Behavioral Ecology of Vertebrates

Unit 8. Parental Care

Module 3 Social
j-packard@tamu.edu

Learning, Discovering and Sharing Knowledge

Learning Objectives (Davies et al. 2012:223)

Co-evolution: care-giver & care-solicitor genotypes:

1. **Care-giving: Mom or Dad?** Parental investment, desertion, maternal and paternal effort
2. **Care-soliciting: siblings compete?** sibling rivalry, siblicide, intra-brood competition, inter-brood competition
3. **Care-giver vs. care-soliciter:** parent offspring conflict, brood hierarchy, begging intensity

Davies et al. 2012, Fig 8.4

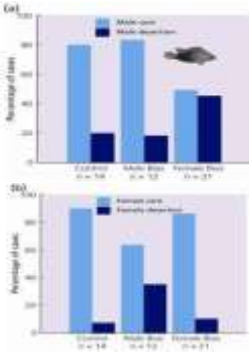
Pay-offs for abandoning the offspring

1. CARE-GIVING: MOM OR DAD?

Cichlids (St. Peters fish) obligate brood care, both males and females, but under different OSR, which sex abandons the young will vary.

1.1 Conditional care (Davies et al. 2012, Fig. 8.4)

- Mouth brooding cichlid: St. Peter's fish
- H1. Desertion is conditional on OSR
- Treatments (OSR):
  - Control (1:1)
  - Female bias (1:3)
  - Male bias (3.1)
- Males more likely to desert when benefits of leaving & mating again are greater than staying & brooding



1.2 Parental Investment: A parent's optimum

- **Parental Investment**: investment by the parent that increases the survival and reproductive success rate of *one* offspring, while taking away the parent's ability to invest in another offspring (Trivers 1972, cited in Davies et al. 2012: 227)
  - What are some examples of parental investment?

An important Distinction:

Parental Investment, Ultimate (function & evolution):
- Parents that invest in an "optimal" amount to their offspring, determined by their biology and available resources, will produce offspring with higher fitness then parents that invest more or less then the "optimum."

Parental Effort, Proximate (causation & development):
- The total parental investment each offspring receives at a given time[1]

Credits: K. Wedemeyer

Examples of Parental investment: Parental investment "includes any investment, such as guarding or feeding, that benefits the eggs and young" Davies et al. 2012; 227.

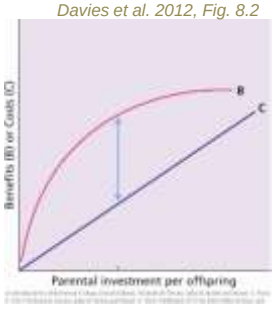
Talking points: Remember, proximate = causation and development and ultimate = function and evolution

Lifetime Parental Investment: "sum of all the resources a parent can gather In its lifetime to be used for offspring care" (Davies et al. 2012; 227)

1.3 Parental Investment: Trade-offs *(credit: K. Wedemeyer)*

- Parental investment involves **trade-offs:**
  - Quality vs. Quantity *within* a brood
  - Current vs. Future broods
- Increase investment = decreased benefits
  - The more investment in one offspring, the less in other offspring
  - Focus too much on one offspring, the continued investment will no longer benefit the offspring but will still cost the parent and will deprive other offspring (current & future) of the parents' lifetime available resources (Davies et al. 2012: 228)

Davies et al. 2012, Fig. 8.2



Optimal Parental Investment = Benefits (B) – Costs (C)

Trade-offs – when parents invest their resources into one offspring, they have fewer resources to invest in other offspring.

Within a brood: if a parent "spreads itself too thin" it could potential have more offspring with lower fitness than if it focused on only a few offspring: fewer offspring with higher fitness vs more offspring with lower fitness

Future broods: "increased investment in any one brood will reduce a parent's ability to invest in future broods" (Davies et al. 2012; 228)

Lit. Cited:

Low 1978 and Zeveloff and Boyce 1980 cited in Pugesek (1990) *Parental effort in the California gull: test of parent-offspring conflict theory*. Behavior Ecology and Sociobiology 27: 211-215.

1.4 Taxon comparisons (Davies et al. 2012:224)

TAXON	MATERNAL	BI-PARENTAL	PATERNAL
Invertebrates	(+)	(((+)))	((+))
Fish	+	+++	+++++++++
Amphibians	+	(+)	+
Reptiles	+	+	-
Birds	+	+++++++++	(+)
Mammals	++++++++++	+	-

1.5 Poll- lets see if you understand

About which topics would you like to chat more?

a) Care as a conditional strategy (mouth brooding fish)
b) Definition of parental investment (theoretical costs)
c) Trade-offs in parental investment (optimal switch)
d) Comparative approach (paternal vs. maternal)
e) I'm good, lets move on

