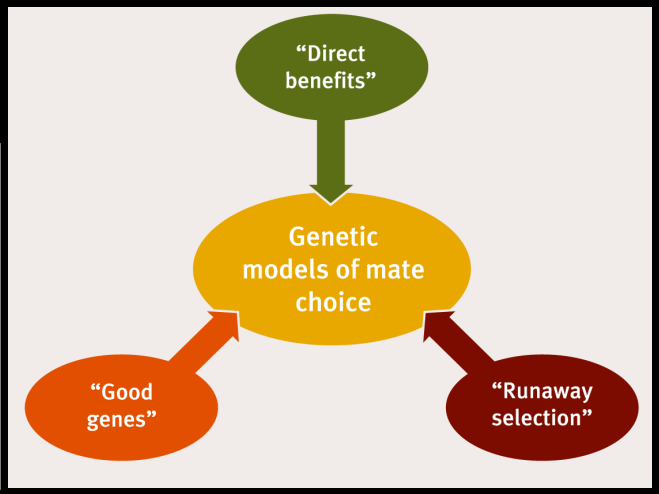
"Direct benefits"
Genetic models of mate choice
"Good genes"
"Runaway selection"

Based on signal “indices” a female can identify males with good genes

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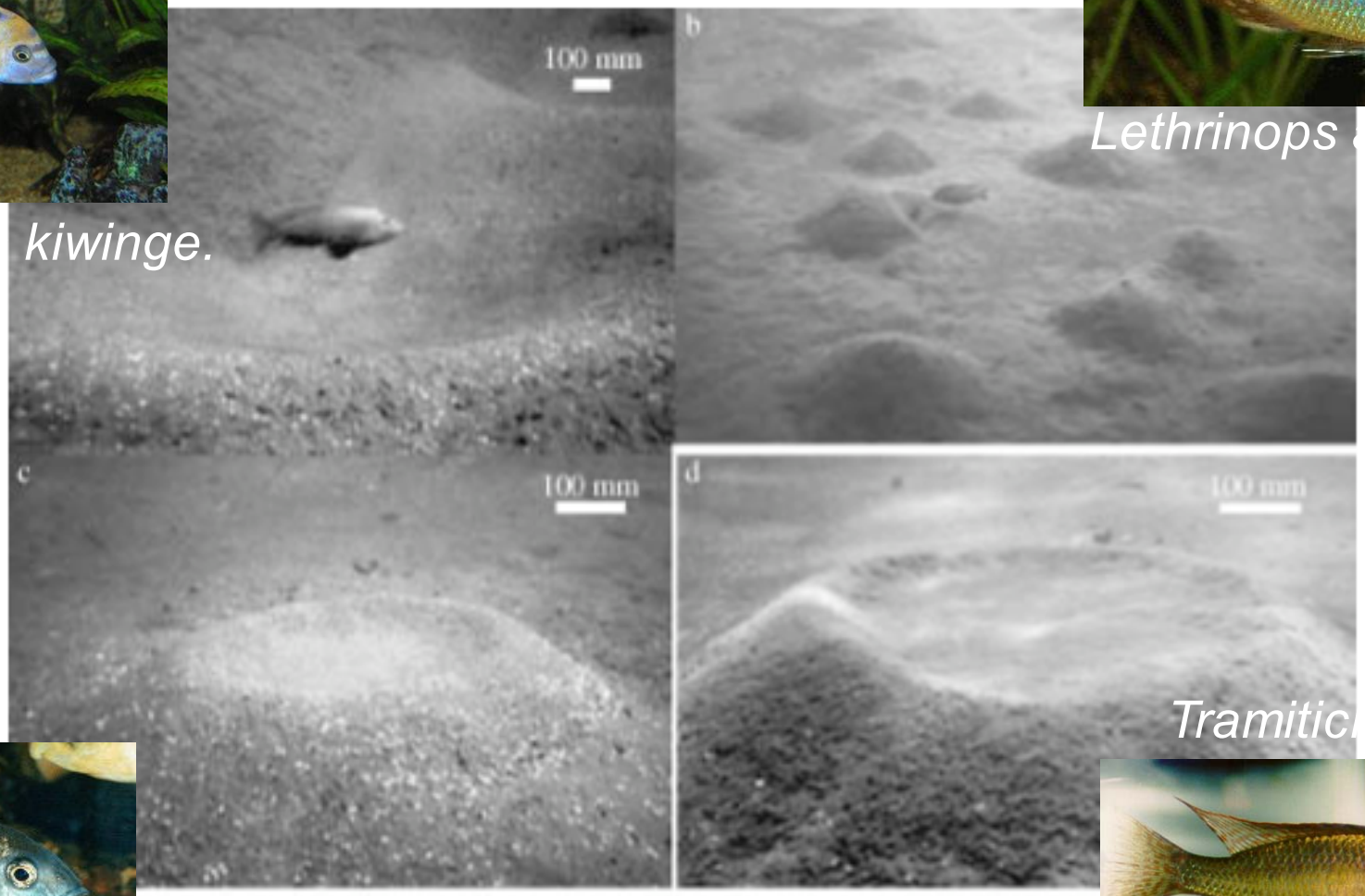
Based on “handicap signals” a female can identify males with good genes

