# UNIT 8. SEXUAL CONFLICT AND SEXUAL SELECTION

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**SOURCES** *(for powerpoint format: http://wfsc.tamu.edu/jpackard/behavior/wfsc622/powerpoints.zip)*

required: Chapter 8 in Krebs & Davies (1993:175-207)

remedial: "Courting" in Halliday 1994; "Fighting" in the Trials of Life video series
supplement: Chapter 4 in Blumstein, D.T. and Fernandez-Juricic, E. "A Primer of Conservation Behavior"

**PARTS OF THIS LECTURE OUTLINE**

1. Reproductive Strategies: Equality of the sexes?
2. Mate Choice: Elaborate ornaments
3. Same-sex Rivalry: Honest displays

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*TIP1: Remember in Unit 7, we established that two strategies can co-evolve in one species? Last unit it was "fight' and "display". This unit the same logic is applied to "mating effort" and "parental effort" Species vary in how much of the parenting and mating behaviors are shown by males and females. In this part, we first describe the two strategies, to clarify that it is not always the female with the "parental duties" nor the male "preoccupied with sex". It has more to do with whether the offspring survive better with parental care and/or whether more ardent individuals get more mates.*

## 1. REPRODUCTIVE STRATEGIES: EQUALITY OF THE SEXES?

1.1. **Comparative: reproductive strategies differ among species (parental effort; mating effort)**

1. genotypes influence the relative allocation of reproductive effort between mating and parental behaviors *(Krebs and Davies 1993:177-178 Fig. 8.2)*
   a. mating effort (ME): find, court, copulate, defend mate
   b. parental effort (PE): gamete size, number of young (clutch or litter size), nurturing offspring (direct & indirect)
2. **sexual selection**: co-evolution of traits with a reproductive function *(Krebs and Davies 1993:183)*
   a. STEP1. the sex (male and/or female) that provides more parental effort is a "valued resource" (pg 176)
      i) differential reproduction due to better survival of offspring that received more care (K-selected)
      ii) **function:** those that provided more parental effort had **more offspring survive** to reproduce, compared to those that abandoned their offspring
   b. STEP 2. traits in the sex that provided the least parental effort were influenced by competition for mates
      i) no fitness cost to abandoning offspring, because extra care made no difference to offspring (r-selected)
      ii) **function:** those that abandoned offspring and had multiple mates would have **produced more offspring** compared to those that were faithful to one mate
3. **operational sex ratio** (OSR i.e. ratio of sexually active Males to Females) *(Krebs and Davies 1993:183)*
   a. monogamous relationships (1 Male : 1 Female)
   b. polygynous relationships (1 Male: several Females)
   c. polyandrous relationships (several Males : 1 Female)
   d. random (promiscuous) relationships (several Males : several Females)
4. **Mating system** refers to the most prevalent pattern of relationships between males and females (snapshot) *(read ahead in the next chapter Krebs and Davies 1993:208)*
   a. Monogamy = mostly monogamous relationships in a population
   b. Polygamy = mostly polygynous or polyandrous relationships in a population
   c. Promiscuous = mostly random relationships in the population

*TIP2: Many of the older textbooks refer to a "polygamous species" or "promiscuous species". This is misleading, because there is not a genotype for "mating system". The proportion of monogamous and polygynous relationships in a population may shift back and forth depending on environmental conditions (distribution of food and mates). For more on this perspective, read ahead about the conditional mating system of dunnocks in the next chapter (Krebs and Davies 1993:238). We do know about the genetic control of the hormones that control parental effort (i.e. prolactin) and mating effort (i.e. testosterone/androgen). This is why a more modern synthesis of this general topic focuses more on the presence or absence of male paternal care, as you will see in the next chapter.*

1.2. **Strategy 1: More Parental than Mating Effort (PE > ME)**
1. **both males & females in monogamous** relationships (i.e. pair 1M:1F; many passerine birds)
2. Primarily **females in polygynous** relationships (e.g. harem 1M:3F; many mammals)
3. Mostly males in polyandrous relationships (e.g. 3M:1F; rare examples like jacana, phalaropes)

