Biases in estimates of penguin response when there is perfect correlation between local pelagic biomass and global pelagic biomass estimates.

By

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Equations in MARAM/IWS/DEC14/Peng/A10add relate standardized regression weights to parameters about the true relationships between penguin response (P), local pelagic biomass (B), measured local pelagic abundance (MB) and local pelagic catch (C). The panel asked that results for $\boldsymbol{r^{A}_{B,MB} = 1}$ be reported. **For δ = 0 and $\boldsymbol{r^{A}_{B,MB} = 1}$ there is no bias in the estimates of $\boldsymbol{\beta^{A}_{B,P}}$ and $\boldsymbol{\beta^{A}_{C,P}}$.** This follows from the equations in MARAM / IWS / DEC14 / Peng / A10add. The situation δ = 0 is when the correlation between C and MB is equal to the product of $\boldsymbol{r^{A}_{B,MB}}$ and $\boldsymbol{r^{A}_{C,B}}$. Otherwise the value δ specifies the degree of departure from this spurious correlation. The general result for δ not equal to 0 and $\boldsymbol{r^{A}_{B,MB} = 1}$ is:

$$\widehat{\boldsymbol{\beta}}^{B}_{B,P} = \frac{\boldsymbol{\beta^{A}_{B,P} - \beta^{A}_{B,P} r^{A}_{B,C}(r^{A}_{B,C} + \delta)}}{\boldsymbol{1 - (r^{A}_{B,C} + \delta)^2}}$$

$$\widehat{\boldsymbol{\beta}}^{B}_{C,P} = \frac{\boldsymbol{\beta^{A}_{C,P} + \beta^{A}_{B,P} r^{A}_{B,C} - \left(r^{A}_{B,C} + \delta\right)\left(\beta^{A}_{B,P} + \beta^{A}_{C,P}(r^{A}_{B,C} + \delta)\right)}}{\boldsymbol{1 - (r^{A}_{B,C} r^{A}_{B,MB} + \delta)^2}}$$

The behavior of the estimators $\widehat{\boldsymbol{\beta}}^{B}_{B,P}$ and $\widehat{\boldsymbol{\beta}}^{B}_{C,P}$ can be explored for selected values of $\boldsymbol{r^{A}_{B,C}}$, $\boldsymbol{\beta^{A}_{B,P}}$, δ and $\boldsymbol{\beta^{A}_{C,P}}$.

Table A1 modified. The estimates of $\widehat{\boldsymbol{\beta}}^{B}_{B,P}$ and $\widehat{\boldsymbol{\beta}}^{B}_{C,P}$, for $\boldsymbol{\beta^{A}_{C,P} = 0}$, and for some selected values of $\boldsymbol{r^{A}_{B,C}}$, $\boldsymbol{\beta^{A}_{B,P}}$, δ, subject to $\boldsymbol{r^{A}_{B,MB} = 1}$.

			δ = 0		δ = 0.15		δ = -0.15	
$r^{A}_{B,C}$	$\beta^{A}_{B,P}$	$\beta^{A}_{C,P}$	$\widehat{\beta}^{B}_{B,P}$	$\widehat{\beta}^{B}_{C,P}$	$\widehat{\beta}^{B}_{B,P}$	$\widehat{\beta}^{B}_{C,P}$	$\widehat{\beta}^{B}_{B,P}$	$\widehat{\beta}^{B}_{C,P}$
0.300	0.800	0.00	0.800	0.00	0.868	-0.150	0.782	0.123
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0.300	0.800	0.00	0.800	0.00	0.868	-0.150	0.782	0.123
0.200	0.800	0.00	0.800	0.00	0.848	-0.137	0.794	0.120
0.500	0.800	0.00	0.800	0.00	0.935	-0.208	0.752	0.137

(Note: β is the standardized regression weight. The unstandardized regression weight between x and y is equal to the β multiplied by the standard deviation of y divided by the standard deviation of x)