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COMMENTS & REPLIES

In defence of the slim dodo: a reply to Louchart and Mourer-Chauviré

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Louchart and Mourer-Chauviré (2011) question our method of estimating the mean mass of the dodo by claiming that tibiotarsus and tarsometatarsus lengths cannot be used for such mass estimates "because different bird species of the same weight can show considerable differences in the lengths of these two bones". This is indeed obvious from the graphs published by Zeffer et al. (2003), which we have used in our paper, but those graphs also show differences in femur length for the same body mass which are not negligible, contrary to what Louchart and Mourer-Chauviré seem to imply. We do not agree that femur length "hardly participates in leg length", for the simple reason that the femur is a segment of the leg, whatever its position relative to the body, and takes part in locomotion (even though it does not move much, as pointed out by Campbell and Marcus 1992). Although Louchart and Mourer-Chauviré consider that the coefficient correlation squares (R^2) for tibiotarsi and tarsometatarsi are too low to be significant, it should be noted that the R^2 for tibiotarsi (0.85) and total limb length (0.85) are very close to that for femora (0.89), which is considered as reliable by Louchart and Mourer-Chauviré, and that even the comparatively low R^2 for tarsometatarsi (0.66) is still significant from a statistical point of view. As to the averaging of estimates, which is considered as flawed by Louchart and Mourer-Chauviré because "it incorporates twice the unreliable estimates from tibiotarsus and metatarsus lengths", it also incorporates twice the estimates from femur length, which the same authors consider reliable, so that this criticism loses much of its weight.

Louchart and Mourer-Chauviré are right when they note that the length measurement we used for a left femur from the Lyon Museum is anomalously low. Indeed, after our paper was published, the person who provided this measurement notified us that it was wrong, the correct length being 155 mm, not 125 mm. The aberrant dot indicating a mass of 8.7 kg on our Fig. 2 should therefore be deleted. However, because we used a sufficiently large number of measurements, the overall effect of this correction is very limited, since we now obtain a mean mass based on femur length of 15.6 (instead of 15.4). The final mean mass combining all estimates is now 10.5 kg and therefore not significantly different from our initial result.

Louchart and Mourer-Chauviré consider that the method put forward by Campbell and Marcus (1992), based on the least circumference of the shaft of the femur and tibiotarsus, is the most reliable approach to estimate the mass of a bird from its skeleton. On the basis of a very small sample (three femora about which no details are provided), Campbell and Marcus obtained a mass of 13.3–16.4 kg. These figures

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were obtained using the “all birds” equation. Using the same method, again on a very small sample (three femora), Louchart and Mourer-Chauviré obtain a lower mass (11.3–15.4 kg) from the “all birds” equation. Moreover, when they use the “HB” equation, which applies to heavy-bodied terrestrial birds, including Columbidae (Campbell and Marcus 1992)–and therefore, is exactly what should be applied to the dodo–they obtain a mass of 9.2–12.3 kg, with a resulting mean of 10.75 kg. This is very close to our own estimate and confirms rather than invalidates our results.

How the final estimate of 9.5–18 kg proposed by Louchart and Mourer-Chauviré is obtained is unclear to us, unless they combine results obtained from different unrelated methods. As they remark, this interval is rather wide and would imply considerable individual variation or an important sexual dimorphism. Contrary to Livezey’s conclusions (Livezey 1993), our data do not suggest either; the numerous limb bone measurements we have obtained rather indicate a certain uniformity in size (see Angst et al. 2011, electronic supplementary material). We think that the reluctance to accept relatively low mass estimates for the dodo partly stems from an excessive reliance on old depictions of *Raphus cucullatus* as an exceedingly fat bird. The ideas of a strong sexual dimorphism and seasonal fat gain both seem to originate with Oudemans (1917), who proposed these hypotheses to account for discrepancies between seventeenth century images of the dodo (as illustrated in Fig. 3 of Angst et al. 2011). However, as already pointed out by various authors, notably Hume (2006), pictorial depictions of very fat dodos are not as reliable as those showing a slimmer bird. Various explanations have been put forward to explain why the dodo was depicted as a bloated bird, including the hypothesis according to which such images were based on captive, overfed individuals (Kitchener 1993). Although eyewitnesses have left very little information about dodo behaviour, an additional possible explanation, as mentioned by Angst et al. (2011), is that the dodos thus represented exhibited a display behaviour in which the feathers were puffed out, the crop inflated and the head thrown back. This kind of display is widespread among Columbiformes, both in courtship and, in some species only, in aggression contexts (Baptista et al. 1997). Looking more impressive, dodos in such a condition would have provided especially attractive models for artists, who, in addition, certainly exaggerated the bizarre features of *R. cucullatus*. From this point of view, too, we think that our mass estimate for the dodo is more realistic than those which show it as a very heavy bird.

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