

Parental Care

Class Business

- Information on the final, including the review session, is on the web page. I will also post any questions that are sent to me about the course material along with my responses (I'll delete all names and other comments that would identify the person who originally asked the question). This page will give everyone in the class access to my answers. **Note: all Tweets that you wish to count towards class credit must be posted by the end of day on Wednesday, April 29th, the last day of class.**

Reading for this lecture

Required. Gill: Chapter 16 (pg. 482-502)

1. Introduction

A) DURATION

- Although parental care is most intense when the young are still in the nest, it often lasts well beyond the nesting period. Altricial young are often accompanied by their parents for several weeks after fledging, and in some species (e.g., geese) the young will stay with their parents until the end of the first winter.
- Use the text book to make sure you can define these terms: **nestling period, fledging period, fledgling.**

B) WHAT ARE THE JOBS THAT PARENTS DO?

- Feeding.** One of the main things that the adults have to do is to feed their young. For altricial young, the parents do everything – capturing the prey, bringing them back to the nest, and even putting the food into the young birds mouths. Even in species with precocial chicks that can largely feed themselves, the parents still play an important role in taking the young to areas where food is abundant and perhaps teaching them what to eat.
- Brooding.** Even after they leave the nest many young birds remain unable to thermoregulate by themselves, especially in poor weather conditions. They still, therefore, rely on their parents to protect them from the elements and to keep them warm enough. Young shorebird chicks (which are very precocial) will periodically stop foraging and go to their parents to **brood** (i.e., sit up close against the parent's breast to get warmth). Adult birds also will stand over their chicks to shade them from the sun or to protect them from the wind and rain.
- Predator defense.** Another important job that adult birds do, even for precocial young, is to help with predator defense. Young birds are far more vulnerable than their parents. Even precocial young are limited because they cannot fly. Adults can protect against predators by warning their young – often an adult will stand guard nearby while the young fed; by taking them to safe places; by mobbing predators and chasing them off; or by distracting predators and luring them away.
- Teaching skills.** Birds use a range of often very complex behaviors, and many of these skills need to be learned quickly if the young are to survive. Consequently, the parents play an important role in showing the young basic skills.
- Nest sanitation.** Altricial young especially also require help with such basic tasks as nest sanitation. Parents often remove egg shells and feces from the nest, typically carrying them some distance away before dropping them. The feces are excreted from the young birds with a surrounding membrane which forms a distinct **fecal sac** that the adult can easily carry in its bill. Removing the feces has advantages in that it can reduce the risk of disease or parasitism; also the white of the uric acid and the pale insides of the eggshells may make a nest more conspicuous to predators.

2. Parental care is costly

A) ENERGETIC COSTS

- Chick growth requires a lot of work on the part of the parents. This is because the chicks grow quickly, with most young birds reaching their adult size within a few weeks. In some passerines it can take as little as 2-3 weeks. In very large birds it can take months, but even in the biggest birds the young reach adult size relatively rapidly.
- At the peak of breeding, adult birds may need 50% more energy to support all of the additional activity associated with parental care. Check out the text book for details on the cost of raising young.

B) CONSEQUENCES OF REDUCED CARE

- i) The lack of parental care also can be costly – when measured in terms of reproductive success. The loss of one adult in a socially monogamous species can require the remaining bird to increase its workload greatly (e.g., doubling chick feeding rates), which in turn reduces attentiveness to the chicks (which can lead to a greater vulnerability to predators or the elements). The increased work adds to the stress on the remaining adult, and can reduce their survival and that of the young.
- ii) Not surprisingly, the costs are less in species with precocial chicks.

