Relationship between body size and mass in the Sierra Nevada yellow-legged frog, *Rana sierrae*

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Abstract

(*This gibberish was written by ChatGPT*)

The Sierra Nevada yellow-legged frog (*Rana sierrae*) is a flagship species for high-altitude ecosystems, playing a crucial role in maintaining ecological balance. This study explores the intricate relationship between length and weight in *R. sierrae*, aiming to elucidate patterns, drivers, and implications for both ecological understanding and conservation efforts. A comprehensive dataset, spanning diverse populations across the Sierra Nevada range, was analyzed to discern variations in body size and mass. Our findings reveal a complex length-weight relationship in *R. sierrae*, characterized by distinct patterns influenced by factors such as elevation, habitat type, and seasonal dynamics. While isometric growth was observed in certain populations, others exhibited allometric patterns, indicating potential adaptations to specific environmental conditions. The influence of biotic and abiotic factors, including temperature fluctuations, resource availability, and predation pressures, on the length-weight dynamics was also investigated. The study underscores the importance of considering life history traits, reproductive strategies, and environmental context when interpreting the length-weight relationship in this species. Furthermore, our research has direct implications for the conservation of *R. sierrae*, as alterations in body size and weight may serve as early indicators of environmental stressors and population health. In conclusion, this investigation provides valuable insights into the length-weight relationship of *R. sierrae*, contributing to a deeper understanding of the ecological dynamics of this iconic amphibian. These findings have direct relevance for conservation strategies in the face of ongoing environmental changes, facilitating targeted efforts to preserve the Sierra Nevada yellow-legged frog and its unique mountainous habitat.

Introduction

Body mass is a fundamental parameter in ecology because it is related to several important attributes of individuals and populations, including species metabolic rates (Gillooly et al. 2001, Brown et al. 2004) and population abundance (Peters and Wassenberg 1983). As stated by Feldman and Meiri (2012), among vertebrates, body mass is commonly recorded in birds

and mammals, but is less often recorded in amphibians. As a result, in amphibians, body size (as snout-vent length) is available for many species, but body mass data are often lacking (Santini et al. 2018 pp. 13–14).

In this study, we report body length and mass recorded from more than 3000 post-metamorphic Sierra Nevada yellow-legged frogs (*Rana sierrae*), and describe the relationship between these two variables.

Methods and Materials

As part of a long-term study of amphibians in the Sierra Nevada (Knapp et al. 2003), we captured 3131 post-metamorphic *R. sierrae* (hereafter, "frogs") from Mesa Lake, Sierra National Forest, during the period 2000-2015 (Figure 1). Frog were captured during the summer active season using hand nets. We measured frog snout-vent length to the nearest millimeter using digital calipers and frogs were weighed to the nearest gram using a spring scale. To describe the relationship between length and weight, we plotted $\log_{10}$(frog weight) against $\log_{10}$(frog length).

Results

The relationship between frog length and mass was linear on a $\log_{10}$ scale and showed little scatter around the regression line (Figure 2).

Discussion

Written by ChatGPT

It is evident that the intricate interplay between these length and mass is influenced by a myriad of ecological, physiological, and environmental factors. Our findings align with previous studies suggesting that variations in body size and mass are not uniform across species, emphasizing the need for a nuanced understanding of the specific ecological context. The identification of isometric versus allometric growth patterns in different animal taxa underscores the species-specific adaptations to environmental conditions, resource availability, and life history strategies. Furthermore, the observed relationships provide valuable insights into the potential impacts of anthropogenic disturbances on animal populations. As environmental changes continue to accelerate, the length-weight relationship serves not only as a crucial metric for understanding the physiological dynamics of species but also as an essential tool for predicting and mitigating the consequences of habitat alterations on biodiversity and ecosystem functioning. This discussion contributes to the broader understanding of the intricate ecological tapestry that governs the length-weight relationship in animals and underscores its significance in the context of contemporary conservation challenges.

Tables

Table 1: A subset of the data used in this study. Length and mass are expressed in millimeters and grams, respectively.

site_id	visit_date	life_stage	length	mass
70550	2014-06-24	adult	52	16
70550	2014-07-16	adult	54	19
70550	2014-07-16	adult	61	26
70550	2006-09-14	adult	52	18
70550	2006-08-31	adult	53	16
70550	2009-07-06	adult	67	36
70550	2010-08-13	adult	68	38
70550	2012-06-16	adult	72	43
70550	2012-07-15	adult	69	41
70550	2012-08-29	adult	71	44
70550	2013-06-28	adult	64	27
70550	2006-08-13	adult	54	16
70550	2007-07-01	adult	57	20
70550	2007-07-31	adult	58	25
70550	2006-08-31	adult	54	18

Figures

Figure 1: (A) Mesa Lake where the study was conducted. (B) An adult Sierra Nevada yellow-legged frog (*Rana sierrae*).

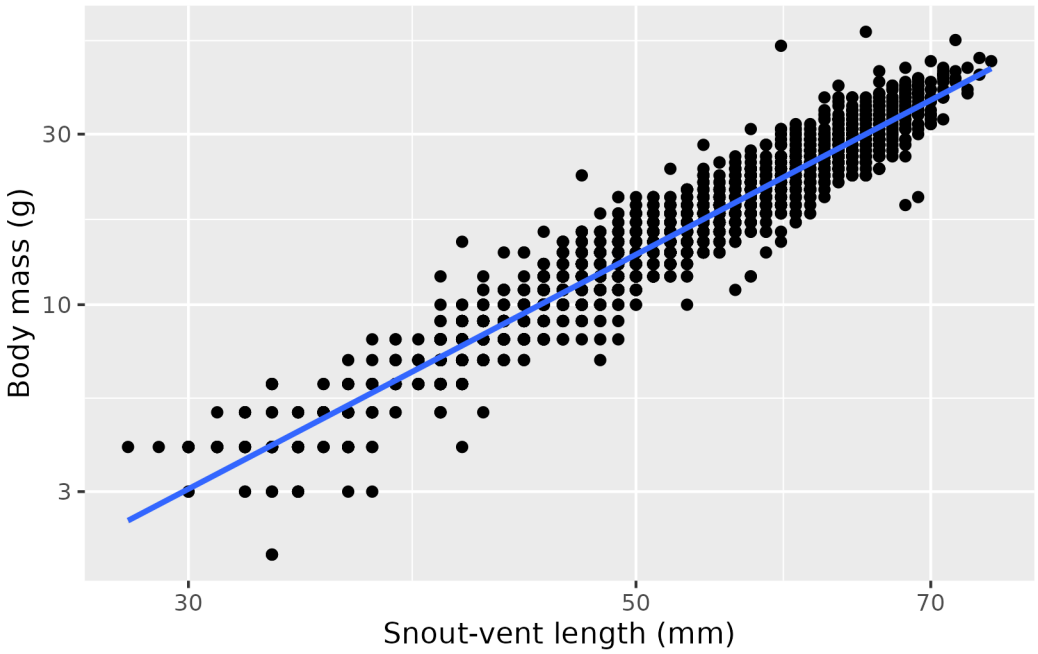

Figure 2: Relationship between length and body mass in post-metamorphic *R. sierrae*. Axes are on a $\log_{10}$ scale.

Acknowledgements

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