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Laterality and temperature effects in flamingo resting behaviour

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Abstract

A webcam and online weather data were employed to study laterality and temperature effects in resting Caribbean flamingos (*Phoenicopterus ruber*) on display at Chester Zoo (Chester, UK). Consistent with previous research, a significant population-level preference for rightward neck-resting was observed, no evidence for lateral support leg preferences during unipedal resting was obtained, and a relationship between temperature and unipedal resting was found, such that on cooler days more birds were seen resting on one leg. These results offer support for the generality of the lateral preference toward rightward neck-resting in Caribbean flamingos, as well as the role of unipedal resting in thermoregulation.

Introduction

Side preferences in brain and behaviour (i.e., laterality) have been observed in a wide variety of animals (Rogers, Vallortigara, & Andrew, 2013) including Caribbean flamingos (*Phoenicopterus ruber*) (e.g., Anderson et al., 2009) and lesser flamingos (*Phoeniconaias minor*) (Anderson, 2009) (but not Chilean flamingos [Anderson & Laughlin, 2014]). Indeed, research has suggested that individual resting flamingos can possess consistent lateral preferences for curving their neck to either their right or their left when laying their heads on their back (i.e., an individual-level lateral preference), and that when groups are tracked over time one may possibly note a greater preference for rightward neck-resting among most flamingos (i.e., a population-level lateral preference) (e.g., Anderson et al., 2009; but see Hughes et al. [2014] who failed to obtain such a result). As the majority of evidence for flamingo lateral neck-resting preferences has come from Caribbean flamingos held at the Philadelphia Zoo (for review see Anderson, 2017), the present study sought to examine such preferences in a different captive population via an online webcam in order to examine the generalizability of this behavioural phenomenon.

In addition to lateral neck-resting preferences, efforts have been made to obtain evidence of lateral support leg preferences during unipedal resting in Caribbean flamingos (e.g., Anderson & Williams, 2010), but convincing evidence of such preferences has not been as readily obtained (for review see Anderson, 2017). Overexposure of one leg to the harsh conditions characteristic of their wading lifestyles and a need for thermoregulation have been cited as potential reasons for the observed lack of lateral preferences in preferred support leg during unipedal resting (Anderson & Williams, 2010). Indeed, studies have suggested a relationship between flamingo unipedal resting and temperature, with a greater percentage of resting flamingos being seen on one leg in cooler temperatures (e.g., Anderson & Williams, 2010), and flamingos

resting on one leg for longer periods of time when it is cooler (Bouchard & Anderson, 2011).

The present study sought to examine the lateral neck-resting and unipedal resting support leg preferences of the Caribbean flamingos on display at Chester Zoo (Chester, UK) via an online webcam. Moreover, local temperature measures were obtained via an internet resource in hopes of examining the relationship between unipedal resting and temperature. This was done in an effort to replicate these previous effects and further establish their generalizability.

Methodology

Immediately prior to beginning each flamingo observation, observers directed their internet browsers to www.weather.com. On this website observers searched for and recorded the current temperature (°C) from Chester, UK.

Twenty once-daily observations of the Caribbean flamingos at the Chester Zoo (Chester, UK) were made between 10 September and 24 October 2012, between the hours of 7:06 a.m. EDT and 10:19 a.m. EDT (aka 12:06 p.m. BST and 3:19 p.m. BST). Observations were gathered by one of four investigators employing a scan sampling technique (Altmann, 1974) that involved simply logging on to the Chester Zoo's flamingo webcam (http://www.chesterzoo.org/must-sees/web-cams/flamingo-cam), pausing the live feed, and tallying the number of birds displaying various behaviours. Observers recorded the number of flamingos visible, as well as the number of resting flamingos. To be counted as resting, a flamingo had to be clearly seen standing and having its head resting on its back with its neck curved to either the right or left of its centre of gravity. Birds that were clearly seen as resting in the following manners were tallied: bipedal stance w/neck to the left, bipedal stance w/neck to the right, unipedal stance on left leg w/neck to the left, unipedal stance on right leg w/neck to the left, unipedal stance on

left leg w/neck to the right, unipedal stance on right leg w/neck to the right, unipedal stance on unclear leg w/neck to the left, unipedal stance on unclear leg w/neck to the right. In all behaviours above, only those birds that were clearly seen as displaying the various behaviours were tallied. If there was any ambiguity, those flamingos simply weren't counted.

