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Paternal care and brood reduction in a pipefish

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Abstract

From an evolutionary and adaptive perspective, the occurrence and extent of parental care in animals (investment in offspring beyond the genetic contribution) is expected to depend on an optimal (fitness-maximizing) balance of its costs and benefits. Males of the sex-role reversed broad-nosed pipefish, *Syngnathus typhle*, which care for eggs and embryos and may perform brood reduction, are particularly interesting in this respect. In this thesis, I explore paternal care in the broad-nosed pipefish with special focus on the causes and consequences of brood reduction.

Firstly, I demonstrate that brooding males absorb nutrients from reduced embryos in their brood pouch, presumably benefiting their own nutrition. This indicates that brood reduction in this species is similar to filial cannibalism (eating of own young), found in many other fish species with paternal care. Furthermore, as the embryos did not absorb nutrients originating from siblings in the same pouch, there is no support for 'nurse eggs' in this pipefish species (**paper I**).

When comparing brooding males with non-brooding males, brooding males were on average in better condition, as measured by hepatosomatic index (HSI). This is contrary to the expectation that the metabolic and other costs of brooding males should deplete their energy reserves. However, given the results above (**paper I**), the higher HSI in brooding males may to some extent stem from nutrients acquired through brood reduction (**paper V**). This uptake is, however, unlikely to fully compensate for the costs of paternal care since another experiment (**paper IV**) showed that males brooding full broods had lower survival, despite a larger relative brood reduction, compared to males with half-sized broods (**paper V**). Furthermore, the more eggs a male received, the more eggs were reduced, which supports the indication that the cost of brooding is related to brood size (**paper II** and **IV**). This clearly indicates that embryos are competing over paternal care and that paternal care is a costly and limiting resource.

Costs of paternal care in terms of reduced energy reserves (HSI) and lower survival (**paper IV**) suggests that males in poor condition (low HSI) should have a lower optimal brood size and thus show a larger relative brood reduction, as found in **paper III**. Also, males with low HSI received fewer eggs at mating and were more likely to suffer mortality from an infection (**paper III**).

When comparing monogynously and polygynously mated males, only monogynous males showed significant brood reduction, whereas polygynous males did not (**paper II**). This may be caused by either increased paternal provision or less competition due to less overlapping needs within half-sib than full-sib broods. Also, broods from larger females survived better than broods from smaller females (**paper III** and **V**). This may show that large eggs have certain qualities which allow them to survive better, or that males provide better care to eggs from larger females, reflecting the sexual conflict of embryo competition and cryptic male choice that may be operating in this species.

In summary, I have found that several factors influence the process of brood reduction (filial cannibalism) in the broad-nosed pipefish. These factors include the number of female mating partners, brood size, egg size and male condition. Consequently, these factors are important in parental conflicts and parent-offspring conflicts over the level of parental care and brood reduction.

Keywords: Parental care, brood reduction, embryo survival, parental condition, filial cannibalism, post-mating sexual selection, HSI, sexual conflicts, *Syngnathus typhle*, male brooding.