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Semelparity

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Synonyms

r strategy

Definition

A reproductive strategy characterized by a single reproductive episode over the course of a lifetime.

Introduction

The term *semelparity* refers to a reproductive strategy characterized by a single reproductive episode over the course of a lifetime and contrasts with *iteroparity* (see "▶ Iteroparity"). Semelparous species have only one reproductive episode in a lifetime; thus they invest all reproductive efforts into optimizing one reproductive episode (e.g., by having a single litter with several offspring; Ricklefs and Miller 1999), at the expense of losing future mating opportunities. This risk, however, pays off to some species. Previous research and theoretical models have shown that semelparous species have higher expected adult mortality; thus it is more optimal for semelparous species to invest all resources into a single reproductive episode (e.g., Young 1990). Nonetheless, both reproductive strategies are observed in plants and animals. Semelparity is uncommon in vertebrates – exceptions include a few fish (e.g., bony fish, Osteichthyes), lizards (e.g., Labord's chameleon, *Furcifer labordi*), amphibians (e.g., gladiator frog, *Hypsiboas rosenbergi*), and a few mammals (e.g., marsupials) (e.g., Braithwaite and Lee 1979). Among invertebrates, most cephalopods and some insects (e.g., butterflies, arachnids) present a semelparous reproductive strategy (e.g., Schneider and Lubin 1997; Fritz et al. 1982). Most annual plants reproduce a single time during their life span, thus are considered semelparous species (Young 1990).

The Evolution of Semelparity

The evolution of semelparity (and iteroparity) has been subject of several theoretical models. One set of models attempts to explain the differential evolution of semelparity by examining the trade-offs between reproductive effort involved in offspring produced and offspring forgone (for a review, see Roff 1993). According to the trade-off models, the reproductive effort of an organism occurs optimally when the benefits of offspring produced outweigh the costs of offspring forgone. That is, the greatest distance states the optimal reproductive strategy for a given species.

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Semelparous (vs. iteroparous) species usually have higher expected adult mortality (e.g., Schneider and Lubin 1997). Accordingly, for species with high forgone offspring rate (i.e., high mortality rates), the optimal reproductive strategy is to invest all reproductive efforts into a single reproductive episode in a lifetime.

In a classic paper, Cole (1954) proposed a demographic model for the evolution of semelparous and iteroparous reproductive strategies. Cole's model resulted in a semelparous species that has one litter of four and dies afterward having the same rate of population growth than a iteroparous species bearing annual litters of an average of three offspring. This suggested that an advantage of just one offspring would select for semelparity. Charnov and Schaffer (1973) then identified that sensible variances in adult and infantile mortality were responsible for costs of a semelparous reproductive strategy that were not accounted by Cole's model. These demographic models have been successful when tested with real-world systems. That is, according to these models, the risks involved in semelparity pay off to species in which the benefits of devoting reproductive efforts to a single reproductive episode outweigh the costs of losing future mating opportunities.

Semelparity and *K*-Selection

Semelparity should not to be confused with a *K*-selection strategy. The former regards to a reproductive strategy in which a single reproductive episode occurs in a lifetime (vs. multiple reproductive episodes; see "► Iteroparity"), and the latter refers to selected traits that cause a species to have fewer but higher-quality offspring (compared to a *r*-selection strategy; see Pianka 1970). For example, the North Atlantic right whale (*Eubalaena glacialis*) has limited offspring, costly gestation, and high parental investment (Knowlton et al. 1994). Despite the high costs of bearing an offspring, this particular type of whale can still produce more than one offspring in a lifetime. Therefore, it cannot be considered a semelparous species, even though it clearly follows a *K*-selection strategy.

Conclusion

Semelparous species incur in a single reproductive episode over the course of a lifetime (Cole 1954). Numerous semelparous species produce more than one offspring in a single litter (Young 1990). Optimal reproductive strategies differ between species within species, and the semelparity reproductive strategy played a key role in the evolution of several species' reproduction and parenting systems (Roff 1993).

Cross-References

- ► Iteroparity
- ► Reproductive Strategies

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