NAME _____

LECTURE GOALS:

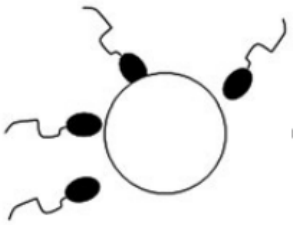
☐ Understand Biological definition of sex.
☐ Appreciate the diversity of mechanisms for sex-determination.
☐ Understand **intra-** and **inter-sexual selection** as evolutionary processes that affect the two sexes differently to produce sex-role behavior and sexual dimorphism.
☐ Be able to compare and contrast the three genetic models of female mate choice.
☐ Appreciate the diversity of behavioral phenotypes within a sex.
☐ Be prepared for the guest lecture next week.

LECTURE OUTLINE:

1. Sexual reproduction is a form of reproduction where two morphologically distinct types of specialized reproductive cells (gametes) fuse.
2. In the biological sense “female” is defined as the individuals that produce larger gametes (eggs) while “male” is defined as the individuals that produce smaller gametes (sperm).
3. In many animal species, sex-determination does not occur according to the XY chromosomal mechanism that we are familiar with from mammals and flies.
    a. In birds, females are the heterogametic sex
    b. In many reptiles, sex is determined by temperature
    c. In many fish species, sex is determined by social interactions.
    d. In some species, there are only females.
4. Not all animals exhibit a fixed sex throughout their lives.
5. Various forms of hermaphrodism exist in fish (and other organisms).
6. Darwin defined intra- and inter-sexual selection (see notes below).
7. Bateman's Principle (a.k.a. the Bateman Gradient) provides empirical evidence to explain the direction of sexual selection.
8. When Bateman's Gradient is reversed, the result is "sex-role reversal" and sexual selection is reversed.
    a. Sex-role reversal can be typical for the species.
    b. Sex-role reversal can be variable within a species.
9. Sexual selection can act on primary and secondary sexual characteristics as well as behaviors and “extended phenotypes”.
10. Genetic Theories for mate choice (usually female)
    a. Direct Benefit Theory
    b. Good Genes Theory
    c. Sexy Sons Theory (a.k.a. runaway selection)
11. Multiple genetic models may apply to a single species. (example: birds)
12. Non-genetic (i.e. learned) mate preferences also occur.
    a. Sexual imprinting
    b. Mate choice copying.
13. What Darwin didn't know and we are only now beginning to appreciate:
    a. Male-male competition persists after mating, as sperm compete with each other.
    b. Females may continue to choose, long after mating by selecting which sperm fertilize her eggs.
    c. There is more female-female combat and also male choice than previously appreciated.

HELPFUL FIGURES & NOTES:
(All PowerPoint files will be available on the Moodle after lecture. This subset of unlabeled and incomplete figures and notes is meant to assist, not replace note taking.)

Anisogamy



Rat

Bird

Darwin distinguished sexual selection from natural selection:
"Sexual selection depends on the success of certain individuals over others of the same sex ... while natural selection depends on the success of both sexes, at all ages, in relation to the general conditions of life. "

Darwin defined two types of sexual 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."

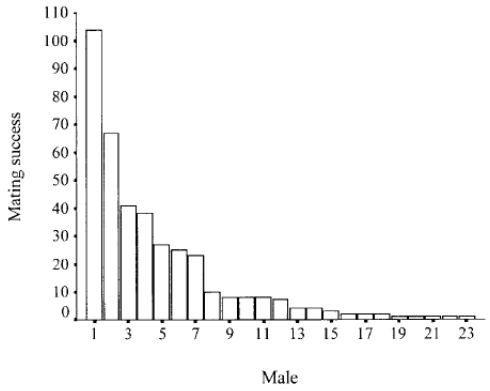


Fig. 1 Mating success of the males that gained matings (n=23). The males that gained no matings (n=15) are not represented in this figure

