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# From Food to Grave Good

## A Reply to Nijman

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Nijman (2021, in this issue) questions the conclusions of our recent paper on nonhuman primate hunting in early to mid-Holocene East Java (Ingicco et al. 2020) on four grounds: (1) there is no evidence that langurs (*Trachypitecus auratus*) carried greater ideological importance than macaques (*Macaca fascicularis*), (2) there are no data to support the selection of langurs over macaques, (3) the higher proportion of males than females is expected from hunting with projectiles, and (4) the higher proportion of juveniles than adults is expected when one economizes one's effort. Here we address these assertions.

Nijman considers that there are no data from Song Terus and Braholo Cave that suggest the greater ideological importance and therefore selection of langurs over macaques by people who inhabited the sites. First, we would point out that macaques were recorded in the faunal assemblages from Braholo Cave and Song Terus, although in much lower proportions than langurs. The ideological value of langurs over macaques is clear in the *Homo sapiens* burial offerings, in which the former species is an important part while the latter remains absent. This contradicts Nijman's first statement and directly tackles the question of the specific targeting of one species over the other.

Regarding the specific targeting of langurs over macaques in the wild as part of a subsistence strategy, Nijman refers to the Dieng Mountains forest, where langurs are more abundant than macaques nowadays. We indeed cannot reject the possibility that prehistoric groups used to hunt in forests comparable to the

Dieng Mountains forest. Yet, while formulating this hypothesis, Nijman makes two inferences we would like to comment on.

First, he considers that the prehistoric groups hunted and foraged in a single forest type or environment. Yet we (Amano et al. 2016a) showed that the communities that inhabited Braholo Cave and Song Terus exploited different types of environments, from grasslands to forests, including seasonal and dipterocarp forests. The hunter-gatherer groups that inhabited Braholo Cave during the early to mid-Holocene hunted cervids and bovids in forest edges and grasslands (Amano et al. 2016b). In the case of Song Terus, mangrove mollusk species were identified in the same archaeological layers that yielded the monkey remains.

Second, Nijman considers that what is true for the Dieng Mountains forest today would have also been true during the onset of the Holocene. Yet the Dieng Mountains forest is known to have been disturbed by anthropogenic activities (Lavigne and Gunnell 2006), either through deforestation, which dates back to 1500 BP on the Dieng Plateau (Sémah et al. 1992), or through reforestation with exogenous species (Marliana 2013). Marliana and Rühle (2014), for instance, showed that there is a lower diversity of plant species in the secondary forest of the Dieng Mountains compared with other places. The impact of these changes to faunal communities in the long run or over the whole Holocene (Sémah et al. 1992) is unknown. Therefore, one could question the use of the Dieng Mountains forest as an example for interpreting Holocene Javanese environments dating back to the pre-Neolithic period.

Nijman further adds that males and adults were more abundant since the hunter-gatherers who inhabited Song Terus preferentially targeted the caller of the group, which is always an adult male, and that therefore there are no reasons to consider that traps were used to capture monkeys. Nijman provides statistics on sex and age ratios in support of his argument. In his table, Nijman (2021) reports a total of 115 adult females to the 30 adult males he observed in the wild. Yet in his statistical test, Nijman uses 115 females to 34 males. We therefore tried to reproduce his test with these values in R statistical software, as follows:

```
library(DescTools)
Sex_ratio <- as.table(rbind(c(31, 69), c(34,115)))
dimnames(Sex_ratio) <- list(Study=c("Killed", "Present"),
  Gender=c("Male", "Female"))
DescTools::GTest(Sex_ratio, correct = "none")
```

We could not reproduce Nijman's statistical test results ( $G = 2.0556$ ,  $\chi^2$  df = 1,  $P = .151$ ;  $G = 2.0376$ ,  $\chi^2$  df = 1,  $P = .1535$

with Williams correction and  $G = 1.6584$ ,  $\chi^2$  df = 1,  $P = .1978$  with Yates correction). The same test using Nijman's table values (30 males to 115 females) also failed to reproduce his results ( $G = 3.3269$ ,  $\chi^2$  df = 1,  $P = .06816$ ). The difference in sex ratio between Song Terus, where females account for 68.4% of the population, and wild groups, where females account for 79% of the population, is therefore not statistically significant. We hence maintain what we wrote in our paper, with the exception of the reference that we made to a publication by Nijman from 2000, which was wrong, as he rightfully pointed out.

We suggested that communities that inhabited Song Terus could have used traps, resulting in the absence of any significant deliberate targeting of individuals based on sex. However, contrary to Nijman's assertion, we did not exclude the use of any projectiles. We actually concluded as such in our paper: "These folivorous monkeys were presumably hunted or, less likely, captured using traps" (Ingicco et al. 2020:275). The reference to traps was made mostly with the intention of not excluding any hypotheses a priori.

Nijman considers males easier targets because, as callers, they are the first ones in the group to be seen. This is an interesting hypothesis that cannot be ruled out. One should nevertheless keep in mind that this would mean that hunters mostly succeeded in killing only one individual for every langur group they encountered. Ethnographic accounts (Chan 2007:104–105) report that this is actually rarely the case.

Finally, Nijman comments on age ratio with the same rationale that he uses for sex ratio. While here, unlike for the sex ratio, the values used by Nijman in his statistical tests for the present-day populations are in agreement with the table he provides, the data used for the archaeological assemblages are at odds. For the prehistoric targeted populations, Nijman reproduces the same values he used for the sex ratio test: 31 adults to 69 juveniles (con. 31 males to 69 females). What is considered here, Braholo Cave, Song Terus, or the two sites at once? Ei-

ther way, there are no such values in our data. His statistical test could, therefore, not be reasonably reproduced.

In conclusion, we maintain that langurs were ideologically more important for the Gunung Sewu hunter-gatherers during the early Holocene and that this species was certainly deliberately targeted over macaques or surilis. The sex ratio at Song Terus is not statistically different from what is found presently in the wild, and this could point to the potential use of traps, although the use of projectiles is a more likely hypothesis.

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