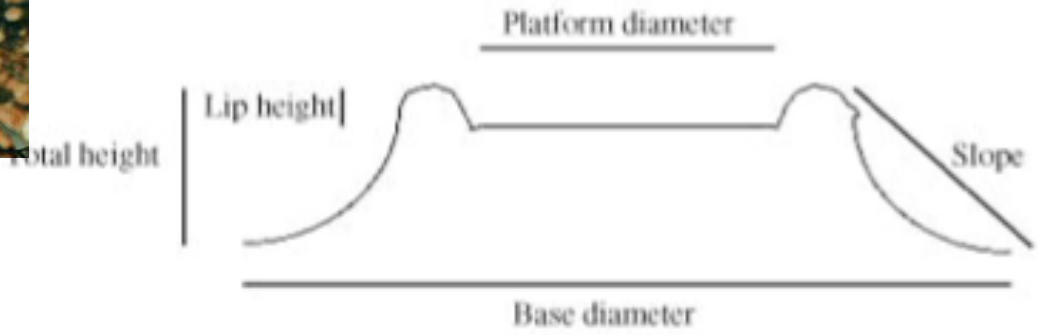
Dimidiochromi kiwinge.

Lethrinops uritus

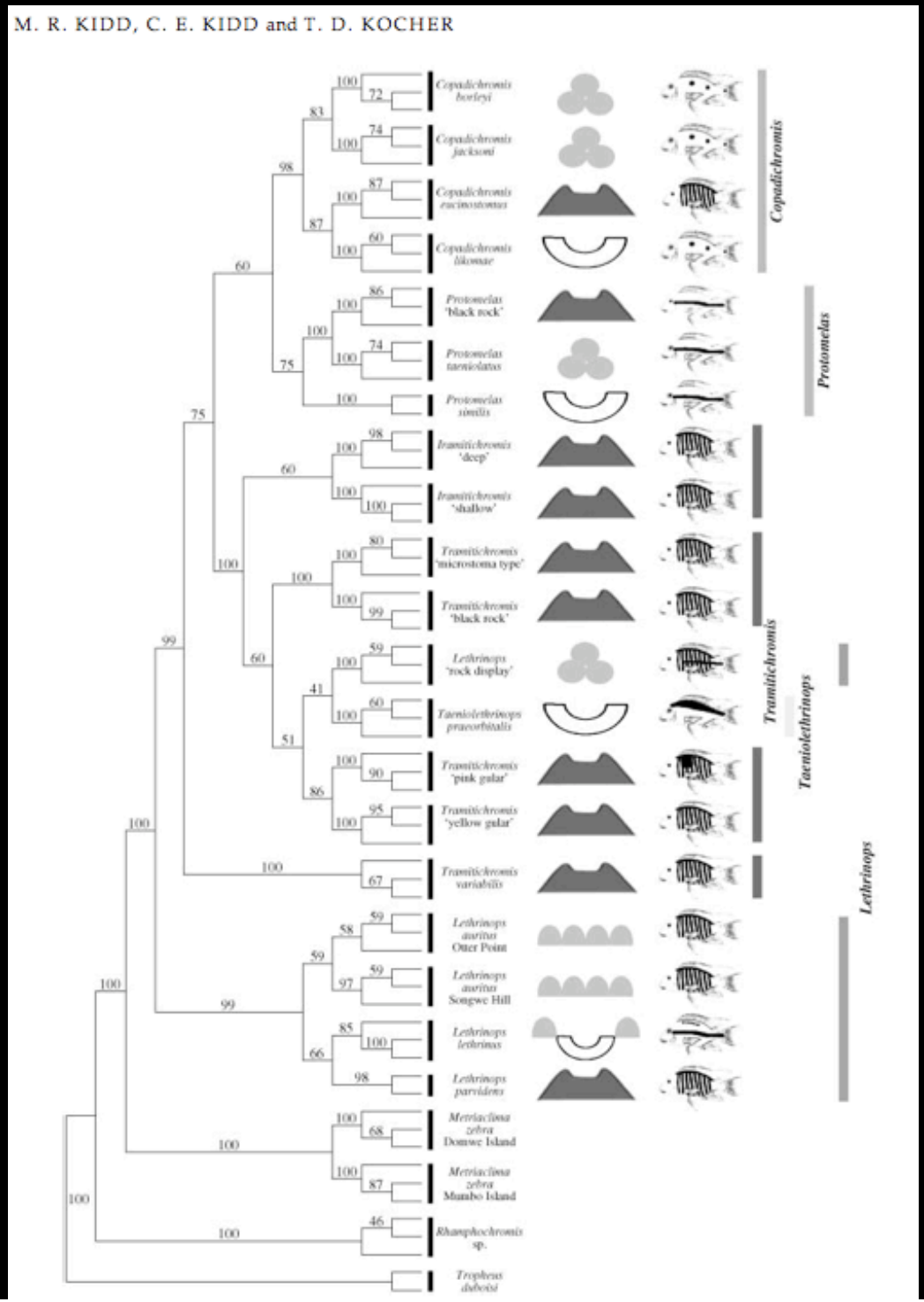


Protomelas

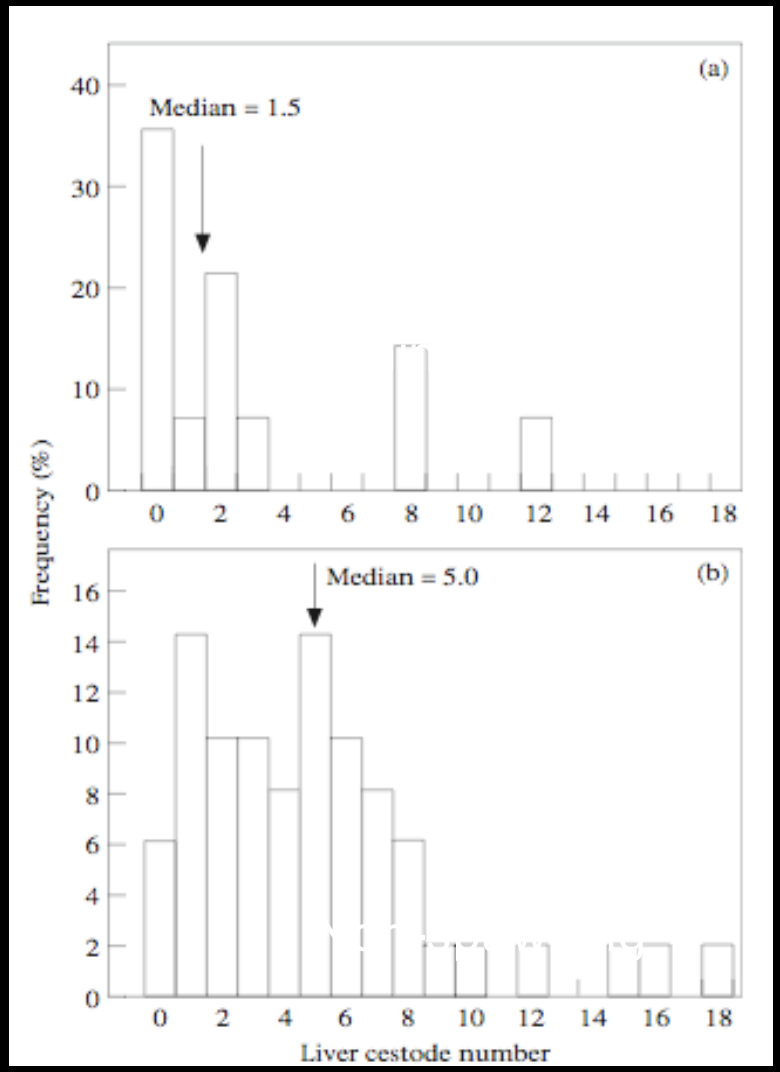
Tramitic romis



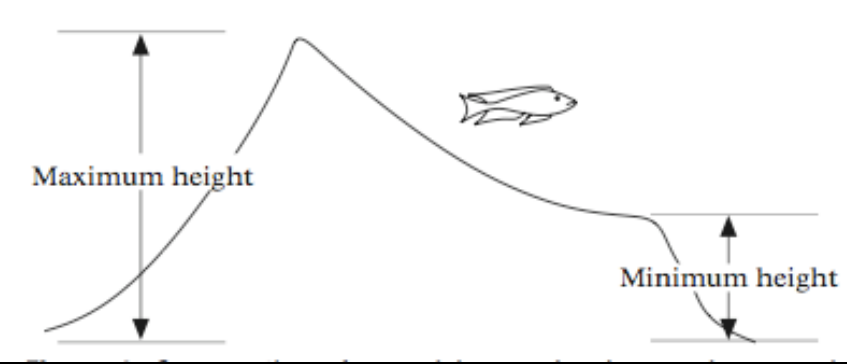
Bower Fish


M. R. KIDD, C. E. KIDD and T. D. KOCHER
Copadichromis borleyi
Copadichromis jacksoni
Copadichromis eucinostomus
Copadichromis likomae
Protomelas 'black rock'
Protomelas taeniolatus
Protomelas similis
Tramitichromis 'deep'
Tramitichromis 'shallow'
Tramitichromis 'microstoma type'
Tramitichromis 'black rock'
Lethrinops 'rock display'
Taeniolethrinops praeorbitalis
Tramitichromis 'pink gular'
Tramitichromis 'yellow gular'
Tramitichromis variabilis
Lethrinops auritus Otter Point
Lethrinops auritus Songwe Hill
Lethrinops lethrinus
Lethrinops parvidens
Metriaclima zebra Domwe Island
Metriaclima zebra Mumbo Island
Rhamphochromis sp.
Tropheus duboisi
Copadichromis
Protomelas
Tramitichromis
Taeniolethrinops
Lethrinops