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

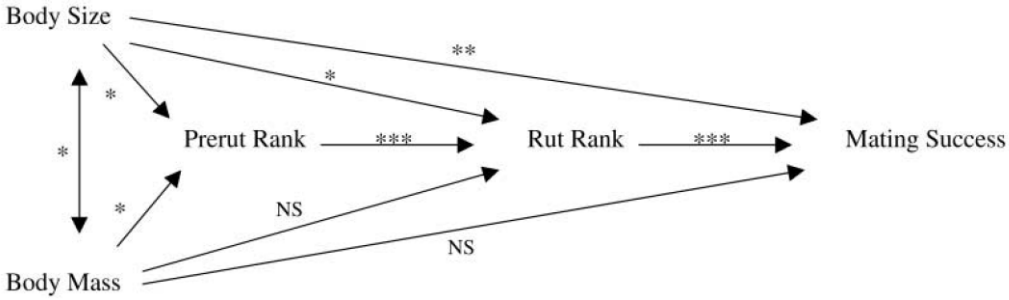
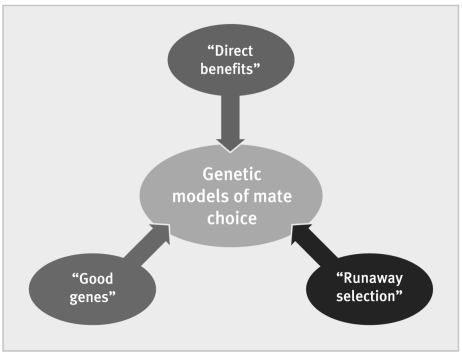


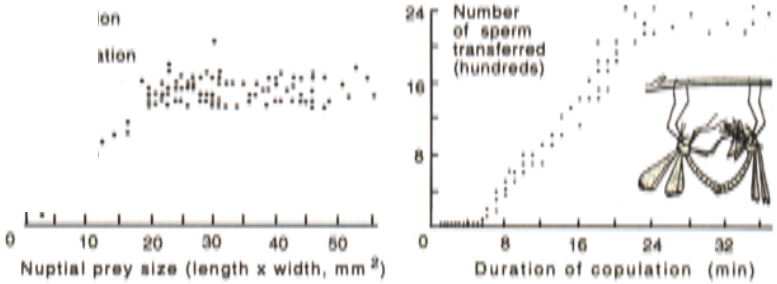
Fig. 2 Summary of the main results, presenting the hypothetical direction of causality. Age is not included in the figure because it was not related to any of the other variables. The levels of significance for the partial correlations are included (*P<0.05, **P<0.01, ***P<0.001, *NS* non-significant).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

Sex-role reversal

	Conventional Male / Female	Reversed Male / Female
Investment in gamete		
Mate choice		
Controlled fertilization		
Offspring investment		
Transfer of resources during copulation		
Competition for mate		
Courtship effort		
Sexual Coercion		
Infanticide		
Post-copulatory competition		
Post-copulatory choice		



