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SHORT NOTE:

CLUTCH PARAMETERS IN A SWISS POPULATION OF *RANA TEMPORARIA*

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Egg numbers and egg sizes of anuran amphibians have frequently been shown to vary among individuals and populations, possibly having important demographic and life history consequences. Here I present data on egg numbers and egg sizes from a *Rana temporaria* population 21 km northeast of Berne, Switzerland (elevation 600 m).

During the 1985 breeding season, 16 amplexed pairs of frogs (representing the range of female body sizes) were taken from the breeding pond and each pair set into a plastic container to allow spawning. The volumes of the whole egg masses and of three

subsamples were measured for each pair and the latter preserved in 70% ethanol. The number of eggs in the subsamples were counted, and the total number of eggs per spawn mass was extrapolated from the average ratio of number of eggs to spawn mass volume in the subsamples. In two small egg masses, for which all eggs had been counted, the deviation from the actual number of eggs was less than 4%. From every egg mass the diameters of a sample of 15 preserved eggs were measured with a micrometer eye piece (to nearest 1/100 mm). Yolk volume of an egg mass was calculated as $n(4/3)(d/2)^3\pi$, n = number of eggs, d = mean diameter of eggs, assuming spherical shape of the yolk.

Females showed a positive relationship between body length and egg number or egg sizes (Fig. 1). Egg numbers per egg mass ranged from 726 to 1901 and average egg diameters varied from 1.83 to 2.38mm, each with an average range of $\pm 8.7\%$ (± 2 C.V.). The relationship of total volume of yolk produced per egg mass (y , cm^3) and body size (x , mm) was:

$$\log y = -6.01 + 3.59 \log x; n = 16, r = 0.94$$

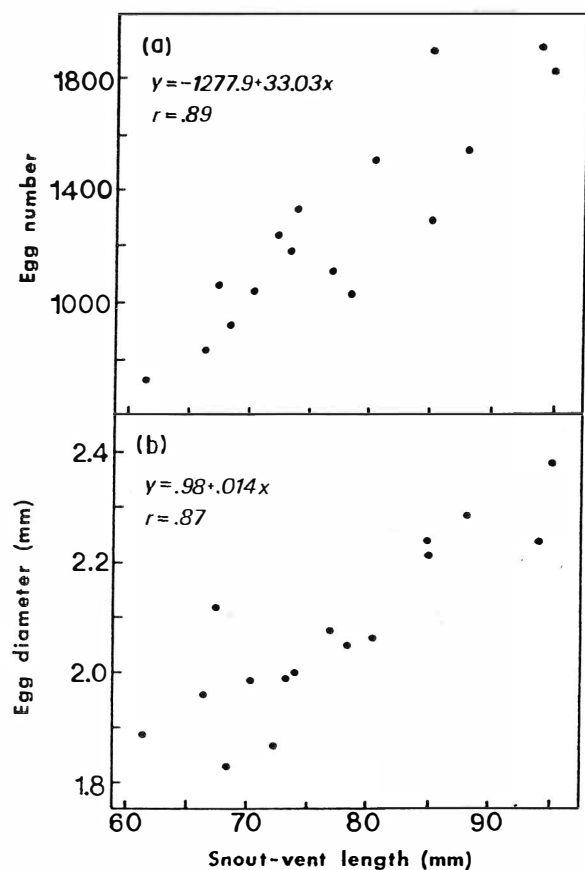


Fig. 1 Relationship between female body length and egg number per clutch (a) and mean egg diameter (b).

The largest female produced 12.75cm^3 of yolk, five times the amount produced by the smallest female (2.57cm^3).

Data on clutch parameters of *Rana temporaria* have been published before by Hönig (1966), Kozłowska (1971), Cooke (1975), Kminiak (1975), Koskela and Pasanen (1975), Jørgensen (1981), Hintermann (1984), Cummins (1986) and Gibbons and McCarthy (1986), but not all authors give the body length-egg number and -egg diameter relationships, making quantitative comparisons difficult.

Body length accounts for about 75-80% of individual variation in egg numbers and egg sizes. A high correlation is typical for egg numbers, but correlation is usually lower for egg diameters. Residual variation in clutch parameters may be explained by environmental differences, experienced by individual frogs (Kaplan, 1987). Additionally, age differences

may account for some of the variation in egg sizes (Gibbons and McCarthy, 1986). Comparison with other populations reveals considerable differences in both egg numbers and egg sizes that cannot be explained by body size differences. Frogs in an Irish population show a similar range of egg numbers and larger egg diameters (about 2.1-2.6mm), despite about 10mm smaller body sizes (Gibbons and McCarthy, 1986). English frogs can have close to 4,000 eggs despite smaller body sizes (Cummins, 1986), and Danish frogs produce eggs of only about 1.1-1.9mm despite similar body length (Jørgensen, 1981). These deviations may partially be due to environmentally induced year-specific variation (Cummins, 1986, Kaplan, 1987), or in the case of egg sizes, to methodological differences. But the considerable variation suggests that populations differ in their trade-off between egg numbers and egg sizes (Smith and Fretwell, 1974) or in total investment. Variation in clutch parameters therefore probably reflects different local selection pressures or environmental constraints, such as water temperatures, length of growing season, predation or competition.

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