

Reproductive strategies in birds



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- Catherine Carrick

Introduction

Birds, like any other organism, constantly struggle to find a balance between the benefits of reproduction and the costs of reproductive effort expressed as adult mortality (RICKLEFS, 1977). As well as behavioural differences among species such as brood size, protection of young or the effort required for foraging, environmental factors influence avian reproductive strategies. This includes bionomics, for example; how efficiently a bird procures and utilizes available resources, and how it protects its investment (offspring). During the last 50 years it has become the consensus that reproduction and mortality rate among birds are directly proportional, and that the age of sexual maturity increases with adult survival rate (RICKLEFS, 2000), where reproduction rate is determined by the length of the breeding season, the <https://assignbuster.com/reproductive-strategies-in-birds/>

clutch size, and nesting success. The evolution of optimum clutch size was one of the first studies conducted by David Lack (1947) where food supply directly influenced fecundity. Later studies showed that in most cases, birds with a longer life span such as albatrosses had decreased clutch sizes, postponed sexual maturity and decreased reproductive success due to greater parental investment and thus a greater risk of parental death. Environments are often unpredictable and birds such as the black kite (*Milvus migrans*) produces more offspring early on its life (SERGIO, 2010). Competition, resources and hazards change in such a way and often so rapidly that the kites would die before being able to reproduce if sexual maturity occurred much later.

Life Histories

When understanding reproductive strategies, is it important to understand what is meant by 'life history'. It is the history of adaptations and genetic modifications of a population in response to changes in the environment. It is not to be confused with a 'life table,' which shows the interactions of adaptations and genetic modifications with the environment.

Genetic variation gives rise to an evolutionary response in the gene pool to variation in the environment. Changes in the environment tend to change the density and age structure among a population making the population either crash, or revert back to a state of equilibrium.

Sex Ratio

Aspects of birds' lives can vary up to 10-fold among species with opposite life histories (RICKLEFS, 2000) and the theme of this evolution include several

components. The first is sex ratios. “Fishers principle” states that when male births are less common, those male offspring have better mating potential than the female offspring and so the males have more offspring. This then means the genes for male procuring tendencies spread, male births become more common and a 1: 1 sex ratio is approached (the equilibrium). This reduces again as being born male becomes less advantageous (Hamilton, 1967). A study by Neville et al (2008) showed the sex ratio of 298 nestlings from 81 nests of golden-winged warblers *Vermivora chrysoptera* to be approximately 50: 50 (1: 1). However, Daan et al (1996) observed some raptor species producing excess daughters early in the breeding season and males later in the season, whilst other species showed the opposite. The deviation may be explained by specific environmental conditions having different consequential outcomes for male and female offspring (DAAN et al, 1996).

Sexual Selection

Males and females differ through sexual dimorphism and secondary sexual characters such as elaborate tail feathers. If there is heritable variation in a trait that affects the ability to obtain mates, then variants conducive to success will become more common over time. Peahens select for male peacocks with the largest most elaborate tail feathers, and so this character is genetically passed on and becomes more common. Access to mates is a limiting factor for males and it was predicted that sexual selection will be a stronger force in the evolution of males than females (BATEMAN, 1948). This leads to stronger competition over mates in males and means that females should be choosy as they invest heavily in reproduction, yet another reason

why males have large plumage – to advertise to females. There are two theories as to why a female would choose a male with costly characters. Firstly is the “ sexy sons” theory where cost arises as the end product of a runaway process. Secondly is the “ good genes” theory where females choose mates with good genes to maximise viability of their offspring (TRIVERS, 1972). For example, those peacocks with the brightest, largest and most elaborate plumage indicate to a female their probable resistance to parasites.

Parental investment

This can be described as any parental interactions with their offspring that increases the offspring survival rate, at the cost of the parents ability to invest in other offspring (TRIVERS 1972). Social monogamy with biparental care (BURELY, JOHNSON, 1992) is common among avian species. However, this has evolved from a very different diapsid lineage in the fact that most extant and extinct diapsids show promiscuity and mainly lack parental care (with exceptions like crocodylians).

Fig. 2 shows the stages of evolution from limited parental care in the basal archosaur leading to increased biparental care and ultimate monogamy among extant avian species. In contrast, social parasitism can avoid the risks of parental investment as seen in North American cuckoos (*Coccyzus* sp.) where the cuckoo lays its eggs in a hosts nest and the host incubates and raises the parasitic cuckoo chicks.

Parent-offspring conflict

The conflict is at its peak during the parental care period. It is loosely divided into intrabrood conflict where the offspring favour different division on parental investment that that preferred by the parent (KILNER, 2007) and interbrood conflict where the demands made by the offspring are too great that the parent withholds investment for future reproduction. An example is given in a study by Stamps et al (1985) on budgerigars (*Melopsittacus undulates*) where in female-fed families the parent controlled food allocation as they did not favour begging, whereas, in male-fed families the offspring had the greatest control, as the male parents were susceptible to allocating food to those who begged.

Optimization in a Variable Environment

D. Cohen (1966, 1968) reached the conclusion that fluctuating environments always favour greater reproduction, whereas constant environments select for small litters (SHAFFER, 1974). A case study by Jetz et al (2008) examined clutch size from 5290 avian species worldwide and correlated the environmental influences with the comparative approach (the relation of clutch size to other biological traits) in one analysis. It showed conclusive evidence that backed Cohen's theory. For example, avian species in more stable seasonal environments had larger clutch sizes than those of tropical birds where the climate changes unpredictably and rapidly.

Nest predation

Prolonged incubation and nestling periods increase the probability that those nests will attract predators. The opposite can be said for minimal incubation and nestling periods. Therefore it can be assumed that those species with

larger clutch sizes, prolonged incubation or nestling periods have adopted and evolved strategies to evade predation. For example, Killdeer (*Charadrius vociferous*) eggs and chicks are extremely well camouflaged (Fig. 3).

Niko Tinbergen (1967) found that in the case of the black-headed gull (*Larus ridibundus*), the adult would remove the eggshell a short time after its chick had hatched, and place it away from the nest. This meant leaving the chick alone momentarily, but the advantage of removing the white, un-camouflaged egg shell outweighed the cost of cannibalism of the chick from neighbouring gulls. This behaviour is heritable among all black-headed gulls. Birds that evolve in areas with few or no predators should then exhibit larger clutch sizes, prolonged incubation and nestling periods. This is seen in island species that have had time to evolve in the absence of predators. However, a study performed by Trevelyan and Read (1989) showed no significant differences in reproductive strategies between mainland Australia and New Zealand species. Trevelyan and Read interpreted these observations to be due to the arrival of humans, stimulating reproductive strategies similar to those on the main land.

Conclusion

Birds expend a great deal of energy providing parental care, breeding and courtship, whether or not the offspring are precocial (an advanced state of development) or altricial (completely dependant on the parent/s). It is clear that productivity of breeding is intrinsically linked to an avian life span and environmental factors which constantly encroach on avian fecundity and mortality. Of the 10, 000 known extant avian species, each has developed a unique reproductive strategy, whether its be elaborate plumage to attract a

mate as seen in tropical birds (genetic); removing egg shells to avoid cannibalism of offspring (behavioural); or laying a large clutch to ensure survival of the next generation in an erratically changing environment.