Successful Spawners had lower parasite load



Good Genes Theory



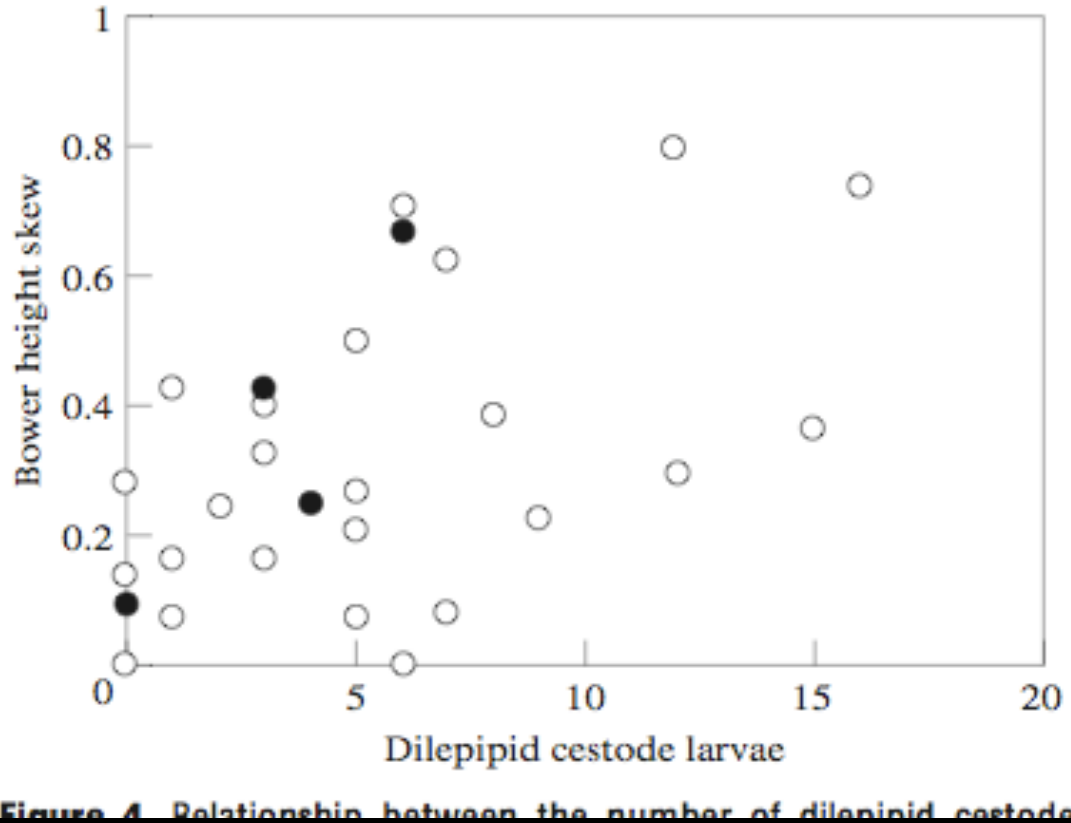


Figure 4 Relationship between the number of dilepipid cestode

Skew = Max-min
max

Zahavi's handicap theory

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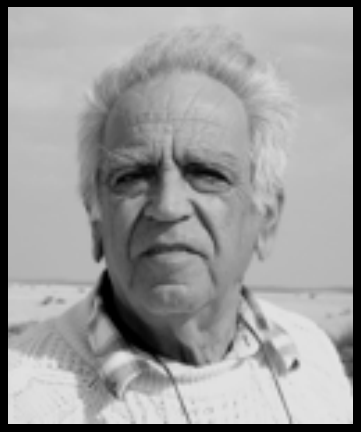
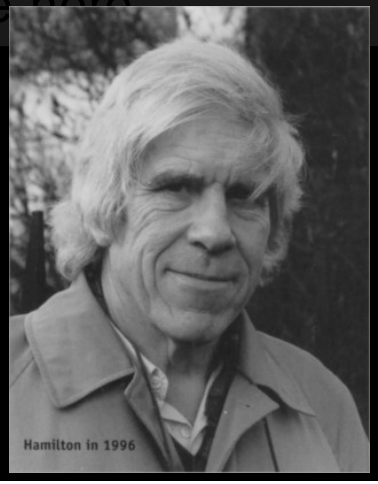
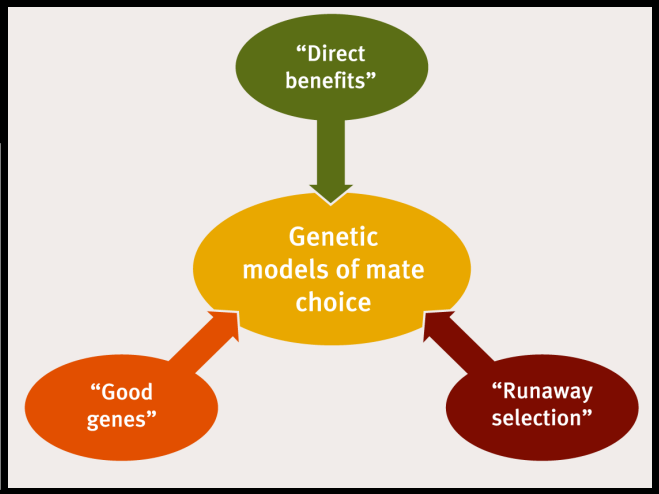




