

## Geographic covariation between metabolic rate and life-history traits

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### ABSTRACT

**Question:** Is there a clinal covariation between life-history traits and metabolic rate?

**Hypothesis:** Reproductive output will negatively covary with metabolic rate along an intraspecific latitudinal gradient.

**Methods:** In a common garden design we studied metabolic rate in five populations of the common terrestrial isopod, *Porcellio laevis*, over a range of 15° of latitude in Chile. We also measured life-history variables in the same populations.

**Conclusions:** Female body mass, female size at first reproduction, egg and juvenile size, and reproductive output were negatively correlated with mean annual air temperature and positively correlated with latitude. In contrast, metabolic rate and egg number were positively correlated with temperature and negatively correlated with latitude. Individuals inhabiting cooler climates (i.e. southern populations) tended to have lower metabolic rates. We found a significant, negative phenotypic correlation between metabolism and reproductive output for all studied populations, in a gradual and consistent direction along the latitudinal gradient.

**Keywords:** latitudinal variation, metabolism, physiology–life history covariation, reproductive output, trade-offs.

### INTRODUCTION

Geographically widespread species must cope with environmental differences among habitats. This ability can, in principle, be achieved by genetic differentiation and/or phenotypic flexibility (Blanckenhorn, 1997). Life-history traits are considered indirect measurements of fitness (Stearns, 1992). In both endotherms and ectotherms, intraspecific variations in life-history traits are pervasive along latitudinal clines (Mousseau and Roff, 1989; Negovetic and Jokela, 2001). Studies of the physiological basis of life-history trade-offs have been a central topic in evolutionary ecology (Townsend and Calow, 1981; Stearns, 1992; Roff, 2001; Zera and Harshman, 2001). Physiological variation in the life history of an individual can have profound implications for fitness (Ricklefs and Wikelski, 2002). Theoretically, the costs of maintenance may have important effects on the quantity of energy available for activity and reproduction (Calow,

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