



Hydro-social metabolism: Scaling of birth rates with regional water use

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Population growth is often intuitively linked with proportionally higher use of fresh water resources. However, this implies that water use per capita does not change with population growth. We not only find that birth rates of regions are negatively related with its water use per capita (i.e. higher birth rate is associated with lower water use), but also that birth rates scale with the latter with a negative power. We use population and water withdrawal data from 1950 to 2005 at irregular 5-year intervals; with virtual water content, virtual water trade and agricultural production data from 1960 to 2000 for the seven continents to investigate the scaling relationship and interpret it through the lens of metabolism theory. Our analysis reveals that the scaling exponent lies between $-1/3$ and $-1/2$. Deviations from the power relationship are observed for Europe and Africa, which are attributed to lower than expected and higher than expected birth rates, respectively. Europe's deviation from the average scaling relationship may be due to the higher rate of return on human capital in industrialized countries. But why Africa deviates, while other developing and developed regions follow the power relationship more closely, remains a puzzle.