

## Mating systems and parental investment



## Mating systems

Pattern of matings in a population



Antithesis = promiscuity

## Polygyny

Scramble: no attempts to defend females, resources

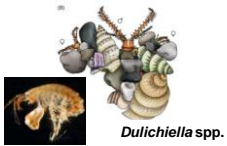


Northern barred frog



horseshoe crabs

Female defense: must be clustered



*Dulichiella* spp.



elk

## Polygyny



Montezuma's oropendola

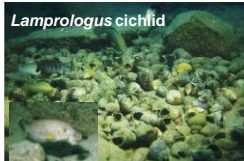


## Polygyny

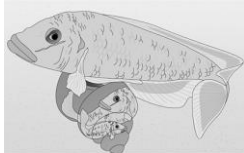
Resource defense: males defend food, nest sites



Red-winged blackbird

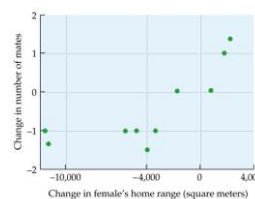


*Lamprologus* cichlid



## Resource distribution

Distribution of females affects males' ability to guard them

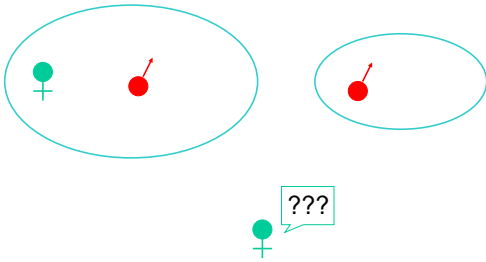


Males cannot monopolize wide-ranging females

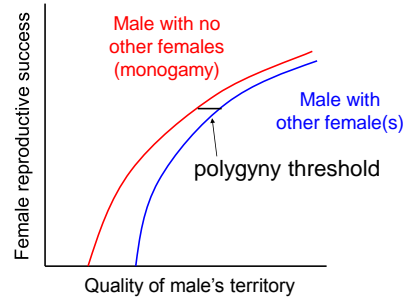


dunnock

### Polygyny threshold

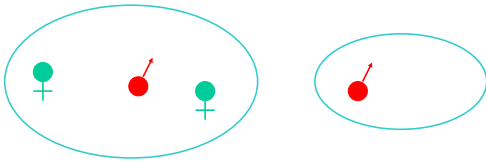


### Polygyny threshold



### Polygyny threshold

Polygyny threshold = point at which it's better to be polygynous on a good territory



### Male dominance polygyny

When females and resources too dispersed, males compete



sage grouse

Leks = communal display arenas



hammerhead bat



Uganda kob

### Leks

**Classical lek:** males display in sight of each other

**Exploded lek:** males rely on vocal communication, e.g. kakapo

### Leks

High variance in male mating success

- 10-20% males achieve >50% copulations
- one male got 75% copulations



### Leks

- Hotshots
  - Females attracted to lek by dominant male



### Leks

- Hotshots
  - Females attracted to lek by dominant male
- Hotspots
  - Leks located in high-use areas



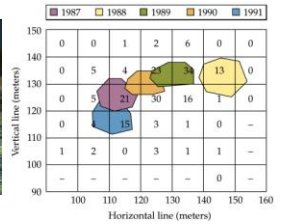
### Leks

- Hotshots
  - Females attracted to lek by dominant male
- Hotspots
  - Leks located in high-use areas
- Female preferences
  - Females prefer large groups of males



### Leks

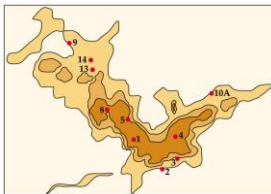
Position of most successful male territory shifts (hot shot?)



Removal of dominant male may cause lek to shift, disband

### Leks

Lek placement varies with respect to female density (hot spot??)



### Paradox of the lek

How is genetic variation maintained?



Hamilton and Zuk

Rowe and Houle

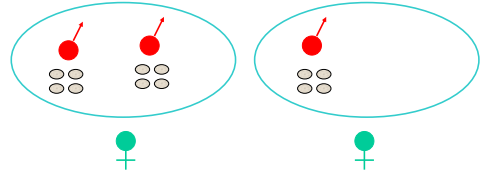
## Paradox of the lek

If females mate once, why do leks form?