Direct Benefit



Good Genes

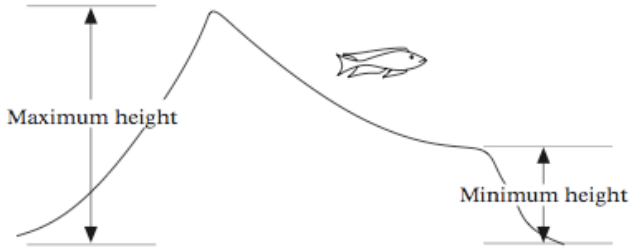
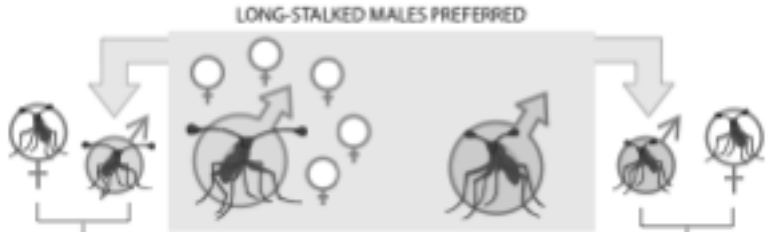
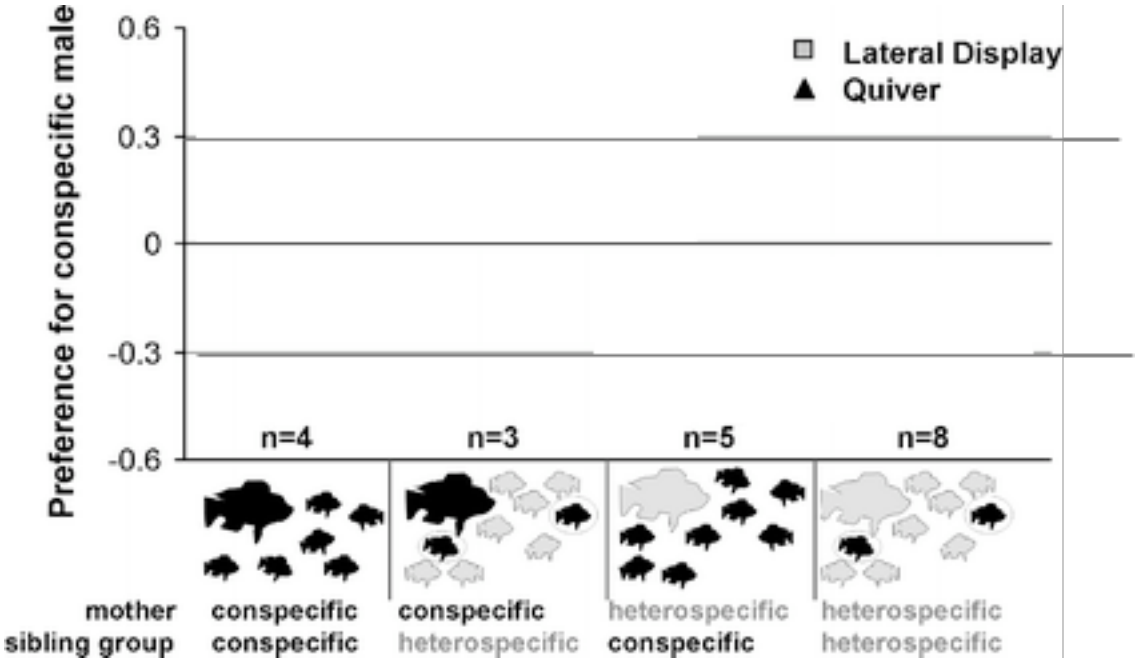


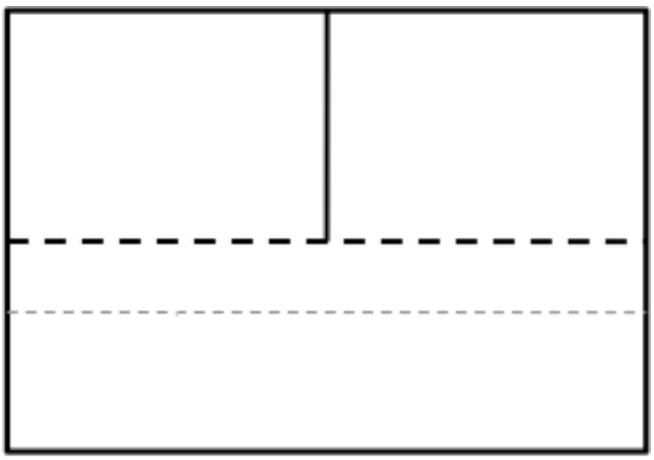
Figure 1. Cross-section of a sand bower showing maximum and minimum height measurements.