Beauty Kills

(rev. in, Zuk & Kolluru, 1998. Exploitation of sexual signals by predators and parasites. *Quart Rev Biol*)


Cyathopharynx furcifer
© Ad Konings, Cichlid press


"Direct benefits"
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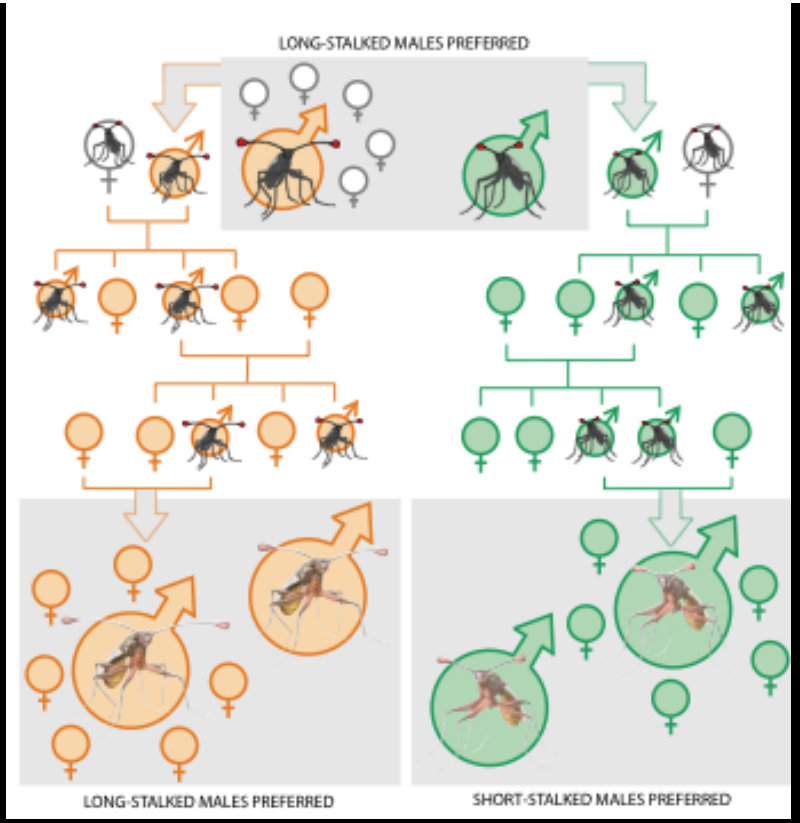
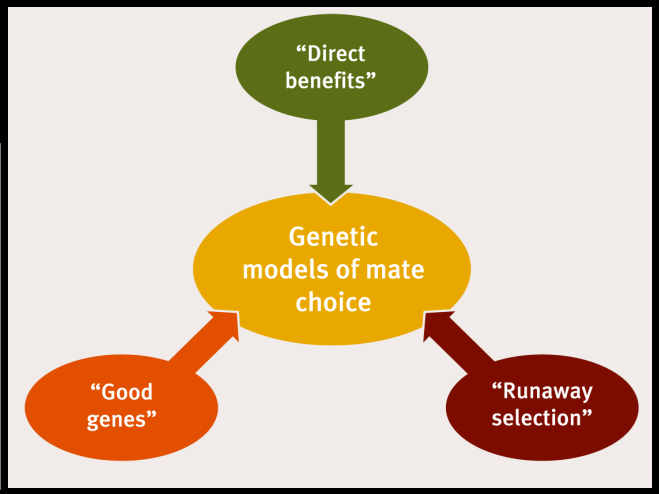
"Runaway selection"