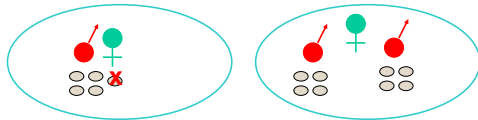


## Polyandry

- Usually characterized by sex-role reversals
- Factors favoring polyandry include
  - Male-biased sex ratio
  - Precocial offspring
  - Superabundant food



## Polyandry

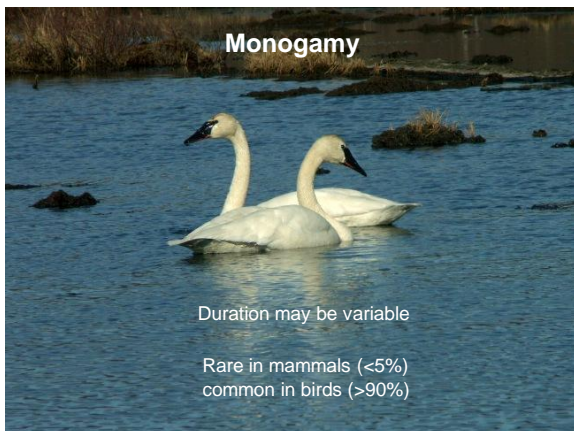
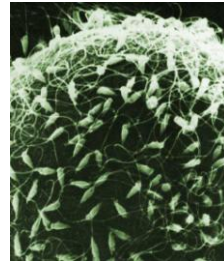


Clutch manipulations reveal incubation constrained at four eggs

Selects for production of two clutches

## Monogamy

Given sex differences in gamete production, why monogamy?



## Monogamy

Duration may be variable

Rare in mammals (<5%)  
common in birds (>90%)

## Monogamy

Occurs in species where females are widely distributed, rarely encountered



mantis shrimp



### Mate assistance

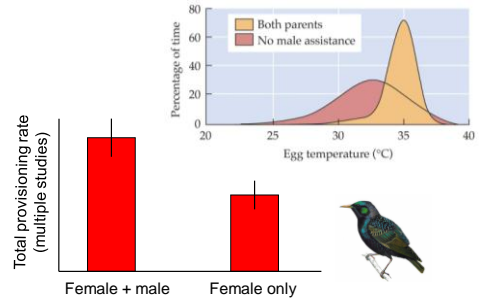
Important when young are energetically demanding



Important where habitat is harsh or offspring survival is low

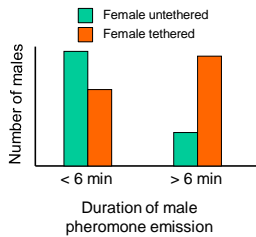


### Mate assistance



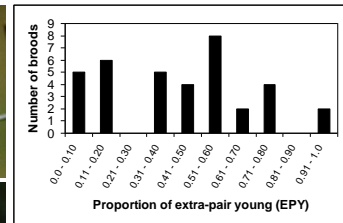
### Female enforcement

Conflict of interests between the sexes regarding care of offspring, opportunities for additional matings



### Extra-pair copulations

In some species, >50% offspring are extra-pair young



50-90% EPY (avg. 78%)

### Why do females solicit EPCs?

Material benefits?



Adelie penguins get rocks from EPC partners

### Why do females solicit EPCs?

Material benefits?

- EPCs are less "institutionalized" version of polyandry
- Many of the same benefits apply



## Why do females solicit EPCs?

### Male defense

...against nest predators



red-winged blackbird

32% predation on females with EPY  
54% predation on females with no EPY

...against infanticidal males



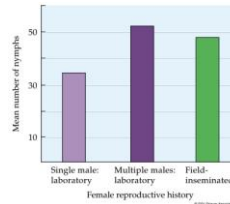
Hanuman langur

Females may mate often to confuse paternity

## Why do females solicit EPCs?

### Genetic benefits

– Guard against poor sperm quality of mate



pseudoscorpion

## Why do females solicit EPCs?

### Genetic benefits

- Guard against poor sperm quality of mate
- Increase genetic diversity of offspring

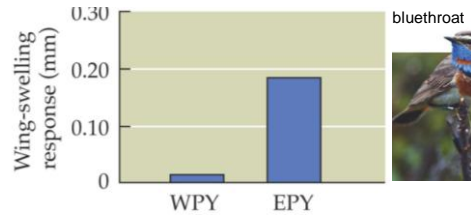


blue tit

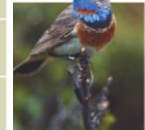
## Why do females solicit EPCs?

