Honey, I ate the kids: The sweet side of filial cannibalism

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As you bite into a chocolate bunny or egg this weekend, consider this: rabbits often eat their own young, and hens their own eggs.

In fact, eating or abandoning offspring has been documented in a variety of mammal and bird species—as well as fish, insects and spiders. Hunger and quality control are among the many reasons proposed for this counterintuitive survivor of natural selection.

Now researchers at the University of Tennessee and the University of Oxford suggest that in some cases, filial cannibalism and offspring abandonment might even be considered forms of parental care. Published in *Frontiers in Ecology and Evolution*, their mathematical model shows that when overcrowding threatens offspring survival—which often occurs due to spread of infection or competition for resources—sacrificing a few so the most can live becomes the ultimate form of tough love.

Putting all your eggs in one basket

To understand the role of overcrowding or 'offspring density' in the survival benefit of filial cannibals, the researchers focused on species that lay eggs.

"Communal egg laying is common in a range of fish, insects, reptiles, and amphibians," says senior author Dr. Hope Klug, Associate Professor at the University of Tennessee, Chattanooga. "This makes it easier to protect, clean, incubate and feed the eggs—but can also increase disease transmission, and competition for food and oxygen."

Offspring density has been found to affect egg survival, and in some cases abandonment or cannibalism, in many of these species.

"For example, in the beaugregory damselfish, fathers were more likely to eat eggs under low oxygen conditions," notes Klug. "Such cases have led the to the hypothesis that eating or abandoning offspring may be an adaptation to improve overall survival of offspring by reducing their

density."

Model parents eat their offspring

Klug and colleagues created a mathematical model to test this hypothesis.

"The model introduced an imaginary individual with a mutation for filial cannibalism or offspring abandonment, into a population of generic egg-laying animals," explains lead author Dr. Mackenzie Davenport, also of the University of Tennessee.

As in the group's previous models, the gene for cannibalism spread throughout the population if it gave parents extra calories.

But for the first time in this model, they found that when offspring mortality increases with egg laying density, both filial cannibalism and offspring abandonment result in increased fitness.

"Under these conditions, the mutants were able to outcompete and replace the generic population," reports Davenport.

This was the case even when cannibal parents were given little or no energy benefit from the extra food—or when abandoned offspring were assumed to die.

"Our findings suggest that surprisingly, filial cannibalism and offspring abandonment can function as forms of parental care, by increasing total offspring survival."

Live fast, die young, be prepared to abort

"The fitness benefit of offspring abandonment and filial cannibalism also increases as adult death rate increases, particularly for the case of filial cannibalism," adds co-author Prof. Michael Bonsall of the University of Oxford.

In other words: if you've got fewer shots at reproducing, you'll need to be ruthless in protecting your brood. But if offspring mortality is density dependent, why produce so many eggs in the first place?

"It is not always possible for parents to predict the environment that their offspring will end up in," explains Bonsall. "Factors like food availability , oxygen availability, diseases presence and predation, might change in an unpredictable manner. Likewise, in many fish and other animals females deposit their eggs in the nests or territories of males and leave, so cannot predict an optimal laying density given that additional females might subsequently add eggs to the nest."

"It's up to empiricists now to test these models in a variety of species," the authors conclude.

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