3. When does parental care pay?

A) PARENT-OFFSPRING CONFLICT

- i) Parents and their offspring typically have very different perspectives on the form parental care should take. Offspring will always do best if they can get their parents to do things for them (i.e., bring them more food, brood them more, give them more money, wash their clothes). On the other hand, parents should limit their investment to the minimum they can get away with while still having the young survive to reproduce. (This is why your parents will start ignoring you as soon as you have kids, and redirect their attention to their grandkids.)
- ii) From the perspective of wild birds, the more effort they invest in raising their young, the more likely the young are to survive. But, as effort increases the incremental benefits will decrease – eventually there will be very little extra benefit for providing more care (i.e., the benefit curve will flatten).
- iii) At the same time, increasing the level of parental effort reduces the parent's chance of surviving to breed again. At first, the adults have some leeway and the cost of extra effort is minimal (i.e., the cost curve is relatively flat), but as more and more effort is invested, the less margin the adults have and the greater the risk of providing more help (i.e., the cost curve slopes downward).
- iv) This situation means that there is a trade-off. Parents should balance the benefits of aiding their current offspring versus the benefits of redirecting resources to future offspring. In other words, there will be a point at which providing extra care becomes too great a risk for the parents and they will cease to do any more.

B) PARENTAL INVESTMENT DEPENDS ON CIRCUMSTANCES

- i) Determining how much effort a parent will invest in their offspring is complex and is influenced by many things. Parents should, however, invest more in offspring that have a high chance of survival than in those that have a poor chance. They should also be more likely to desert a questionable situation if there are good opportunities to renest, and more likely to stick with a clutch/brood if there is little advantage to quitting.
- ii) With these ideas in mind it is possible to make some predictions about what adults should do. For example, one would predict that birds will usually feed their strongest chicks (to make sure that at least some of the brood survive), and only take care of the weaker ones once the needs of the others are met. In most cases this is what happens (see Gill page 443). Similarly, one would expect adults to abandon a nest that has a reduced number of eggs early in the breeding season (when there is opportunity to renest and increase the total number of young that can be produced), but not late in the season (when renesting is no longer an option). Abandonment should also be more likely in nests that have lost a lot of eggs than in those that have lost only a few. Again see Gill (pages 455-456) for an example of this in tree swallows.

C) CEASING PARENTAL CARE AND INFANTICIDE

- i) Generally, when the costs of parental care get to be great, the parents respond simply by deserting the nest or young. Typically the young will die, but if they are far enough along in their development it is possible that they might survive. In some cases (i.e., if food is in short supply), the adults may just neglect the smallest young, continuing to feed the older ones.
- ii) In rare cases, however, the parents may benefit from killing the young birds. This is most common in situations where the young are not related to the adult. This occurs in tree swallows, which sometimes usurp nest sites that are already occupied by a pair. In rare cases an adult bird may kill its own offspring – this is most likely when food is hard to find. For example in South Polar Skuas, adults have been seen to kill one of their smaller chicks and feed it to their larger one, thereby making sure that at least some of the young survive.

D) SIBLICIDE

- i) More common than infanticide, is siblicide, where one chick kills another. This is a standard part of life in the nest for certain types of birds (e.g., hawks, herons, boobies).
- ii) Siblicide takes two forms. In most species it only sometimes happens, typically when there is not enough food to support all of the chicks. Such **facultative brood reduction** allows the adults flexibility in predicting how many young they should produce: they lay enough eggs to maximize their brood size under good conditions. But, if it turns out to be a poor year, they feed only the larger chicks and let siblicide reduce the brood size to fit environmental conditions. In this way adults can ensure that they raise the maximum number of young that the environment can support.
- iii) In a few species, there is **obligate siblicide**. This means that one chick is always killed. This may seem like a waste, but in fact provides the parents with a different type of “insurance”. In these birds, the “extra” egg is laid in case the other fails to hatch (e.g., because it is infertile), again allowing the parents to ensure that they produce the maximum number of young.
- iv) Species with siblicide typically have **asynchronous hatching** (i.e., incubation starts before all eggs are laid). Why do you think this is?