1.3**. Strategy 2: More Mating than Parental Effort (ME > PE)**
1. **Male & Female in a random** system (mostly invertebrates)
2. **Male in a polygynous** system *(Krebs and Davies 1993:178 Table 8.1)*
   a. elephant seals: high payoff (100 per active male)
   b. red deer: medium payoff (24 offspring per active male)
   c. low OSR (e.g. 1:24, 1:100)=> many males are excluded from breeding
3. **Female in a polyandrous system** *(Krebs and Davies 1993:239)*
   a. phalaropes: sequential nests tended by males
   b. spotted sandpipers: >1 male nests in female territory
   c. jacanas: females defend resources where males nest

1.4. **Take-home message: reproductive strategies**
1. compare species: relative mating effort (ME) vs. parental effort (PE)
2. If PE>ME: then predict a monogamous system ( Male & Female equal); polygynous (F female gives more PE); polyandrous (Male gives more PE)
3. If ME>PE: then predict a polygynous system ( male red deer); or polyandrous system ( Female phalaropes)

| Part 1 | **Study Questions for Chat & Quiz 8 " Sexual Conflict and Sexual Selection "** |
|---|---|
| 1.1.1 | Why distinguish between mating effort and parental effort in developing hypotheses about allocation of energy for reproduction? (TIP: define each type of effort, refer to different functions) |
| 1.1.2 | What are the definitions of the following terms: "mating system", "sexual selection" and "operational sex ratio"? |
| 1.2 | Comparing monogamous, polygynous and polyandrous mating systems, what are the predictions about which sex shows more parental effort? |
| 1.3.1 | Comparing random, polygynous and polyandrous mating systems, what are the predictions about which sex shows more mating effort? |
| 1.3.2 | What are your favorite examples of species that illustrate differences between the relative mating and parental effort in polygynous and polyandrous mating systems? |
| 1.4 | What alternative reproductive strategies have been identified for monogamous and polygamous mating systems? |

## 2. MATE CHOICE: ELABORATE ORNAMENTS

2.1. **Long-tailed widow birds: tail display** ***(Krebs and Davies 1993:191 Fig. 8.7)***
1. H1: females choose mates with longer tails
   a. test: cut tails, lengthened tails, controls
   b. result: males with longer tails had more females

2.2. **Barn swallow: tail display** ***(Krebs and Davies 1993:198 Box 8.2)***
1. H1: longer tails attract females, handicap foraging
   a. test: cut & lengthened tails, controls (2)
   b. result: supported H1; long-tailed males paired earlier=> more broods
      i. Benefits: more extra-pair copulations
      ii. Costs: inefficient foraging=> short tail the next year (implies malnutrition)
2. H2: longer tails correlated with resistance to parasites

2.3. **Sedge warbler: song display** ***(Krebs and Davies 1993:192 Fig. 8.8)***

1. H1: larger repertoire size attracts females
2. test: correlation of repertoire size & pairing date
3. result: males with larger repertoire paired earlier

2.4. **Take-home message: mate choice (inter-sexual competition)**

1. mate choice=> selection for exaggerated displays (unless too costly)
   a. Fisher's "runaway process" hypothesis
   b. Hamilton-Zuk "good genes" hypothesis derived from "Handicap"
2. e.g. long-tailed widow birds, barn swallows, sedge warbler s

| Part 2 | Study Questions for Chat & Quiz 8 " Sexual Conflict and Sexual Selection " |
|---|---|
| 2.1 | How did Andersson test Fisher's "runaway process" hypothesis of mate choice? (TIP: widowbirds, Fig. 8.7 |
| 2.2 | How did Moller test the Hamilton-Zuk "good genes" hypothesis of mate choice? (TIP: derived from the "handicap" hypothesis of Zahavi; barn swallows, Box 8.2) |
| 2.3 | How was the function of a vocal display tested in a species of your choice? (TIP: e.g. warblers Fig. 8.8) |
| 2.4 | For you, which species best illustrate the distinction between two alternative hypotheses about the mate-choice function of elaborate displays? why? (TIP: runaway vs. good genes) |

**3. SAME-SEX RIVALRY: HONEST DISPLAYS**

3.1. **Red deer: antler display and fighting** ***(Krebs and Davies 1993:162: Fig. 7.5)***

