Appendix S2. The Modified Royce Method (Juanicó 1978)

The MRM quantifies the overlapping of Gaussian distributions originated from linear regressions between paired morphometric measurements. The phenotypical similarity or divergence is estimated integrating the overlap area (Fig. 1 S2).

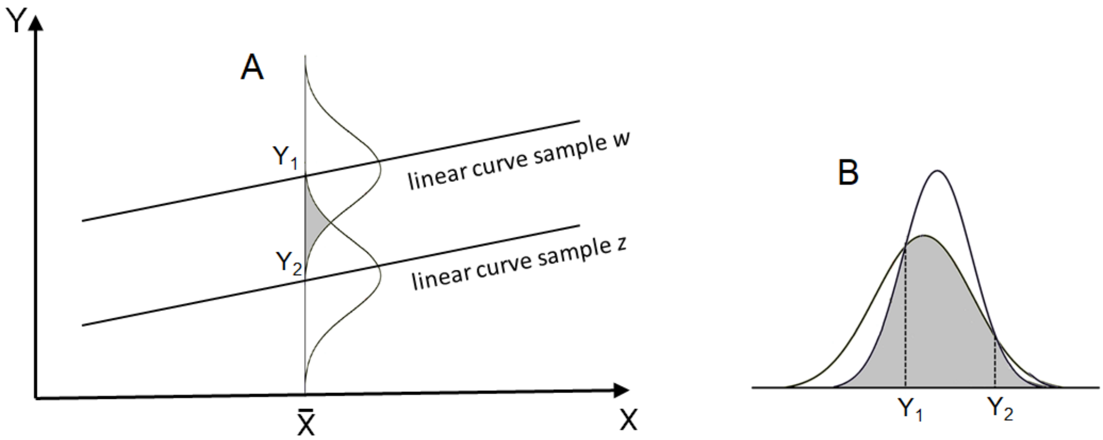

Fig. 1 S2. Overlap of two normal curves with equal (A) and unequal (B) variances. Y_1 and Y_2 are the intersection points between the curves. The shaded surface represents the overlapping area.

Taking two samples, *w* and *z*, of paired morphometric measurements, the two variables are transformed to reach linearity and homoscedasticity. Then, a linear regression is fitted using the last squares method. For this study, linear regressions fitted were: $\ln(\sqrt{\mathrm{FL}}) \sim \ln(\mathrm{ML})$, $\ln(\mathrm{FW}) \sim \ln(\mathrm{ML})$, $\ln(\sqrt{\mathrm{RW}}) \sim \ln(\mathrm{ML})$, $\ln(\sqrt{\mathrm{LBRL}}) \sim \ln(\mathrm{ML})$, $\sqrt{\mathrm{GL}} \sim \mathrm{ML}$ (females only), $\ln(\mathrm{GL}) \sim \ln(\mathrm{ML})$ (males only), $\sqrt{\mathrm{GW}} \sim \mathrm{ML}$ (females only) and $\ln(\mathrm{GW}) \sim \ln(\mathrm{ML})$ (males only).

To avoid inherent biases introduced by the least squares method and variability of the measurements (Johntson 1977), all regressions were fitted within intervals of the same size. These were 43–80 mm ML (females) and 47–93 mm ML (males) for *Doryteuthis sanpaulensis* and 61–145 mm ML (females) and 56–176 mm ML (males) for *D. pleii*.

Bearing in mind the above, the following steps were followed:

1. If $s_w^2 = s_z^2$, the normal deviation curves for a given X value only intercepts to a single Y value. To Y_w and Y_z calculated for a given X from the linear regression, we have:

$$Y_1 = \frac{\hat{Y}_w + \hat{Y}_z}{2} \tag{1}$$

then the superposition (S) (i.e. overlap between the two normal curves) can be resolved by:

$$S = \int_{-\infty}^{Y_1} N_w(Y) \cdot dY \tag{2}$$

where N is the Gaussian function (note that in this case, the method is identical to Royce's method when $s_w^2 = s_z^2$ and $n_w = n_z$).

2. If $s_w^2 \neq s_z^2$, then there are two intercepts: $Y_1$and Y_2. For $s_w^2 > s_z^2$ and $Y_1 < Y_2$, S can be calculated as:

$$S = \int_{-\infty}^{Y_1} N_z(Y) \cdot dY + \int_{Y_1}^{Y_2} N_w(Y) \cdot dY + \int_{Y_2}^{+\infty} N_w(Y) \cdot dY \quad (3)$$

for which Y_1 and Y_2 are necessarily known. For Y_1 and $Y_{2,}$ it follows that:

$$N_w(Y) = N_z(Y) \;\therefore\; N_w(Y) - N_z(Y) = 0 \quad (4)$$

This can be solved by a simple 2nd degree equation: $aY^2 + bY + c = 0$, for which the roots are $Y_1$and Y_2. Each coefficient can be estimated as:

$$a = \frac{s_w^2 - s_z^2}{s_w^2 \cdot s_z^2} \quad (5)$$

$$b = 2\left(\frac{\hat{Y}_w \cdot s_z^2 - \hat{Y}_z \cdot s_w^2}{s_w^2 \cdot s_z^2}\right) \quad (6)$$

$$c = \frac{s_w^2 \cdot \hat{Y}_z^2 - s_z^2 \cdot \hat{Y}_w^2}{s_w^2 \cdot s_z^2} - 2\left(\ln \frac{1}{s_z \cdot \sqrt{2\pi}} - \ln \frac{1}{s_w \cdot \sqrt{2\pi}}\right) \quad (7)$$

This procedure allows for correct estimations of superposition for a given X and any value of s_w^2 and s_z^2.