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DEALING WITH SEASONAL HABITATS: ENERGETIC CONSTRAINTS VS. COGNITIVE BUFFER EFFECTS ON BRAIN SIZE

J.T. van Woerden, C.P. van Schaik, K. Isler

Anthropological Institute and Museum, Univeristy of Zurich, Switzerland

Presenter's Email: j.vanwoerden@aim.uzh.ch

The degree of habitat seasonality affects various aspects of species-specific behaviour and physiology. Given the high energetic costs of brain tissue, we predict that, all other things being equal, a high degree of seasonality poses an energetic constraint on relative brain size. On the other hand, seasonal habitats may lead to an increase in brain size, if behavioral flexibility helps to deal with these periods of food scarcity, as is shown in birds. Primates are an ideal case to test these hypotheses, because they are relatively large-brained and rely on seasonally variable resources (fruits, insects or young leaves). Using phylogenetic comparative analyses and controlling for body mass and other possible confounding variables, we tested whether energetic constraints or cognitive buffer effects prevail in brain size evolution of primates. We found a strong and consistent negative relationship between relative brain size and the degree of seasonality in both habitat and diet in lemurs (N=19 sp.), but only a weak cognitive buffer effect: larger brained lemurs experience only slightly less variation in their dietary intake than would be expected given the seasonality of their habitat. In Asian cercopithecines (N=47 sp.) this cognitive buffer effect is much stronger, i.e. the relatively larger brained species show more behavioral flexibility. From this, we conclude that energetic constraints are more pronounced in a taxa group if a large percentage of body metabolism is needed to maintain brain function (as in lemurs), whereas a large absolute brain size may facilitate cognitive buffer effects (as in cercopithecines).

Keywords: food scarcity, brain size evolution, lemurs, Asian cercopithecines