Temporal changes in body conditions of wintering waterfowl in Humboldt Bay

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INTRODUCTION

- Climatic/temperature variability, predation, and increasing competition affect food availability[1,2]
  - Food availability affects body energy reserves
- Energy reserves imply survivability and reproduction[3]
  - Most accurate measurements (lipid extraction) involve destruction of birds
  - Non-destructive Body Condition Index – inferring energy reserves as a score from morphometrics[4]
- Tested whether waterfowl energy reserves as functions of body condition indices change as the winter proceeds
  - Waterfowl decrease in energy reserves per increasing day of capture & temperature[5]
  - Decrease due to food limitation - important management questions on sources/tradeoffs of food scarcity
  - Predicted hunted waterfowl would score higher on body condition indices earlier in the hunting season and lower in the late season - negative correlation between body condition and time

Figure 1: A brant being prepared for measurements - South Spit Humboldt Bay

METHODS

- On-site hunted carcass sampling around the Humboldt Bay, 22 Oct 2022 – 05 Feb 2023
  - Humboldt Bay National Wildlife Refuge
  - South Spit Humboldt Bay
- Morphometric suite measurements
  - Left and right flat wing chord (mm)
  - Left and right short tarsus length (mm)
  - Culmen length (mm)
  - Mass (g)
- Demographic data
  - Species
  - Sex
- Body condition indices
  - Mass/[average] tarsus
  - Mass/[average] wing
  - Mass/culmen
- Linear regressions of body condition indices versus time

RESULTS

19 species collected – 8 species $n > 15$ (Figure 2)

Figure 2: Photo grid of waterfowl species of $n > 15$.

Species	n	Mass/Wing	Mass/Tarsus	Mass/Culmen
ACGO	19	0.596	0.579	0.287
AGWT	68	0.15	0.294	0.143
AMWI	79	**0.000294**	**0.0012**	**0.0000906**
BRAN	22	0.169	0.186	0.329
BUFF	48	0.964	0.867	0.87
MALL	16	0.239	**0.0416**	0.105
NOPI	37	0.776	0.655	0.425
NSHO	78	0.564	0.949	0.942

Table 1: Linear Regression p-values of waterfowl species and their associated body condition indices. Significant values ($p < 0.05$) are in bold.

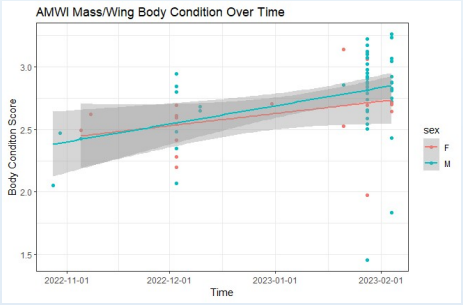

Figure 3: Linear Regression of AMWI mass/wing body condition over time ($p = 0.000294, n = 79$).

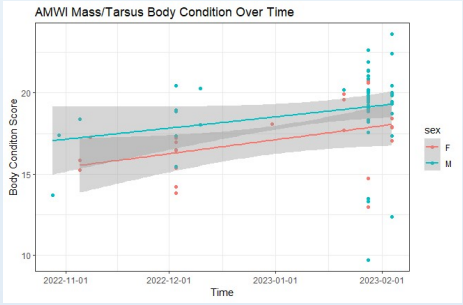

Figure 4: Linear Regression of AMWI mass/tarsus body condition over time ($p = 0.0012, n = 79$).

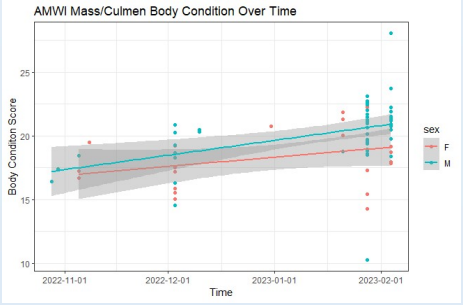

Figure 5: Linear Regression of AMWI mass/culmen body condition over time ($p = 0.0000906, n = 79$).

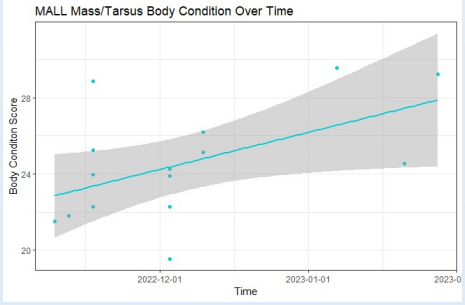

Figure 6: Linear Regression of MALL mass/tarsus body condition over time ($p = 0.0416, n = 716$). Note that female $n = 2$.

DISCUSSION

- Results dispute winter food limitation hypothesis - nearly all indices increased in score
  - Spring migrants may affect local food availability more than winter
- Ratios and residuals of morphometrics frequently challenged and improved – other indices with more robust scaling: scaled wing index,[4] scaled mass index,[6] body size index[7]
  - No body condition index based on morphology is universally applicable
  - A method of scaling individual mass to correct for inherent size
  - Does not derive energy reserves of a bird, lipid extraction needed to know parameters for the population
- Future studies - sample over entire migratory period instead of just hunting season

Figure 7: Data collection - Humboldt Bay National Wildlife Refuge

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