From the obtained tallies we computed the total number of birds clearly engaging in unipedal resting on each day, the total number of birds clearly engaging in bipedal resting on each day, and the daily percent preference for unipedal resting among resting flamingos (Note that this measure was not generated for days when no birds were observed resting). These particular variables would later be correlated with daily temperature measures in order to examine a potential thermoregulatory function of unipedal resting. Moreover, the total numbers of birds seen resting their necks to the right and left (irrespective of leg stance) were summed across all twenty observations. Similar sums were generated for left and right support leg during unipedal resting (irrespective of neck-resting direction), and for those instances of rightward and leftward neck-resting that had occurred during unipedal resting when leg stance data was also available. This second neck-resting tally (specific to unipedal resting and when leg stance was known) was calculated in order to allow for an informal comparison of the relative strengths of neck-resting and unipedal support leg preferences.

All correlational analyses were performed via SPSS PASW Statistics (Release 18.0.3) for Mac, and all one-tailed binomial analyses (normal approximation w/continuity correction) were conducted according Siegel (1956).

Results

A one-tailed binomial analysis (normal approximation w/continuity correction) (Siegel, 1956) examining the proportion of total numbers of flamingos seen resting their necks

to the right vs. the left (irrespective of leg stance) across all observations yielded statistically significant results (Right=47, Left=29; z=-1.95, one-tailed p=0.026), suggesting a greater probability of rightward neck-resting. A similar analysis was performed to examining the proportion of flamingos clearly seen resting on their right vs. left legs during unipedal resting failed to obtain evidence of a population-level lateral preference in support leg during unipedal resting (Right=8, Left=7; z=0, one-tailed p=0.500). A final binomial analysis examined the proportion of right vs. left neck-resting preferences for those birds for which unipedal leg stance data were also available. This analysis yielded marginally significant results with a greater proportion of rightward neck-resting (Right=11, Left=4; z=-1.55, one-tailed p=0.061).

Pearson (r) correlation analyses were employed to examine the relationships between daily temperature and the total number of birds clearly engaging in unipedal resting on each day, the total number of birds clearly engaging in bipedal resting on each day, and the daily percent preference for unipedal resting among resting flamingos. Temperature was significantly negatively correlated with the number of flamingos seen resting on one leg on a given day (r(18)=-0.589, two-tailed p=0.006) (see Figure 1), and while the relationship between temperature and percentage of resting birds engaging in unipedal resting did not achieve statistical significance, it was generally trending in the same direction (r(15)=-0.406, two-tailed p=0.106), both of which suggest that more birds engaged in unipedal resting on cooler days. The total number of birds clearly engaging in bipedal resting on each day was not significantly related to daily temperature; (r(18)=0.153, two-tailed p=0.518). While the number of total flamingos visible on the cam was for some reason marginally negatively related to temperature (r(18)=-0.439, two-tailed p=0.053), no relationship was observed between temperature and the total number of resting flamingos (irrespective of leg stance) observed on a given day (r(18)=-0.377, two-tailed p=0.101), and thus this seems unlikely to have influenced the results described above.

