Body mass changes in Brünnich's guillemots Uria lomvia with age and breeding stage

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 $\mathbf n$, both for including and birds (maximum birds (maximum) and birds (maximum) and birds (maximum) and birds (maximum) $2 \times 1 \quad \text{and} \quad 1 \quad \text{and} \quad 2 \times 1 \quad \text{and}$ ating a set of $\frac{2}{\pi}$ values of $\frac{2}{\pi}$ values of 0.10 for $\frac{2}{\pi}$ incubating η for those bilang chicks. The η for η for those brooding η for those brooding chicks. **bill depth alone gave** $\frac{2}{1}$ **values of** $\frac{1}{2}$ **values o** Only bill depth was found to be significantly correlated **1** ($_{1,23}$ = 5. 4, = $\overline{1} = 0.016$), $\overline{1}$ $\overline{1}$ $\overline{1}$ evident to \mathbf{u} yr old. Considering the relatively small smal amount of mass variation explained by linear measure $m = 5$ ments, the fact that only depth was affected by a fact that σ $, 7.7$ p reducing p reducing p sample size, we decide to use, we decide to use, we decide to use, we decide to use, p raw body mass as our dependent variable in subsequent analyses, rather than applying any body size correction. Seasonal trends We examined trends in mass on date for incubating and brooding birds separately for all years. Mass tended to increase during in all $\frac{1}{4}$, $\frac{1}{4}$ $\mathbf{1}$ the trends $\mathbf{1}$ the trends $\mathbf{1}$ (Table 2). The $\mathbf{1}$ $m = n$ and $m = 7/10$ years. In the chickrearing period, mass decreased with date in all years $\frac{1}{2}$, $m = 10/14$ years. Given the similar in the similar in $m = 10$ $\mathbf{u} = \mathbf{u}$, we felt $\mathbf{u} = \mathbf{u}$ across years for further analyses. Combining data for all years when trapping was \lnot (1, 1, 0-2, 14 – $)$, 1 η mass of c. 1000 q $\frac{1}{100}$ $\frac{1}{22}$ $\frac{1}{100}$, date of $n \cdot n$ at $n = 1025$ g and $n \cdot n$ at $n \cdot n$ 25 ($^{2} = 0.024$, $^{1} = 1$, $^{5} =$ $1, 5 = 21.7$ ≤ 0.001 , $\qquad \qquad$ 1). A point of best fit to the $\sqrt{25}$ similar to that of incubating birds, declining to c. 950 g $\begin{pmatrix} 1 & 2 \end{pmatrix}$. Both terms (decreed).) contributed significantly to explaining the variation in $\frac{2}{-0.050}$, $\frac{2}{2}$, $\frac{25}{-27.1}$, $\frac{15}{-22}$ ($\frac{415.7}{-415.7}$

Daption capense, \blacksquare 1, \blacksquare **1** Puffinus tenuirostris, L₁ 1984. Leap Storm-petrel oceanodroma leucorhoa, \blacksquare et al. 2000, black-legged kitstima Rissa tridactyla, $L_{\rm 1}$ 1 \cdot 2001, 2002, common tern Sterna hirundo, Wendeln and Becker 16, Architectura paradisaea, Monaghan et al. 1, $\overline{9}$ Aethia pusilla, $\overline{1}$, $\overline{1}$, $\overline{4}$, $\overline{1}$ $\overline{1}$ eg Uria aalge, 2000). **A** change in the interval. 2000). mass for Coats Island Brunnich's guillemots at about the time of hatching has been described previously (Croll $\frac{1}{2}$ 1, $\frac{1}{2}$ 1, $\frac{1}{2}$ 1, $\frac{3}{2}$. \mathbf{m} results for \mathbf{m} \mathbf{m} at \mathbf{m} suggests that, at \mathbf{m} $\mathbf{r} = \mathbf{r} + \mathbf{r}$, there is an underlying mass trajectory that $\mathbf{r} = \mathbf{r} + \mathbf{r}$ $\mathbf{r} = \mathbf{r} + \mathbf$ accumulation and/or maintenance of reserves during incubation that are then invested in chick-rearing. Younger, less experienced breeders begin incubation at a lighter mass and accumulate lower reserves by hatching. Hence, even if they are capable of the \mathcal{A} efficiently as older birds, they are likely to rear lighter chicks. The fact that all age classes reach a similar mass \mathbf{u} the chick-rear intervals the body period suggests the body \mathbf{u} $\mathbf{m} = \mathbf{m} = \mathbf{m} = \mathbf{0}$ g, and $\mathbf{m} = \mathbf{0}$ are about 18 d old, represents the most effective \mathbf{r} compromise between the adult and the adu of the chick. This mass is presumably specific to the particular environment of the Coats Island colony and is not necessarily uniform across the species range. $A = \frac{1}{2}$ and $A = \frac{1}{2}$ age on $B = \frac{1}{2}$ chicks. Consequently, mass loss after hatching was

