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Juvenile survival and benefits of play behaviour in brown bears, *Ursus arctos*

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ABSTRACT

The play of healthy, well-fed young mammals and birds includes varied and improvised behavioural routines and occurs in relatively stress-free contexts. Play behaviour has evolutionary costs but no apparent benefits. Play, therefore, poses a problem for evolutionary theory. Theory on play generally assumes future (adult) benefits, but benefits of animal play may be short term. In a 10-year field study, we measured play and survival in young of 11 families of individually identified, free-ranging brown bears, *Ursus arctos*. Our results are the first to relate play to survival. Cubs who played more during their first summer survived better from their first summer to the end of their second summer. To explain this apparent association, we applied statistical controls to three potential confounding factors: cub condition, prenatal and first-year salmon availability, and maternal characteristics. Controlling for these factors, we confirmed that survival increases as play increases, independently of these other possible effects. Play can have demonstrable and measurable evolutionary and population consequences if it increases short-term survival of immatures. Mechanisms linking play of bears or of other animals to short-term survival are not yet known. We speculate that play experience relieves past stress and builds resistance to future stress. We cite known neuroendocrinological mechanisms that may support this suggestion.

Keywords: Alaska, brown bear, play behaviour, survival, *Ursus arctos*.

INTRODUCTION

Play characterizes the behaviour of young mammals and birds (Fagen, 1981; Power, 2000). Frequent and complex play occurs in taxonomic orders whose members have large brains relative to body size (Iwaniuk *et al.*, 2001). Energy costs of play ultimately reduce future reproductive success (e.g. Sharpe *et al.*, 2002). Costly behaviour like play must have benefits (Sharpe *et al.*, 2002) or else involve fundamental constraints. Benefits of animal play, and therefore its evolutionary significance, remain unclear (Caro, 1988; Pellis and Iwaniuk, 1999). Long viewed as preparation for adulthood, play of immatures may in theory be

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