



Morphometric Analysis and Reversed Sexual Size Dimorphism of the Blue-winged Kookaburra (*Dacelo leachii leachii*) in the Greater Darwin Region

An analysis of the Darwin River Natural History Museum Collection

Damien Stanioch

Darwin River Natural History Museum (DRNHM), Northern Territory Australia
August 2026

Abstract

This report analyses the morphometric traits of the Northern Blue-winged Kookaburra (*Dacelo leachii leachii*) based on the Darwin River Natural History Museum (DRNHM) collection. Utilizing a robust dataset of 332 individual specimens opportunistically collected in the Greater Darwin area, this study aimed to define baseline morphometrics for the local population and identify significant biological trends. The analysis confirms a strong pattern of Reversed Sexual Size Dimorphism (RSD)—with females being universally larger and heavier than males—aligning with broader literature on the *Dacelo* genus. By isolating statistical significance from biological significance (using effect size), the data reveals that while nearly all female traits are mathematically larger, core structural body metrics (Total Length, Weight, Head & Body length) represent the most biologically meaningful divergence.



Morphometric Analysis and Demographics of the Black-footed Tree-rat (*Mesembriomys gouldii gouldii*) in the Greater Darwin Region, Northern Territory

An analysis of the Darwin River Natural History Museum Collection

Damien Stanioch

Darwin River Natural History Museum (DRNHM), Northern Territory Australia
August 2026

Abstract

This technical report presents a morphometric and demographic assessment of 50 Black-footed Tree-rat (*Mesembriomys gouldii gouldii*) specimens salvaged across the Greater Darwin region between 2011 and 2025. The audited dataset spans four developmental age classes: Adults ($n = 41$), Sub-adults ($n = 4$), Juveniles ($n = 3$), and Pups ($n = 2$). Two-sample t -tests between adult females ($n = 21$) and males ($n = 18$) revealed no statistically significant sexual dimorphism across any measured external trait ($p > 0.05$), reflecting shared arboreal foraging demands and non-dimorphic territory use in tropical eucalypt savannas.

Ontogenetic analysis demonstrated significant growth progression across age classes ($p < 0.001$, ANOVA), highlighted by accelerated hind foot (pes) maturation. Juveniles attained over 92% of mature foot length (61.0 mm) while remaining under 47% of adult mass (282.7 g), providing essential arboreal gripping capability prior to weaning. Overall morphometric ranges align closely with published Top End literature (Friend 1987; Rankmore 2006; Ward 2009).



Morphometric Analysis and Sexual Dimorphism of the North-Eastern Red-Tailed Black-Cockatoo (*Calyptorhynchus banksii macrorhynchus*) In the Greater Darwin Region

An analysis of the Darwin River Natural History Museum Collection

Damien Stanioch

Darwin River Natural History Museum (DRNHM), Northern Territory Australia

August 2026

Abstract

A comprehensive morphometric investigation was performed on N=32 adult specimens of the North-eastern Red-tailed Black-Cockatoo (*Calyptorhynchus banksii macrorhynchus*) collected opportunistically across the Greater Darwin region (Northern Territory, Australia). Data curated by Damien Stanioch for the Darwin River Natural History Museum (DRNHM) collection were analysed to evaluate sexual dimorphism, multivariate morphological structure via Principal Component Analysis (PCA), and the reliability of visual body condition scoring.

Statistically significant ($p < 0.05$) and biologically meaningful sexual dimorphism was identified across wing structure, cranial dimensions, and bill size, with males exhibiting consistently larger linear measurements than females. Conversely, total mass, total body length, and body score showed no statistically significant differences between sexes. Multivariate PCA demonstrated clear separation between sexes along Principal Component 1 (accounting for 43.61% of variance). The 5-point body condition score demonstrated a strong positive correlation with body mass ($r = 0.726$, $p < 0.0001$), confirming its biological validity for field assessment.



Multivariate Morphometric Variation, Sexual Dimorphism, and Geographic Size Adaptation in the Northern Brown Bandicoot (*Isoodon macrourus macrourus*) from the Greater Darwin Region, Northern Territory