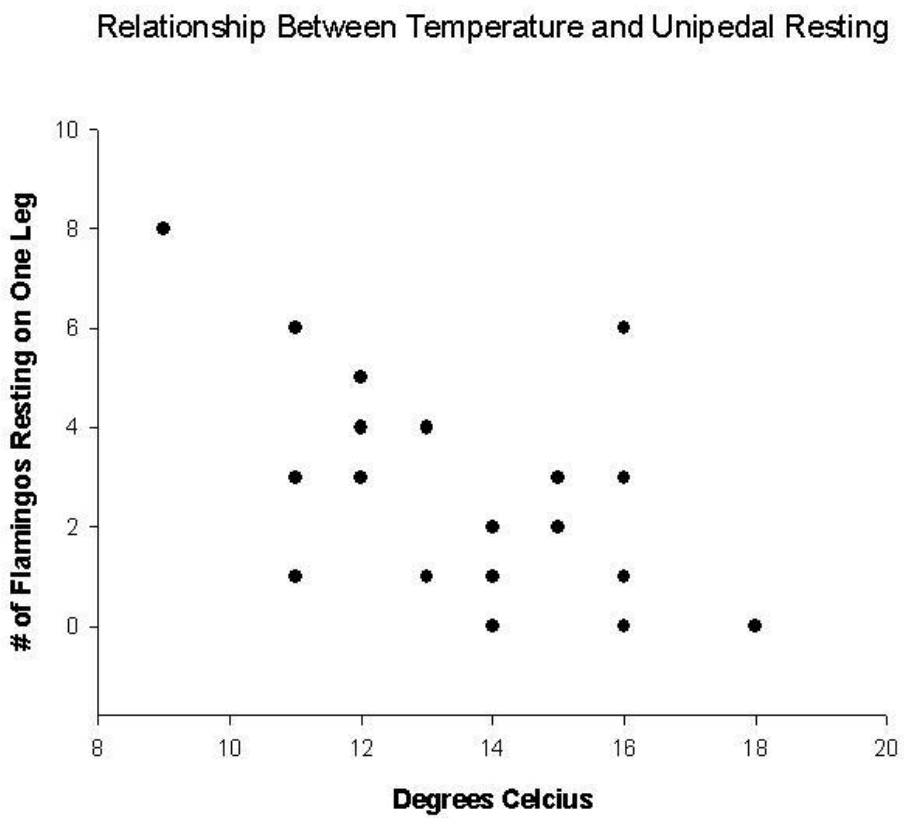

Figure 1: The relationship between temperature and the number of flamingos observed resting on one leg.

Discussion

Results evidenced a population-level lateral preference for rightward neck-resting in the Caribbean flamingos on display via the Chester Zoo flamingo webcam (cf., Anderson et al., 2009). Moreover, no evidence was found for a population-level support leg preference during unipedal resting, which is also consistent with previous findings (e.g., Anderson & Williams, 2010). Indeed, it is noteworthy that even when restricting our analysis of neck-resting to those resting birds for which unipedal leg stance data were also available, we still obtained some evidence (albeit, marginal) of a tendency towards rightward neck-resting. Given this, it seems that the tendency towards lateral neck-resting preferences is stronger than that of leg preferences during unipedal resting. It seems likely that the wading lifestyle of flamingos has discouraged such leg preferences,

as a leg preference could result in chronic exposure of one limb to the often harsh aquatic environments which are typical of flamingo haunts, could conceivably lead to excessive heat loss from one limb (cf., Anderson & Williams, 2010), and could conceivably lead to undue stress and wear on the preferred limb (but see Chang & Ting, 2017).

The present results also provide evidence for a thermoregulatory function of unipedal resting. In previous reports we obtained evidence of a greater percentage of resting flamingos engaging in unipedal resting on cooler days (e.g., Anderson & Williams, 2010), as well as a tendency towards engaging in unipedal resting for longer periods on cooler days (Bouchard & Anderson, 2011). While the correlation between temperature and percentage of resting flamingos engaging in unipedal resting did not achieve statistical significance in the present report, the relationship was in a direction consistent with previous research (e.g., Anderson & Williams, 2010). More impressively, we did obtain evidence of a significant negative correlation between daily temperature and the total number of flamingos seen engaging in unipedal resting on a given day. Thus, our results suggest that on cooler days more flamingos will be seen engaging in unipedal resting, providing further evidence for a thermoregulatory function of this behaviour.

Conclusions

The present results offer further evidence of a lateral preference for rightward neck-resting in Caribbean flamingos and suggest that this effect may generalize to flocks beyond the Philadelphia Zoo. Lateral support leg preferences during unipedal resting were not found, and a thermoregulatory explanation of unipedal resting was supported as flamingos were more likely to engaging in unipedal resting on cooler days, thus evidencing the generalizability of the phenomena.

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