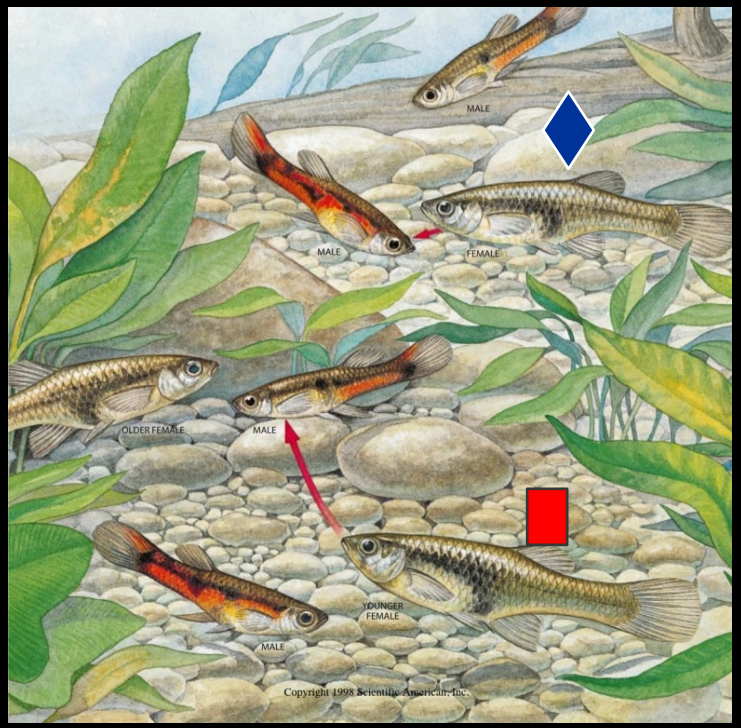
Genetic evidence for Runaway Selection

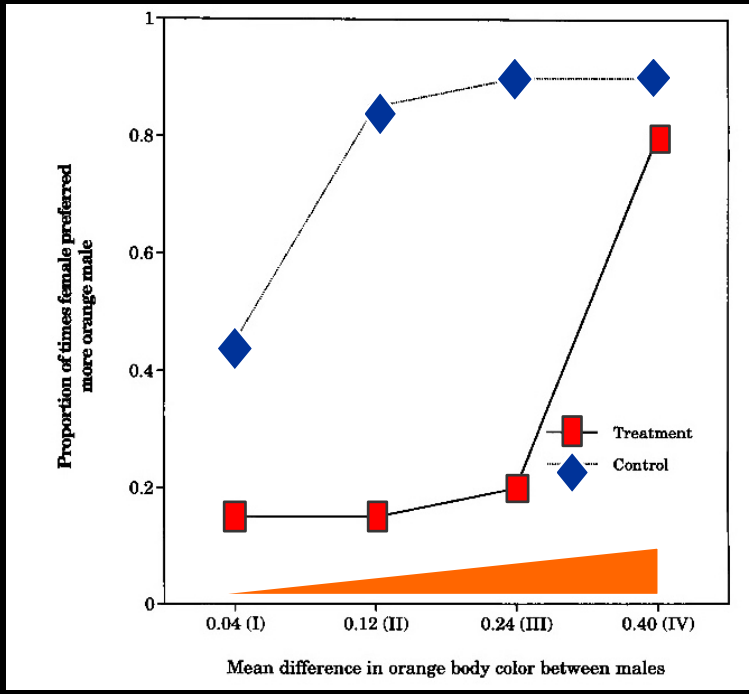


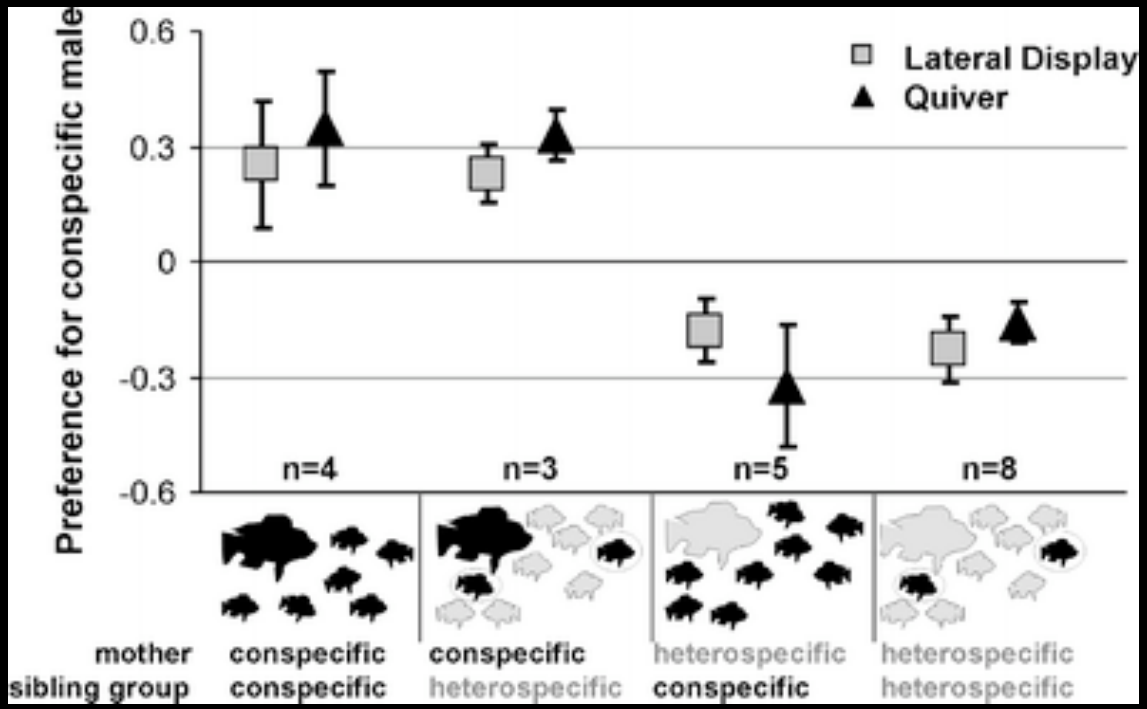

Cyathopharynx furcifer
© Ad Konings, Cichlid press


"Direct benefits"
Genetic models of mate choice
"Good genes"