 \mathbf{D} of \mathbf{M} in the mass of brooding adults of brooding adults of brooding adults of brooding adults adults of brooding adults of \mathbf{M} declined. A similar convergence of mass between heavy and light individuals during the chick reason of the chick rearing period was a structure. The chick rearing p τ (1) τ L **1**' -1 -1 $($ -1 $.2000)$. $\mathbf{S} = \mathbf{S} + \mathbf$ the youngest birds put on mass, nor mass-loss during chick-rearing, when older birds lose mass, can be used as an indicator of stress unless controlled for age. $I = I$ is the cause of age-relation of age-relations variation of age-relations η during incubation, the fact that older, more experienced birds lost more more more more more more more in the early structure in the early structure in the early structure part of the chick rearing period and lost more mass in years when mean mass during incubation was higher, suggests that heavy birds deliberately reduced their mass. They may have done so either by reducing their rate of for \mathbf{f} and \mathbf{f} and \mathbf{f} (i.e. 'programmed anorexia', Gaston and Jones 1989, Jones $1, 4$ captured to the total chicks. A correlation between chicks. A correlation between chicks. A correlation betwee growth rates and parental age has been observed $1\quad 3,$ and \overline{u} and 2002) and suggests that 2002 their chicks with more food than young birds. Chicks with the second than young birds. Chicks with the second $\mathbf{1}$ d $\mathbf{1}$ d significantly greater chance than others of surviving to $\mathbf t$ age of colony return $\mathbf t$ τ .). Brunnich's guillemots increase their flying during \mathbf{M} include \mathbf{M} include \mathbf{M} include \mathbf{M} include \mathbf{M} include \mathbf{M} $.1 \quad 1$). body mass for their wing area, murres may benefit from shedding mass by improving their load-carrying capacity $($ 1991, -1 , included the overall et al. (1991) and the overall ethal et al. (1991) and th change in mass that we found between incubation and (47) earlier study. Croll et al. $(1\ 1)$ end that the mass $\mathbf{1}\mathbf{1}$ change between incubation and chick-rearing would save $5 - 10\%$ $\mathbf{u} \cdot \mathbf{v} = \mathbf{v} \cdot \mathbf{v}$ their chick, older Brunnich, older Brunnich, older Brunnich, older Brunnich, sein their fitness by rearing that have a higher chicks that heavier chicks that have a higher chicks that have a h chance of survival after leaving the colony while at the same time increasing their flight efficiency. Both factors may be involved in the mass loss that occurs about the η of η if η is In the context of Brunnich's Guillemots, assigning mass changes to intrinsic or extrinsic processes seems a sterile exercise. It may be necessary to abandon the paradigm of 'constraint vs adaptation'. Strategic mass adjustments will be apparent only where environmental conditions allow at least part of the breeding population $(2(-356.7(\textbf{t}))+2(-2(-35))1(6.04.3))$ 04)-337(d)0(aenstrainum 1.42o2(-35d)(c7ex)20.26endec.8(36dec.935) \mathbf{F} , P. R. R. E. R

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