1. advertisement: males with deep roars intimidate smaller males
2. assessment: parallel walk => male with smaller antlers leaves
3. fighting: equally matched in body size=> weaker male leaves

*TIP3: Notice that this example refers to tactics of escalation and de-escalation that are likely to change with maturation in each individual. The individual that escalates in each encounter may not be a superior genotype, merely older. In a social environment with male equal-age individuals, the social environment is different than in a population with a few older individuals and many younger individuals, Consider the chance demographic fluctuations in the social environment.*

3.2. **Toads: croak display and fighting** ***(Krebs and Davies 1993:163 Fig. 7.6)***

1. advertisement: deeper croaks more intimidating than high pitched
2. assessment: fewer attacks on large defender independent of croak
3. fighting: equally matched for size=> male with weaker kick leaves

3.3. **Bullfrogs: calling display and wrestling** ***(Krebs and Davies 1993:187 Fig. 8.5)***

1. calling attracts females and males
2. males wrestle in dispute of good-quality territory
3. females prefer to lay in territories with warm water & less plants

3.4. **Take-home message: same-sex rivalry => honest displays**

1. better fighters get more females; displays repel rivals & attract females
2. e.g. red deer, toads and bullfrogs

| Part 3 | Study Questions for Chat & Quiz 8 " Sexual Conflict and Sexual Selection " |
|---|---|
| 3.1 | For a mammal of your choice, describe the function of displays in same-sex rivalry? (TIP: e.g. red deer) |
| 3.2 | For an amphibian of your choice, describe the function of displays used in same-sex rivalry? (TIP: e.g. toads, bullfrogs) |
| 3.3 | What is the evidence that male displays have dual functions? (e.g. mate choice and same-sex rivalry) |

**SUMMARY**

1. **Reproductive strategies: equality of the sexes?**
    1. PE>ME: monogamous M & F; polygynous F; polyandrous M
    2. ME>PE: polygynous M (red deer); polyandrous F (phalarope)
2. **Mate choice: elaborate ornaments**
    1. mate choice=> selection for exaggerated displays (unless too costly)
    2. e.g. long-tailed widow birds, barn swallows, sedge warblers
3. **Same-sex rivalry: honest displays**
    1. better fighters get more females; displays repel rivals & attract females
    2. e.g. red deer, toads and bullfrogs

| Summary | Study Questions for Chat & Quiz 8 "Sexual Conflict and Sexual Selection" |
|---|---|
| 4.1 | What are the take home messages of these notes on sexual selection? |
| 4.2 | How have mate choice and same-sex rivalry shaped alternative reproductive strategies in males and females? |

*TIP4: From a practical perspective, it is important to know your species. Which sex provides parental care is very important for managing reproductive success and providing an environment suitable for survival of young. Conversely, if there is a problem with survival of the young who have been produced, the first thing to look for is whether there is a good match between the environment and the species' behavioral adaptations for parental care. If few offspring are being produced, then you need to look for issues associated with mating effort. Many females of breeding age who are not pregnant or caring for young, may be an indication that something n the environment is not a good match to the behavioral adaptations for mating effort in your target species.*

*TIP5: This unit is setting the stage for the next unit about behavioral adaptations to fluctuations in the physical and social environment. It helps readers generalize from the concept that some genetic strategies related to conflict may be fixed and some may be conditional. In the conditional genetic strategy, individuals may switch tactics depending on the condition of the environment. So you should have clear in your mind now that we will be talking about two co-evolved traits, "parental effort" (tactics: high, medium, low) and "mating effort" (tactics: choosy, competitive). These traits are not necessarily linked to the sex chromosomes. There are sex role reversals in species that have a phylogenetic history of more actively breeding males than females (Operational Sex Ration). You should also have it clear in your mind that the concept of a "mating system" actually referred to the patterns of relationships (monogamous, polygynous, polyandrous, random) measured at a "snapshot" in time for a sample of populations. This sets the stage for learning in the next chapter that species with a phylogenetic history of adaptation to a fluctuating environment, may have a conditional mating system, where individuals switch back and forth between monogamy and polygyny depending on how the resources fluctuate and the Operational Sex Ratio changes.*