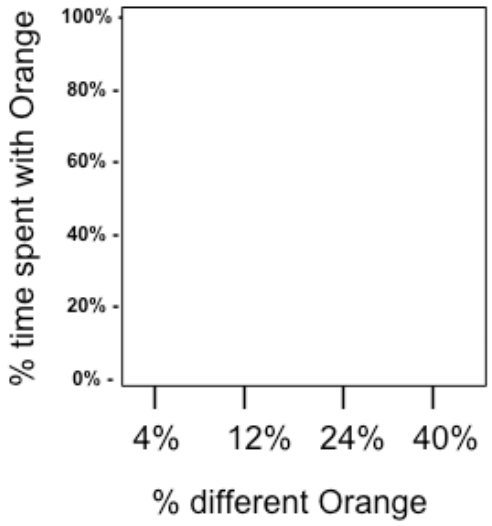
Runaway Selection

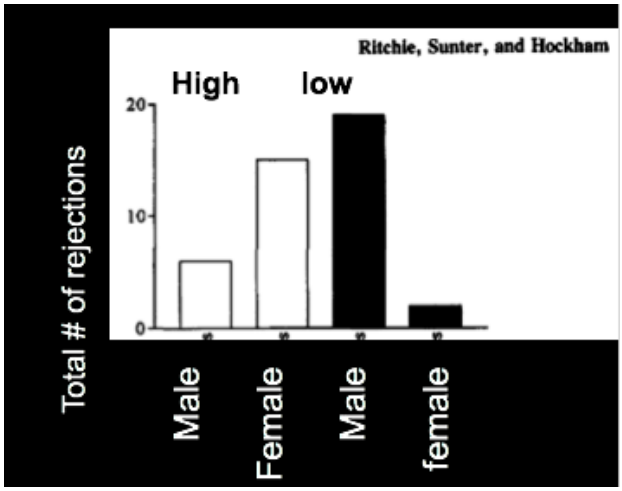


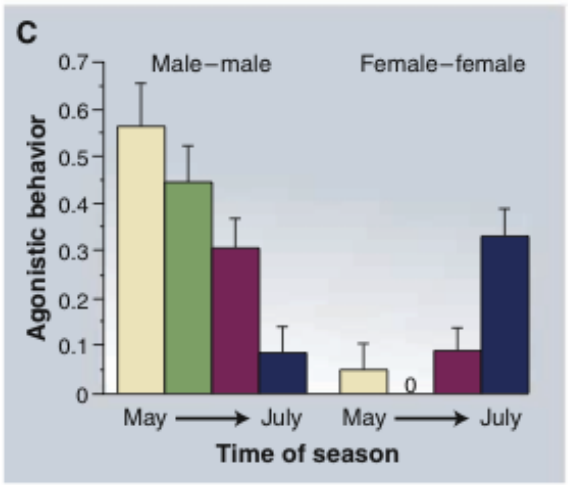


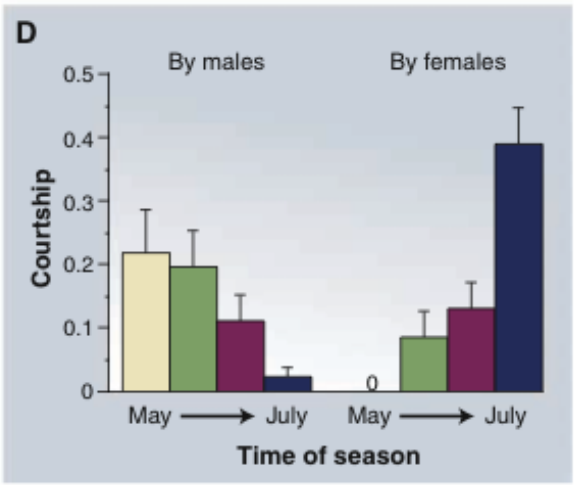
Mate choice Copying






Ritchie, Sunter, and Hockham
High
low
Total # of rejections
20
10
0
Male
Female
Male
female


C
Male–male
Female–female
Agonistic behavior
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
May
July
May
July
Time of season


D
By males
By females
Courtship
0.5
0.4
0.3
0.2
0.1
0
May
July
May
July
Time of season

VOCABULARY:

(Practice writing interesting, informative sentences that include, and capture the meaning of, 4-5 words from this list. To simply memorize a definition, is not sufficient).

Gamete
Anisogamy
Sex determination
TSD - ESD
GSD
Heterogametic vs. Homogametic
Hermaphrodite
Sexual Selection
Inter-sexual Selection
Bateman's Principle (a.k.a. Bateman's Gradient)
Intra-sexual Selection
Secondary Sexual Characters
Competition
Choice
Sex-role reversal
Sex-role Syndrome
Direct Benefit Hypoth.
Nuptial Gift
Extended Phenotype
Good Genes Hypoth.
Zahavi's Handicap Theory
Runaway Selection Hypoth.
Sexy Son's Hypothesis
Sexual Imprinting
Mate choice copying
Cryptic female choice
Sperm competition