"Runaway selection"

Culturally based preference

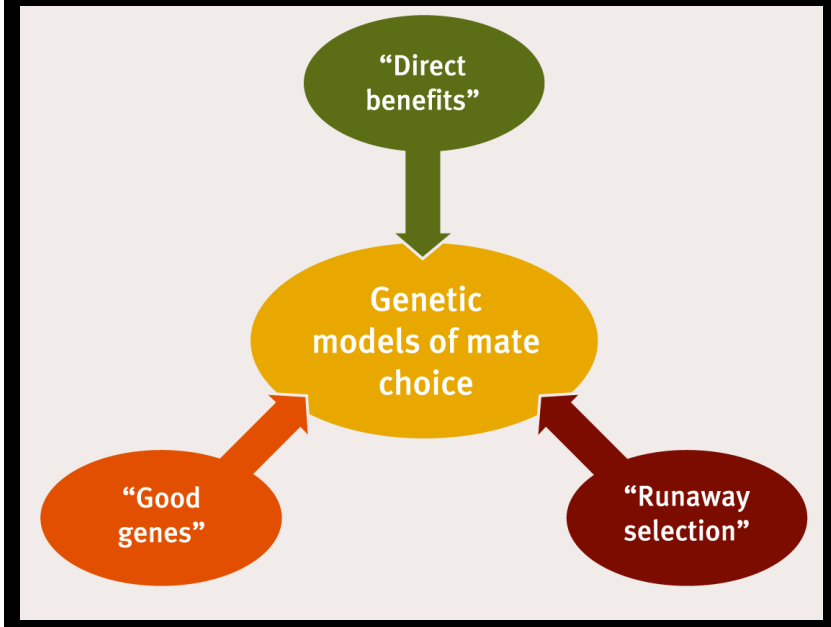






Females learn from mothers

Verzijden et al (2008) Behavioral Ecology and Sociobiology



Genes

Environment

Sexual Imprinting

Cultural Models of Mate Choice

Mate choice copying