Parental provisioning in relation to offspring sex and sex ratio in the great tit (*Parus major*)

Stephanie P.M. Michler\(^1\), Maarten Bleeker, Marco van der Velde, Christiaan Both, Jan Komdeur & Joost M. Tinbergen

(Animal Ecology Group, Centre for Ecological and Evolutionary Studies (CEES), University of Groningen, Groningen, The Netherlands)

(Accepted: 14 June 2010)

Summary

Sex-biased parental care is expected if the offspring sexes differ in their energetic needs or if they differentially affect their parents’ reproductive success after independence. Furthermore, parents should adjust provisioning rate and prey size to the needs of individual nestlings and the entire brood. We investigated experimentally whether parental care in the great tit varied with individual offspring sex and brood sex ratio. We created broods of skewed sex ratio and monitored parental provisioning behaviour as number and size of prey items brought to individual young and broods. We found that male and female nestlings were fed at equal rates and with equally sized prey items independently of the brood sex ratio. The male share of provisioning did not change with offspring sex or sex ratio. However, parents brought significantly larger prey items to male biased broods with a small decline in provisioning rate such that the total amount of food brought did not change. Our findings suggest that parents did respond to manipulated brood sex ratio without distinguishing between the individual nestling sexes. Bringing larger prey items at slightly lower rates to male biased broods might reduce the cost of solicitation activities or satisfy increased needs in those broods.

Keywords: parental care, parental food allocation, *Parus major*, sex-biased provisioning, sex ratio manipulation.

Introduction

In order to maximise their fitness, parents should trade-off the costs of producing and raising a certain sex to independence against the potential fitness

\(^1\) Corresponding author’s e-mail address: s.p.m.michler@rug.nl or s.p.m.michler@gmail.com
benefits they can expect from investing in this offspring sex (Fisher, 1930; Trivers & Willard, 1973; Charnov, 1982; Frank, 1990). Several variables like laying date (Dijkstra et al., 1990; Daan et al., 1996; Laaksonen et al., 2004b), parental condition (Kölliker et al., 1999; Nager et al., 1999; Whittingham & Dunn, 2000), male attractiveness (Ellegren et al., 1996; Sheldon et al., 1999), territory quality (Komdeur, 1998), food availability (Appleby et al., 1997), pair bond duration (Green, 2002) or relative position in the laying sequence (Bednarz & Hayden, 1991; Badyaev et al., 2002) have already been described as potential factors affecting the relative fitness returns of male and female offspring in birds. Additionally, different energetic requirements of the two offspring sexes might cause differential parental investment in sons and daughters and, thus, be a reason for adaptive sex allocation (Fisher, 1930; Charnov, 1982).

In avian species where the young strongly depend on parental care, differential provisioning of food towards the two offspring sexes is one mode of sex allocation (Charnov, 1982). Furthermore, parents can adjust their provisioning behaviour to reduce negative consequences of competitive interactions among nestlings thereby minimizing nestling control over food allocation (Kölliker et al., 1998; Tanner et al., 2007). Indeed sex-biased parental care has been shown to occur in a range of bird species where either one or both parents preferentially provision one offspring sex (Stamps, 1990; Gowaty & Droge, 1991). Even in species with little or no sexual size dimorphism of nestlings we can expect differential parental provisioning of the offspring sexes as there is evidence that the sexes differ in their competitive abilities or physiological requirements (Boncoraglio et al., 2008; Nicolaus et al., 2009). Additionally, parents of the different sexes might have different optimal investment strategies towards sons and daughters which could lead to a conflict over parental care (Gowaty & Droge, 1991; Lessells, 2002).

Descriptive studies on parental provisioning in relation to offspring sex and sex ratio have so far provided mixed results. Several studies on pre-fledging parental care found an increased provisioning rate of either one or both parents to sons or male biased broods (Yasukawa et al., 1990; Westneat et al., 1995; Nishiumi et al., 1996; Westerdahl et al., 2000; Green, 2002; Magrath et al., 2004). Others found increased parental effort to daughters or female biased broods (Stamps et al., 1987; Gowaty & Droge, 1991) and yet others found no relation between offspring sex or brood sex ratio and parental provisioning behaviour (Leonard et al., 1994; Whittingham et al., 2003).