### Genetic benefits

- Guard against poor sperm quality of mate
- Increase genetic diversity of offspring
- Mate with genetically superior male



bluethroat



## EPCs in humans

Population	% nonpaternity
southern Africa (!Kung)	2
rural Michigan, USA	~10
Munich and Copenhagen	>10
Italy	13.2
India	15.3
urban Michigan, USA	20.1
Liverpool, UK	20-30



## Parental investment



### Parental investment

Behavior that increases fitness of offspring at cost to parent



Nutrition in egg



Pre-hatching (nest site, protecting eggs)



Post-hatching (provisioning, protecting young)



### Parental investment



### Patterns of parental investment

- Female-only care predominates
- Male, biparental care is rare

How do we account for the general female bias in parental care?



### Patterns of parental investment



Logic suffers from "sunk cost" or "Concorde" fallacy

What about the abrupt termination of investment in polyandrous species?

### Patterns of parental investment

Explained by order of gamete release?

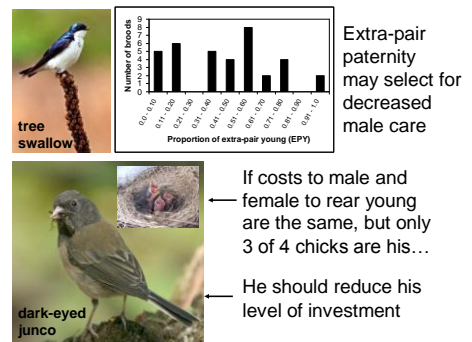
Provider sex	Mode of fertilization	
	Internal	External
Male	Few	Many
Female	Many	Few

guppy

piranha

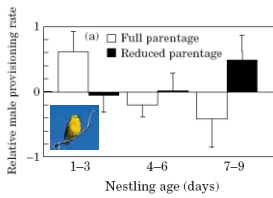
How to explain the predominance of male care in frogs where males deposit sperm first?

### Importance of paternity

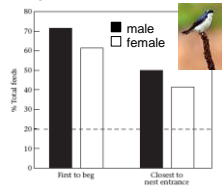


### Recognition of unrelated young?

No apparent discrimination against EPY



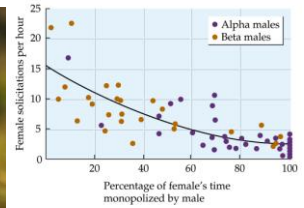
Male yellow warblers do not adjust feeding rate in response to cuckoldry



Male tree swallows show no feeding bias to own chicks, feed those closest or most in need

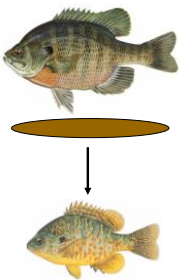
### Recognition of unrelated young?

Alpha, beta male dunnocks care for young in proportion to time spent with female

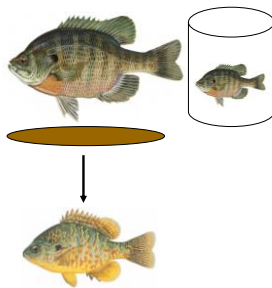


Females may use mating solicitations to manipulate male parental investment

Control = male bluegill on nest

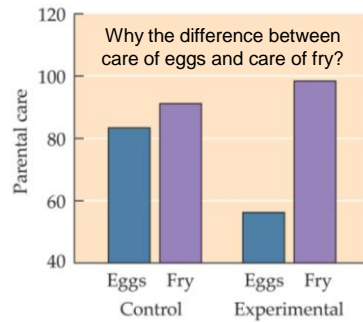


Experimental = male bluegill on nest with "sneaker" in a jar



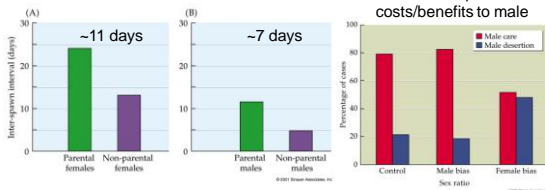
Tested defensive responses to nest predator

### Recognition of unrelated young?



### Sex differences in costs of investment

Male care persists where costs to females exceed costs to males?



### Sex differences in costs of investment



Large eggs require high level of care