Preregistration

Sexual Dimorphism in Penguin Bill Length Across Species

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Study Information

Title	Sexual Dimorphism in Penguin Bill Length Across Species
Description	Sexual dimorphism, or biological differences between males and females of the same species, is a widespread phenomenon with important implications for ecology, evolution, and biodiversity (Tsuji, 2020). In birds, sexual dimorphism in bill morphology often reflects ecological specialization, sexual selection, or niche differentiation between sexes (Bolnick, 2003; Temeles, 2010). In penguins, bill morphology is a key functional trait linked to foraging ecology, mate choice, and species recognition, making it an ideal trait for studying dimorphism (Gorman, 2014). The availability of high-quality field data in the form of the palmerpenguins dataset (Horst, 2020) provides an opportunity to quantify sexual dimorphism in penguins and test whether its magnitude varies across different species. The palmerpenguins dataset provides standardized morphometric data for Adelie, Chinstrap, and Gentoo penguins in the Palmer Archipelago, allowing direct comparison of bill length across

	sexes and species. By testing whether bill length differs consistently between male and female penguins across species, this study contributes to a broader understanding of how sexual dimorphism presents across organisms and how it may relate to ecological differentiation. More specifically, it asks whether dimorphism is uniform across closely related species or whether species-specific ecological pressures (e.g., diet, habitat) influence its magnitude.
Hypotheses	I hypothesize that bill length is significantly different between males and females within species, and that the magnitude of this difference may vary among species
Study type	Observational Study - Secondary analysis of an existing, publicly available dataset (palmerpenguins).
Blinding	No blinding is involved in this study.
Study design	Cross-sectional design with a between-subjects comparison. ## Randomization Not applicable (no experimental manipulation).
Explanation of existing data	The palmerpenguins dataset was collected in the Palmer Archipelago (2007–2009) and released in a cleaned, teaching-friendly format (Horst et al., 2020; Gorman et al., 2014)
Data collection procedures	Data were originally collected in the Palmer Archipelago, Antarctica, between 2007–2009. Field biologists measured bill length (in mm), sex, and species identity. For this preregistration, I will use the pre-cleaned dataset provided by the palmerpenguins R package.
Sample size	n~= 300

Sample size rationale All eligible individuals will be included. Based on package documentation, this is expected to be approximately n ~= 300 total, with counts varying by species and sex.

Analysis Plan

Statistical models Primary confirmatory model:Two-way ANOVA with linear model

References

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