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Extinct and extant DNA of New Zealand Black Swans*

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Response to Rawlence et al. (2017): Native or not? Extinct and extant DNA of New Zealand Black Swans

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Recently, several research groups have published insights into the evolutionary history of black swans, especially the history of these species in New Zealand. These studies use different evidence bases, address different questions, and provide different perspectives on possible histories. Here, in response to Rawlence et al., we reiterate the aspects of our study and its findings. We conclude that all recent contributions have been valuable, and are not necessarily mutually exclusive in regard to their interpretation.

Our paper on New Zealand extant black swans (*Cygnus atratus*; Montano et al., 2017) suggests that individuals of the species were still present on the island before the human-driven reintroduction that was documented to occur in the 19th century. As we point out the limitations of our inferential analysis, we highlight the multiple evolutionary scenarios that can lead to the signatures of an old coalescent time among extant *C. atratus* lineages in NZ. Remaining individuals of the species that migrated from Australia previously to the human reintroduction could have admixed with newly introduced individuals which would be detected as an old coalescent time for the current population.

Our study does not indicate a specific time for the potential spontaneous immigration events from Australia to NZ as this information is not recoverable in our analyses. Most importantly, we simply address the admixture of populations of the same species and never call into question the extinct species of *C. sumnerensis*. Assessment

of hybridization between *C. sumnerensis* and *C. atratus* is beyond the scope of our paper, and it is not addressable without adding genetic samples of *C. sumnerensis* to our analysis.

In reply to Rawlence et al., the findings of Rawlence et al., 2017 are not in contrast to ours as the two studies do not address the same question (i.e., extinction of *C. sumnerensis* from the current NZ black swans genetic pool and the potential population admixture of *C. atratus* between introduced individuals and local individuals already living in NZ, respectively). Rawlence et al., 2017 indeed report that fossils of NZ black swans after Maori colonization belong to *C. atratus*, the species that we consider in our paper, and they also suggest that spontaneous migration of *C. atratus* occurred from Australia to NZ previous to human-driven reintroduction. All these aspects support the hypothesis suggested by our paper about a population admixture of *C. atratus* between local and introduced individuals of black swans in NZ. Therefore, the status of current NZ *C. atratus* could fit the definition of *xenonative* or *restored native* defined in Crees & Turvey, 2015, depending on the results that will be achieved with further genetic investigation.

In conclusion, besides specific limitations of our statistical analysis that are explicitly noted in our study, we recommend further investigation on the genetic origin of current NZ *C. atratus* populations as this aspect of our research is not conclusive but cannot be addressed by the analysis of ancient *C. sumnerensis* DNA.

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