An analysis of the Darwin River Natural History Museum Collection

Damien Stanioch

Darwin River Natural History Museum (DRNHM), Northern Territory Australia

August 2026

Abstract

Morphometric analyses of the Northern Brown Bandicoot (*Isoodon macrourus macrourus*) provide fundamental insights into population health, sexual dimorphism, and eco-geographical adaptation. This study analysed 71 opportunistically collected wild adult specimens ($n=47$ males, $n=24$ females) recovered within a 70 km radius of Darwin, Northern Territory, held in the Darwin River Natural History Museum collection. Ten quantitative morphological variables were evaluated using univariate Welch's t-tests and Multivariate Principal Component Analysis (PCA) to quantify sexual dimorphism, evaluate trait distributions, and assess body size trends against Bergmann's Rule across the recognized subspecies of *I. macrourus*. Males exhibited significant biological and statistical size superiority over females across all major somatic metrics, weighing on average 76% more ($1,625.87 \pm 582.19$ g vs. 923.62 ± 308.82 g, $p=5.99 \times 10^{-9}$) and displaying greater head-body lengths (404.60 ± 41.87 mm vs. 346.54 ± 27.59 mm, $p=1.91 \times 10^{-9}$). Linear appendage measures such as pes length and head dimensions confirmed strong male-biased sexual size dimorphism (SSD), whereas ear length ($p=0.152$), tail length ($p=0.107$), and body score ($p=0.278$) showed no statistically significant dimorphism. Principal Component Analysis revealed that the first two components accounted for 74.5% of the total morphometric variance, with PC1 (64.7%) representing overall body size and clearly segregating males and females along the primary axis. Comparative evaluation against published morphometrics for southern/eastern subspecies (*I. m. torosus* and *I. m. moresbyensis*) confirms that *I. m. macrourus* exhibits smaller body mass and dimensions, supporting an inverse Bergmann's Rule pattern or clinal sizing dictated by primary productivity and seasonality rather than classical heat-conservation mechanisms.



Morphometric Analysis, Sexual Dimorphism, and Geographic Variation in the Agile Wallaby (*Notamacropus agilis*) in the Greater Darwin Region, Northern Territory

An analysis of the Darwin River Natural History Museum Collection

Damien Stanioch

Darwin River Natural History Museum (DRNHM), Northern Territory Australia

September 2026

Abstract

This technical report provides a rigorous biometric, statistical, and taxonomic analysis of 71 adult Agile Wallaby (*Notamacropus agilis*) specimens housed at the Darwin River Natural History Museum. All morphological parameters were evaluated to determine sexual dimorphism, establish baseline population metrics for the Top End population (*N. a. agilis*), and assess geographic variation across Australian and New Guinean subspecies in the context of Bergmann's Rule.

Key statistical findings include pronounced sexual dimorphism, with males significantly exceeding females across all linear measurements and body mass ($p < 0.05$). When evaluating continental and island populations, Bergmann's Rule (the ecological principle stating that body size within a broadly distributed clade increases in colder/higher-latitude environments) does not apply to *Notamacropus agilis*. Instead, body size in this species is primarily governed by primary productivity, seasonal water availability, and diet quality (Resource / Primary Productivity Hypothesis).



Morphometric Characterisation and Subspecific Comparison of the Northern Common Brush-tail Possum (*Trichosurus vulpecula arnhemensis*) from the Greater Darwin Region

An analysis of the Darwin River Natural History Museum Collection

Damien Stanioch

Darwin River Natural History Museum (DRNHM), Northern Territory Australia

September 2026

Abstract

Morphometric data from 102 adult specimens ($N = 102$; 42 males, 60 females) of the Northern Common Brush-tail Possum (*Trichosurus vulpecula arnhemensis*) collected within a 70 km radius of Darwin, Northern Territory, were analyzed to define physical traits, sexual dimorphism, and phenotypic distinctiveness relative to southern subspecies. Each registration number was treated as an individual biological specimen. Males exhibited statistically significant larger dimensions in weight ($1,385.00 \pm 315.99$ g vs $1,256.08 \pm 271.21$ g; $p = 0.0348$), head length (84.45 ± 3.44 mm vs 82.07 ± 3.86 mm; $p = 0.0015$), head width (51.02 ± 3.98 mm vs 48.95 ± 2.31 mm; $p = 0.0035$), forearm length (83.60 ± 3.56 mm vs 81.52 ± 4.70 mm; $p = 0.0127$), and manus length (39.60 ± 2.83 mm vs 38.25 ± 2.73 mm; $p = 0.0186$).

Tail length (278.83 mm vs 278.88 mm; $p = 0.9912$) and ear length (45.57 mm vs 45.80 mm; $p = 0.7820$) showed no sexual dimorphism. White tail tips were observed in only 10.78% ($n = 11$) of the population, ranging from 3 to 19 mm in length. Comparative synthesis with published literature demonstrates that *T. v. arnhemensis* represents the smallest subspecies of *Trichosurus vulpecula*, conforming to Bergmann's Rule, and possesses significantly reduced pelage density and tail brush compared to southern temperate populations (*T. v. vulpecula* and *T. v. fuliginosus*).