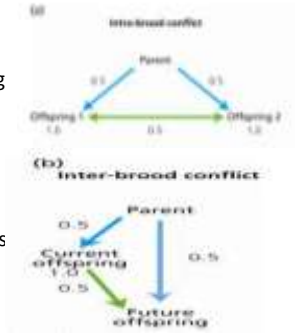
Davies et al. 2012, Fig 8.10

Sibling competition for parental care

2. CARE SOLICITING: SIBLINGS

2.1 Sibling competition (Davies et al. 2012, Fig. 8.7)

- Intra-brood
  - Parents: no difference in genes shared with offspring
  - Siblings share fewer genes
  - Predict siblings compete for care within a brood
- Inter-brood
  - Same probability that genes are shared
  - Older siblings reduce the viability of the next brood

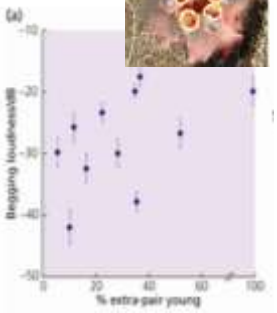


2.2 Sibling rivalry (Davies et al. 2012, Fig. 8.10)

- Ornamental feathers in cute coot chicks
- H1: Attractive chicks receive more care
- Treatment:
  - All orange control (O)
  - All black control (B)
  - Mixed broods (O & B)
- Orange chicks compete better for care

2.3 Sibling relatedness (Davies et al. 2012, Fig. 8.6, 8.9)

- Predictions: sibling's demand for care depends on relatedness
  - Selfish demands increase with lower relatedness
  - More highly related sibs should demand less
- Test: comparisons across bird species
  - Species with higher extra-pair paternity (lower relatedness among sibs) beg more loudly



2.4 Siblicide (Davies et al. 2012:240-241)

FACULTATIVE	OBLIGATE
• Inter-brood conflict	• Intra-brood conflict
• Galapagos fur seal	• Raptors, pelicans, boobies
• Poor conditions=> pups grow slowly and wean late	• Two eggs per clutch
• When new pup is born, older sibling pushes it away from nipple (or may bite it)	• One sibling always kills the other
• Younger pup dies	• When the first egg fails, the second sibling succeeds
	• Adaptation to fluctuating & unpredictable conditions

2.5 Poll- lets see if you understand

About which topics would you like to chat?

a) Sibling competition (intra- & inter-brood)
b) Sibling rivalry- attractiveness (cute coot chicks)
c) Sibling rivalry & relatedness (species comparisons)
d) Siblicide (facultative & obligate)
e) I'm fine, lets move on

Lets dialogue more about this using the elearning discussion tool

Davies et al. 2012 Fig. 8.14

How many chicks do you see gaping in this photo?

Horsfield's hawk-cuckoo and blue & white flycatcher host (gape on left is actually the cuckoos wing)

Prudent parents and selfish offspring

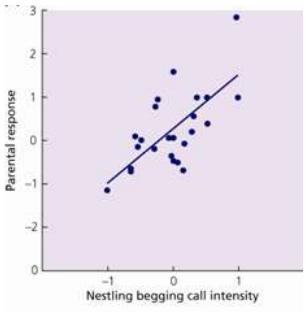
3. CARE-GIVING VS. -SOLICITING

3.1 Parent offspring conflict (Davies et al. 2012, Fig. 8.8)

- Trivers (1974)
- Ultimate costs and benefits differ from perspective of parents & offspring
- Parents: predicted optimal PI is lower
- Offspring: predicted optimal PI is higher

3.2 Begging call intensity (Davies et al. 2012, 8.11)

- Great tits (each point is a separate brood)
- H1: offspring that beg more intensively receive more care
- Treatment:
  - Cross fostered broods
  - Parental food delivery
- Offspring begging correlated with mother's genetic tendency to provide food (androgen mechanism)



3.3 Costs to parent (Davies et al. 2012 Table 8.5)

BROOD HIERARCHY	Young surviving 2 weeks post fledging	
	GOOD FOOD	POOR FOOD
Synchronous hatching	2.9	1.3
Asynchronous hatching	2.3	2.1

3.4 Poll- lets see if you understand

About which topic would you like to chat more?

a) Parent offspring conflict (theory)
b) Begging call intensity (great tits)
c) Costs to parent vary with conditions (blackbirds)
d) I'm good, lets move on

Lets dialogue more about this using the elearning discussion tool

Summary

(Davies et al. 2012:253)

Co-evolution: care-giver & care-solicitor genotypes:

1. **Care-giving: Mom or Dad?** Parental investment, desertion, maternal and paternal effort
2. **Care-soliciting: siblings compete?** sibling rivalry, siblicide, intra-brood & inter-brood competition
3. **Care-giver vs. care-soliciter:** parent offspring conflict, brood hierarchy, begging intensity