

# Temporal dynamics of nutritional stress and diet of rhinoceros auklets breeding on two distant colonies in Japan

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Oceanographic changes are known to affect the food availability and reproductive success of piscivorous seabirds. In the northwestern Pacific, breeding rhinoceros auklets (*Cerorhinca monocerata*) have been relying on the Japanese Anchovy as a primary food source for the last two decades, but the stock of anchovies has declined in recent years. To understand the effect of anchovy shortages on nutritional stress levels of rhinoceros auklets, we measured corticosterone (CORT) concentrations in blood plasma samples of birds breeding on Teuri Island (northern Japan Sea) in 2015-2019 and Daikoku Island (western Pacific coast) in 2015-2017. We also sampled food loads brought by adults to feed their chicks. Food loads and CORT levels were compared with the same datasets collected at three colonies in the northeastern Pacific. We found that plasma CORT levels were elevated under poor food conditions compared to those in rhinoceros auklets breeding under favorable foraging conditions. This indicates that birds breeding on Teuri and Daikoku colonies were negatively affected by the decline in anchovies. CORT concentrations were also highest on both colonies in 2016, which was associated with the lower average mass of food loads delivered by parents compared to other years. The species composition of food loads, however, differed between the two locations, and did not correlate with nutritional stress. During the study period no single species appears to have replaced anchovy as the preferred prey. We suggest that these consistent patterns in inter-annual changes in the birds' food load mass and nutritional stress between two distant colonies may reflect a recent large-scale ecosystem change in the northwestern Pacific. This ecological change might negatively affect the regional population of rhinoceros auklets.