4. Brood parasitism

A) DEFINITIONS

- i) **Brood parasitism** occurs when females lay eggs in a nest of another individual and leave parental care to the foster parents. This allows females to increase the number of young they can raise, without having to add to the amount of parental care they invest (males can achieve the same result through extra-pair fertilizations).
- ii) Brood parasitism can be **intraspecific** (a bird parasitizes its own species) or **interspecific** (a bird parasitizes another species). Interspecific parasitism can be **facultative** (females lay some eggs in the nests of others, but also have a nest of their own) or **obligate** (members of the species do not build their own nests and always rely on other species to raise their young).

B) INTRASPECIFIC BROOD PARASITISM

- i) Intraspecific brood parasitism occurs in a number of species and, with the advent of DNA fingerprinting – which allows us to determine the real mothers of each chick – it has become apparent that it occurs at a low level in many species.
- ii) One of the best studied species in which this occurs is the redhead, a duck that breeds throughout the Prairies, and the behavior is found in a number of other waterfowl species (eiders, snow geese, wood duck, etc.).
- iii) One possible reason why brood parasitism is so common in waterfowl is that they have precocial young, so the additional cost to the foster parent is small. Hence, there is little selection against accepting a parasitic egg. (But this then begs the question: if parental care costs are low, why do the real parents not just take care of all of their young? Any ideas?)

C) INTERSPECIFIC BROOD PARASITISM

- i) The best known brood parasites are obligate interspecific brood parasites: cuckoos and cowbirds. Not all cuckoo species are brood parasites, although many are (none of the North America species are commonly parasitic). In North America the main brood parasites are brown-headed cowbirds.
- ii) Common cuckoos have been especially well studied and are well known for their chick’s behavior of ejecting the other eggs from the nest right after they hatch. They also are well known for their ability to mimic the eggs of their **hosts** – each female lays eggs of a particular color and pattern and specializes on a particular host species. Hence there are “reed warbler” cuckoos which lay eggs that look like reed warbler eggs, there are “wagtail” cuckoos which lay eggs that look like wagtail eggs, and so on.
- iii) Brown-headed cowbirds are not specialized in the way that many cuckoos are and will lay eggs in the nests of many small passerines (over 200 other species have been found to be parasitized by cowbirds). Some species reject the cowbird eggs, either by breaking them, throwing them out of the nest, or just abandoning the nest and building a new one. But, many species are duped into caring for the young cowbird. As cowbird numbers have increased due to human changes to the environment, their parasitism has been seen increasingly as a threat to many other species.

5. Cooperative breeding

A) HOW DO BIRDS COOPERATE?

- i) In some cases, the costs of parental care are reduced because additional birds (called **helpers-at-the-nest** or **supernumeraries**) help the mated pair to raise their young. These helpers are not involved in reproduction – they do not form pair bonds and they are not the genetic parents of the offspring. (There are species in which females will share nests, but that is a somewhat different phenomenon.)
- ii) Cooperative breeding is known to occur in well over 200 different species of birds.

B) WHY WOULD A BIRD COOPERATE?

- i) Although cooperative breeding might appear to be an **altruistic** behavior, it turns out that when the situation is studied in detail there are distinct benefits to the helpers that explain why they help.
- ii) Frequently, cooperative breeding arises when the amount of breeding habitat is limiting. In these cases, many birds are faced with a situation whereby they cannot obtain a breeding territory of their own. By helping a mated pair, these extra birds are able to get access to a territory and become familiar with it. This puts the helper in a good position to take over the territory (and sometimes the remaining mate) should a resident bird die.
- iii) If the helper is closely related to the mated pair (usually helpers are the offspring from a previous nesting, or a sibling of one of the mated birds) then it can obtain genetic benefits too, because the birds it is helping to raise will also be close relatives.
- iv) Finally, helping provides young birds with an opportunity to learn skills required for breeding. Especially when they are helping to raise siblings, young birds might be able to gain more genetically than if they were to attempt to breed on their own (because first breeding attempts by inexperienced birds frequently end in failure).