Morphometric Analysis and Sexual Dimorphism of the Northern Brush-tail Possum (*Trichosurus vulpecula arnhemensis*) in the Greater Darwin Region

An analysis of the Darwin River Natural History Museum Collection

Damien Stanioch

Darwin River Natural History Museum (DRNHM), Northern Territory Australia

September 2026

Abstract

This technical report presents a comprehensive morphometric analysis of the Northern Brush-tail Possum (*Trichosurus vulpecula arnhemensis*), based on 102 adult wild specimens (60 females, 42 males) opportunistically collected within a 70" km" radius of Darwin, Northern Territory. Univariate parametric testing (Welch's t-test) revealed statistically significant sexual dimorphism in body weight ($p=0.035$), total head length ($p=0.001$), total head width ($p=0.004$), forearm length ($p=0.013$), manus length ($p=0.019$), and tail friction pad length ($p=0.018$), with males exhibiting consistently larger mean dimensions across these structures. However, primary skeletal frame indicators—specifically head-and-body length ($p=0.153$), tail length ($p=0.991$), and total length ($p=0.233$)—showed no statistically significant differences between sexes.

Principal Component Analysis (PCA) demonstrated substantial morphological overlap between males and females in multivariate space. PC1 accounted for 35.6% of the total variance and represented overall body scale, while PC2 explained 13.3% of variance, driven predominantly by ear dimensions. Although statistically significant differences exist in specific head and limb dimensions, the overall biological significance of sexual dimorphism in *T. v. arnhemensis* remains modest (<10% size difference), supporting a pattern of minor male-biased dimorphism in tropical arboreal marsupials compared to temperate populations of *Trichosurus vulpecula*.



Morphometric Characterisation, Sexual Dimorphism, and Principal Component Analysis of the Magpie Goose (*Anseranas semipalmata*) from the Greater Darwin Region

An analysis of the Darwin River Natural History Museum Collection

Damien Stanioch

Darwin River Natural History Museum (DRNHM), Northern Territory Australia

October 2026

Abstract

Morphometric and physiological data from 122 adult Magpie Goose (*Anseranas semipalmata*) specimens ($n = 122$; 61 males, 61 females) were analyzed to quantify sexual dimorphism, spatial and temporal population distributions, and cranial allometry within the Greater Darwin region. All specimens were sourced opportunistically within a 70 km radius of Darwin, Northern Territory, for the Darwin River Natural History Museum (DRNHM). Males demonstrated statistically significant larger dimensions across all primary skeletal and mass traits ($p < 0.001$). Mean male body mass (2,382.0 g) exceeded female mass (1,678.7 g) by 41.9%.

Principal Component Analysis (PCA) isolated two primary axes of morphological variation, explaining 71.3% of total variance. The primary axis (PC1, 60.5% variance) represented general structural size, driving distinct, non-overlapping cluster separation between the sexes. PC2 (10.8% variance) captured shape variance independent of overall size, driven primarily by head height. Functionally and biologically, these differences underscore intense sexual selection, energetic demands of reproduction, and biomechanical adaptations for monsoonal wetland habitats.



Morphometric Variation and Comparative Analysis of the Red-winged Parrot (*Aprosmictus erythropterus coccineopterus*) in the Top End, Northern Territory

An analysis of the Darwin River Natural History Museum Collection

Damien Stanioch

Darwin River Natural History Museum (DRNHM), Northern Territory Australia

October 2026

Abstract

Morphometric variation and sexual dimorphism in the Red-winged Parrot (*Aprosmictus erythropterus*) were analysed using 84 adult salvaged specimens from the Darwin region, Northern Territory (73 females, 11 males). Thirteen continuous morphological metrics were evaluated using parametric (t -tests), non-parametric (Mann-Whitney U), standard error (SE), Cohen's d effect sizes, and Principal Component Analysis (PCA). Tarsus length was the sole metric showing statistically significant sexual dimorphism ($t_{14,2} = -2.47, p = 0.028; d = 0.78$), with males exhibiting longer tarsi (19.95 ± 0.85 mm, SE = 0.26) than females (19.27 ± 0.88 mm, SE = 0.10). Macro-skeletal features (Head & Body, Open Wing Length) showed moderate male-biased size trends ($d = 0.40 - 0.43$) power-limited by sample ratio, while body mass showed structural equality (103.92 ± 20.44 g in females vs. 103.27 ± 19.17 g in males; $d = -0.03$). Extensive comparison with Australian literature confirms that Top End populations correspond morphometrically to the northern subspecies *A. e. coccineopterus*, exhibiting smaller linear dimensions and lower body mass than southern *A. e. erythropterus*.